Paper: ISSN 1027-6343
Online: ISSN 1607-7954

the eggs

E.G.U. NEWSLETTER

ISSUE 37, JANUARY 2012
AVAILABLE ON-LINE AT www.the-eggs.org

Air Quality and Climate in Megacities and Regional Hot Spots

THE EGGS | ISSUE 37 | JANUARY 2012

Cover photo: Sunrise in the peak of the only remaining glacier in the heart of western Pacific Warm Pool, Papua, Indonesia. Image credit: R. Dwi Susanto.
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EGU Election Autumn 2011

The EGU Election Autumn 2011 for the next EGU President as well as for the next EGU General Secretary was closed on 01 December 2011. We sincerely thank all those EGU members who used their voting right. We would also like to thank each of the candidates for their initiative in standing for the office of President and General Secretary. Active participation in elections ensures continuation of the well-established bottom-up structure of our Union!

In total, we received 2192 ballots for the EGU president and General Secretary elections, respectively. Please see the results at http://www.egu.eu/elections/.

Günter Blöschl is the elected EGU President for the term 2012–2016. He will be inaugurated as President-Elect (Vice-President) for one year term (2012-2013) during the plenary meeting of the next EGU General Assembly 2012 in Vienna, Austria. He will then serve as the Union President during two years (2013-2015) starting from the plenary meeting of the EGU General Assembly 2013. Lastly, he will serve as the Past-President (Vice-President) for one more year (2015-2016).

Mioara Mandea is the next EGU General Secretary for the term 2012–2014. She will be inaugurated during the plenary meeting of the next EGU General Assembly 2012 in Vienna, Austria.

Air Quality and Climate in Megacities and Regional Hot Spots

the CityZen Project

CityZen (megaCITY Zoom for the ENvironment) is a three year European Commission funded project focused on the effects of megacities and emission hot spots on their local, regional and global environment, regarding both air pollution and climate change. With 16 partners from 10 countries on 3 continents the project has addressed the complex interactions of megacities within the air quality and climate change context using state-of-the-art models, in-situ measurements and satellite observations. The project has used a "hot-spot" approach looking in an integrated manner across diverse megacities in western Europe, the Eastern Mediterranean and China. This short article gives an overview of the project and outlines some of the main findings. The integrated application of observations and models has demonstrated the regional impact of megacities and articulated some of the forward looking challenges. Overall, the CityZen project has found that despite vastly different meteorology, pollutant transport, and atmospheric chemistry conditions resulting in strong regional characteristics affecting pollutant levels in the different focus regions, similar future air quality and climate change challenges will be faced across many megacities.

The global urban population has risen from about 3% of the world's total population in the year 1800 (Brunn and Williams, 1983) to about 47% by 2000 (UN, 2004). In 2007, for the first time in history, more than half of the world's population was living in cities, and the trend is expected to continue.

Megacities, often defined as cities with over 10 million people, have grown from only two in the 1950s to over 20 today. With the development of megacities there has been a concentration of anthropogenic pollutant emissions and land-use change that has large environmental implications from local to regional scales. Rapid economic growth in megacities is often not followed by an equally rapid growth in infrastructure such as road construction or public transportation systems, leading to inefficient traffic flow and enhanced air pollution. For instance, Gurjar and Lelieveld (2005) point out that the per capita CO emissions in megacities tend to be higher than in densely populated countries.

Furthermore, a recent study of Asian megacities found that they cover less than 2% of the land area, hold more than 30% of the population and produce ~10% of the anthropogenic gas and aerosol emissions. These numbers mean that large fractions of the population are exposed to disproportionately adverse health impacts in megacities (Guttikunda et al., 2005). The increasing emissions from the emerging and evolving megacities as well as changes in the emission patterns increase the severity of several environmental problems, in particular in relation to air pollution, climate change, water and soil resources. It has become urgent to assess and address this broad problem in the science and policy context.

CityZen (megaCITY Zoom for the ENvironment) is a three year European Commission funded project finishing in 2011. The focus of the project has been to address the complex interactions of megacities within the air quality and climate change context using state-of-the-art models, in-situ measurements, and satellite observations. The main objectives of CityZen, of which selected preliminary results will be presented, are:

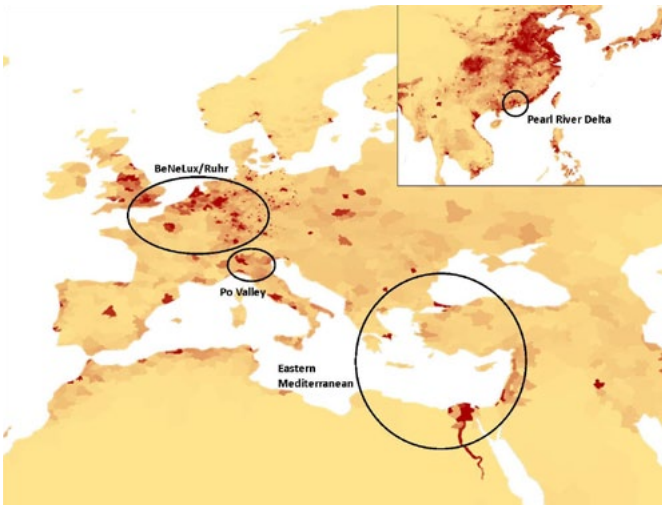

Figure 1. Population density map with the CityZen hotspot areas circled. Credit: NASA, Visible Earth (http://visibleearth.nasa.gov/), National Center for Geographic Information and Analysis (NCGIA).

- Quantify and understand current air pollution distribution and development in and around selected megacities/hot spot regions, including the interaction across the different spatial scales.
- Estimate the future impact of emission changes with a focus on the effect of rapid growth in the population of megacities/hot spots and the increasing background of pollutants, with a concentration on ozone, particulate matter, and their precursors.
- Estimate how megacities/hot spots influence climate change.

• Estimate how megacities are responding to climate forcing which can influence transport patterns, chemical oxidation and biogenic emissions, with a concentration on biogenic volatile organic compounds.

• Study mitigation options to limit adverse human health effects and climate impact.

• Develop tools to estimate interactions between different spatial scales (megacities to global).

• Communicate the project results to policy makers providing a scientific underpinning of policy work.

Motivation for Study Regions From a human health perspective in the European Union (EU), the pollutants of greatest concern are ground level ozone and particulate matter (PM), specifically fine PM (PM2.5) (EU, 2005). Ozone is a secondary air pollutant, which means that it is formed in the atmosphere and has no significant emission sources. Ground level ozone is formed from photochemically driven reactions of primarily nitrogen oxides (NOx = NO2 + NO), volatile organic compounds (VOCs), and carbon monoxide (CO). These ozone precursors are emitted in significant amounts from the transportation sector, as well as power generation, and industrial sources which are significant in urban areas. Ozone is of particular interest on varying spatial scales because of the time it takes to form in the atmosphere, which can thereby have a significant impact not only on the urban area, but on the surrounding region as well. In addition to the adverse impacts on human health, ozone can negatively impact vegetation, resulting in adverse consequences for crop yields.

Anthropogenic sources of fine particulate matter are emitted primarily from combustion sources, including the transportation sector, power generation, and industry. The smaller size fraction of PM is of greater concern for human health than the larger size fraction (PM10) because of its ability to penetrate deeper into the lungs. The health effects of air pollution in the EU were estimated as a loss in statistical life expectancy of more than 8 months due to PM2.5 in air, which corresponds to 3.6 million life years lost annually (EU, 2005). For ozone, roughly 21,000 cases of hastened mortality in 2020 were estimated for the EU. These adverse health effects are of particular consequence to more vulnerable parts of the population, such as children, the elderly, and those suffering from asthma and cardiovascular diseases (EU, 2005).

In CityZen an emissions hot spot approach was used with the main megacity/hot spot areas focused on the Po Valley in Italy, the BeNeLux region, London, Paris, and the Eastern Mediterranean including Athens, Istanbul, and Cairo (Figure 1). These European megacities are contrasted with the Pearl River Delta in China, including Guangzhou and Hong Kong. The Focus Regions The Eastern Mediterranean hotspot region includes Istanbul as a megacity and Athens -extended area, about 5.5 million people, and Cairo metropolitan area which is a megacity with more than 16 million inhabitants. The Eastern Mediterranean is a cross road of air masses where man-made pollution meets with natural emissions. These emissions include nitrogen oxides, carbon monoxide, volatile organic compounds, as well as particulate matter. The main pollution sources include the industrial sector, transportation, and domestic heating, as well as transport from the continental part of Europe, Balkans and the Black Sea. Local and regional forest fires and agricultural/biomass burning emissions are also affecting the area during the dry season. Spots of intense burning activity are found north of the Black Sea and combined with the dominance of the northerly winds over the Aegean Sea, contribute significantly to pollution build up during summer. Natural emissions from semi-arid North African regions (e.g. Sahara desert), from the vegetation that surrounds the Mediterranean Sea and from the Mediterranean Sea itself also affect the area. Southerly winds from Africa mobilises the transport of air masses with high loads of dust and low levels of NOx and O3 over the Eastern Mediterranean. This air flow pattern is most frequent during the transition periods (spring and autumn). Air masses transported from the Atlantic Ocean atmosphere and within the upper troposphere from Asia can also reach the area under certain air flow conditions. The Po Valley hotspot region also affects the East Mediterranean basin at times. Several large, continuously growing, agglomerations are located inside the Eastern Mediterranean hotspot region or close to it; Athens, Istanbul and Cairo have grown dramatically over the past 10 years. Pearl River Delta (PRD) is an area with one of the fastest economic growth rates in China. Urbanization in the PRD is characterized by city clusters with two megacities (Guangzhou and Hong Kong) and many medium-sized to small cities linked by dense highways. Until around 1985, the PRD had been mainly dominated by farms and small rural villages, but after the economy was reformed and opened, the Pearl River Delta has become the most economically dynamic region of China with an average rate of GDP growth exceeding 16% annually during the period 1980-2000. The expansion of the economy in this region causes ever higher demands for energy, mobility and communications.

As a consequence, smog from coal burning and traffic exhaust together cause serious photochemical smog and particulate pollution problems from urban to regional scale. Atmospheric visibility has deteriorated with less blue sky each year owing to high concentrations of O3 and fine particles. Especially under stagnant conditions the levels of PM2.5 and ozone represent a serious impact on human health. The radiative forcing by aerosols and black carbon attain high levels and serious impact on climate is to be expected. Atmospheric chemistry is complicated owing to interactions between primary emissions and photochemical processes, between gaseous and aerosol phase, and between local and regional air pollution. Transformation and transport of air pollutants show rather unique characteristics under such conditions of high concentrations of primary and secondary pollutants. The possible impact on regional air quality and climate change is a major concern of national government as well as the global community. Much of the area is frequently covered with brown smog. This has a strong effect on the pollution levels in Hong Kong. Long-term records of space observations have shown that the increases in pollutant amounts over China have been much larger than what was originally expected from emission estimates (Richter et al., 2005).

Technical Underpinning of Policy – Preliminary Scientific Findings One component of the CityZen project is to work with national authorities, intergovernmental organisations, and EU institutions to prepare for and whenever possible provide technical underpinning for policy. While individual project partners work within and communicate with the policy-forming side of their organizations, CityZen has and will continue to produce documents containing concise policy-relevant summaries of the scientific conclusions. Preliminary messages with relevance for air quality or climate policy formation have already been issued.

A selection of the preliminary scientific findings is presented here:

• Analysis of the trends in air pollutants over the past decade, mainly ozone precursor species and aerosols, from satellite and ground-based observations in the CityZen regions have generally found decreasing trends in Western Europe and increasing trends elsewhere. A study of NOx trends, as observed from satellites from 1996 to 2008 in twelve megacity areas in Europe and the Middle East (London, Paris, Essen, Berlin, Milan, Madrid, Barcelona, St. Petersburg, Moscow, Istanbul, Bagdad, and Tehran) found that strong negative trends tend to dominate in Western Europe, while positive trends dominate outside of Western Europe (Konovalov et al., 2010). The modelled linear trends in NOx emissions ranged from -5.2 % per year (Berlin) to +4.5 % per year (Tehran). The exceptions to this were Barcelona and Madrid which showed increasing NOx trends (Konovalov et al., 2010). A subset of European air quality monitoring stations was derived from the comprehensive Airbase repository in order to extend existing trend assessment work (usually based on remote monitoring sites) to urban areas. This subset confirmed the findings above regarding downward trends of NO2 concentrations in Western Europe, also showing that it was accompanied by mild increases of O3 concentrations in NOx-saturated areas – raising an important point for consideration when shaping future air quality management strategies. The same data was mined to assess PM10 trends, finding significant downward trends at 37% and significant upward trends at 16% of the European monitoring sites investigated. (Summarized from (Colette et al., 2011)). Ground-based measurements from a monitoring site within London showed similarly decreasing trends from 1998 to 2009 for non-methane hydrocarbons (NMHCs) and CO, but at a much faster pace in some cases. Ethane and propane showed the slowest rate of decrease, -4% per year and -3% per year, respectively, while the remaining NMHCs (C2-C8) decreased between -12% per year and -26% per year. Carbon monoxide showed a trend of -12 % per year (von Schneidemesser et al., 2010). Satellite observations of NOx and aerosols have shown increasing levels of pollution in the Pearl River Delta region of China from 1996 to 2010. Similar observations of sulfur dioxide levels in east central China were increasing up to 2007, but have been decreasing since then. This indicates that measures taken to remove sulfur from the emissions of coal fired power plants have been effective (personal communication, A. Richter).

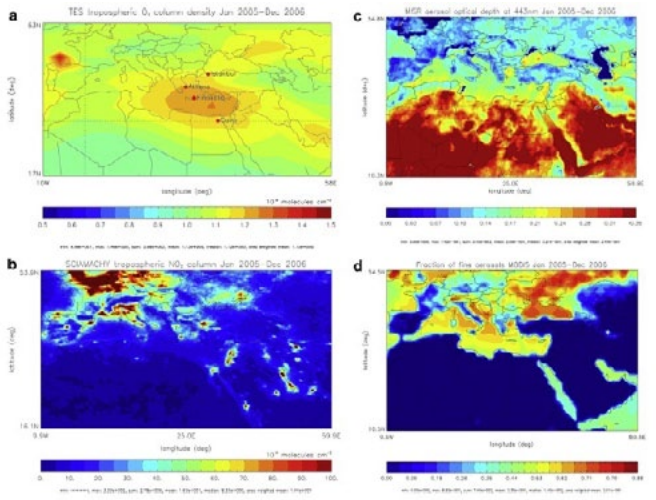

Figure 2. (Kanakidou et al., 2011) (a) Tropospheric ozone column as deduced from TES (Troposhperic Emission Spectrometer) satellite sensor gridded in 2° x 4° lat x lon – the locations of Istanbul, Athens, and Cairo are indicated. Finokalia is a background station; (b) Tropospheric nitrogen dioxide column from SCIAMACHY; (c) MISR aerosol optical thickness at 443 nm in 0.5° x 0.5° and (d) MODIS aerosol small mode fraction in 1° x 1° resolution. Mean columns for the years 2005-2006. (a,c,d) have been derived from daily data using the Giovanni visualization tool of NASA (Acker and Leptoukh, 2007).

• Trends in PM10 and NO2 over Western Europe for the past decade showed downward trends, which were reproduced well by a number of models. A coordinated modelling experiment was designed to assess the capacity of state-of-the-art chemistry-transport tools to reproduce air quality trends and inter-annual variability. Four regional and two global models simulated the past 10 years over Europe and beyond, some of them duplicating the simulation with constant emissions of pollutants to assess the respective role of meteorological and anthropogenic variability. The models consistently found downward trends of NO2 and PM10 over most of Western Europe, in agreement surface monitoring stations giving confidence in their ability to reproduce air quality trends. The much milder trend of O3 were more challenging to capture, as well as its year-to-year variation that was shown to be dominated by the meteorological variability. (Summarized from (Colette et al., 2011)).

• The East Mediterranean region has significant air pollution, often exceeding air quality targets, owing to a number of factors, including high background levels, significant natural emissions, climate, and location of the Mediterranean with respect to local and regional emission sources. Various studies conducted in the Eastern Mediterranean, including Athens and Istanbul have observed significant contributions of natural sources, specifically dust from the Sahara and other arid regions in the area as well as maritime emissions such as sea-salt. These natural contributions can account for one-quarter of PM mass to over half of PM mass during dust-transport events, even in urban areas (Hatzianastassiou et al., 2009; Kocak et al., 2010; Theodosi et al., 2011; Theodosi et al., 2010). Certain meteorological conditions can contribute to elevated background levels of pollution to the region, as recent measurements (2005-2006) of PM at background stations in the Eastern Mediterranean have shown (Theodosi et al., 2011). In addition to the significant contribution from regional background levels and natural sources, local sources of pollution, such as traffic, domestic heating, and industry are particularly important for determining aerosol levels in the urban areas and megacities (Gerasopoulos et al., 2011; Hatzianastassiou et al., 2009; Kanakidou et al., 2011; Kocak et al., 2010; Theodosi et al., 2011; Theodosi et al., 2010).The Mediterranean is located at a crossroad of air masses, being influenced by pollution transported from Europe, Asia, and Africa, as well as more local sources (Gerasopoulos et al., 2011; Kanakidou et al., 2011). Figure 2 shows enhanced levels of pollution over the greater East Mediterranean region as observed by satellites. Finally, the climate of the Mediterranean is such that solar radiation is intense year-round, driving photochemical reactions and negatively affecting air pollution, increasing the likelihood of photochemical pollution episodes, especially, but not only, in summer (Kanakidou et al., 2011). In addition, temperature changes due to meteorological variability and climate change are expected to significantly impact atmospheric composition (Im et al., 2011). These characteristics contributing to air quality in the Eastern Mediterranean mean that aerosol and ozone air quality limits are frequently exceeded, especially in

the regions' megacities, and a variety of influences need to be considered when forming air quality policy to try and address these issues.

• A London case study found that isoprene (a proxy for biogenic VOCs) still plays a relatively small role in overall VOC reactivity, and thereby ozone formation. The exception to this is periods of high temperature and sunlight, which increases biogenic emissions significantly (e.g., summer 2003 heat wave). While significant decreases in anthropogenic VOCs were observed over the past decade, likely owing to effective regulation of emissions, isoprene has not seen a rise in importance relative to the anthropogenic VOC fraction (von Schneidemesser et al., 2010). Furthermore, a significant fraction of the isoprene in urban areas likely originates from anthropogenic sources. To reliably assess the influence of biogenic emissions in a region it may be necessary to include the measurement of monoterpene species in routine monitoring, as isoprene, which is frequently used as a proxy for biogenic emissions, may not be sufficient. These results may have implications for urban air quality policies and monitoring practices, as well as emission inventories used in modelling. (Summarized from (von Schneidemesser et al., under review)).

• A modelling study of ozone formation in the Pearl River Delta region of China found that ozone formation is likely VOC-limited in the urban, inland areas and NOx-limited in the more rural areas with a predominance of aged emissions (Wang et al., 2010). The Pearl River Delta region of China has significant photochemical pollution episodes. Emissions of nitrogen oxides in the PRD area are dominated by mobile sources (47%) and power generation (39%); the three largest sources of VOCs are mobile sources (38%), evaporation losses of solvents and petroleum (24%) and biogenic sources (23%), with the largest concentration of emissions over the urban areas in the region. The ozone response to reductions of anthropogenic VOCs and NOx, separately and simultaneously revealed significant spatial differences in VOC- and NOx-limited conditions. In the urban areas, less efficient ozone production resulted from intense NOx emissions which reacted with and thereby suppressed ozone concentrations. As emissions were transported out of the urban areas and concentrations of NOx were lower, ozone production efficiency increased. These varying regimes of ozone production efficiency over the PRD region are shown in Figure 3. Additionally, synoptic weather conditions in the PRD significantly influence the formation and distribution of ozone. (Summarized from (Wang et al., 2010)). The different regimes and their effect on ozone production efficiency should be considered when forming and implementing policy for emission reductions to achieve the largest benefits.

• High resolution of emissions is important on a local/megacity scale for understanding pollutant production and exposure, but less important for climate studies that aim at understanding changes in pollutant production over a regional to global scale. Urban- to global-scale models are used to simulate and improve understanding of ozone production and distribution. However, urban scale models are typically used to assess ozone in terms of air quality, while global scale models focus on ozone in terms of climate change and its role as a greenhouse gas. As the emissions from megacities leading to ozone production are substantial, and spatial distribution of emissions are not even, this study aimed at understanding and quantifying the inaccuracies that arise when ozone production is modelled on a coarse scale (e.g. in a global chemistry-transport model). This was accomplished by applying a regional model using finer and coarser resolution of emissions over large urban areas. The main difference resulting from the varying resolution of the emissions was that finer resolution was able to capture areas of high NOx in pollution plumes which caused suppressed ozone levels, whereas in the coarse resolution few grid boxes reached such high concentrations of NOx. This resulted in a small enhancement of ozone production in the coarser grid models in most of the cases that were studies. Overall these differences were small and the coarser resolution was deemed sufficient for climate studies, whereas the high resolution would be more important for local air pollution studies. (Summarized from (Hodnebrog et al., 2011)). An established approach to focus on urban scale processes in regional models is two-way nesting. Two-way nesting involves simulating several sub-domains and their interactions, simultaneously, however this technique is computationally expensive. In CityZen, the impact of megacities on the regional scale was addressed by innovative chemistry-transport modelling using scale bridging approaches: grid stretching (Siour et al., under review) and upwards nudging (Maurizi et al., 2011). Grid stretching involves a single grid with variable horizontal resolution that permits focusing on selected areas, while upwards nudging uses data from high resolution model runs and forces this data into low resolution areas to improve concentration fields. By allowing a feedback of the inner (high resolution) grid area to the larger, coarser grid scale, these strategies offer an alternative to two-way nesting. Both approaches confirmed that an improved representation of megacities was crucial to capture air quality in their vicinity although the added value was limited compared to the classical meso-scale single-nested approach regarding air pollution export at the larger (regional) scale.

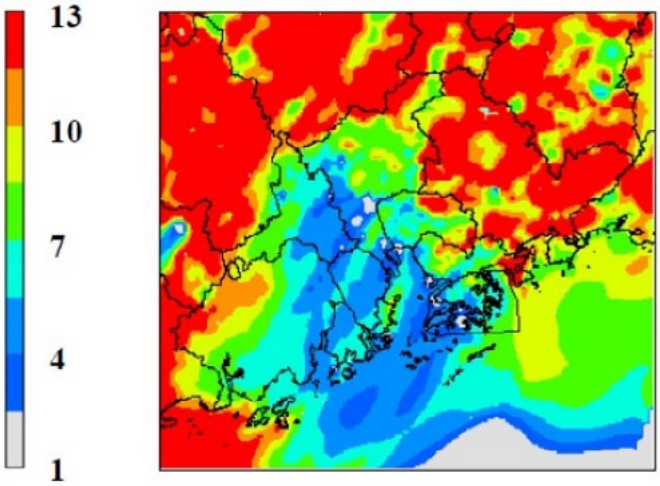

Figure 3. (Wang et al., 2010) Regional distribution of ozone production efficiency over the Pearl River Delta region based on the overall chemical production of ozone and NOz over the surface layers during daytime on 16 October 2004. Less efficient ozone production (1-5) is found in the urban areas with intensive NOx emissions, whereas high ozone production efficiency (>11) is found in upwind and rural areas with less NOx source emissions.

• Under climate conditions expected for 2030, model simulations predict increased ozone concentrations, however, projected emission reductions will more than compensate for this and therefore most areas have predicted ozone reductions (Figure 4). Until 2030, according to model results, the predict-

ed effect of climate change on surface ozone is an increase in almost all of Europe (not shown). The only exceptions are the Northwest of the British Isles and the Northwest of Russia. However, when projected reductions in ozone precursor emissions are taken into account (Figure 4), surface ozone is assumed to decrease, i.e. the decrease due to emission reductions overwhelms the increase due to climate change. (For the projected reductions see (Benedictow et al., 2010)). The only exceptions are the highly polluted areas such as London, BeNeLux, parts of the Po Valley and Moscow, where the reduction in titration following the NOx emission reductions will lead to further increases in ozone. This finding is another illustration that air quality improvements in ozone will remain limited as long as this area remains saturated in NOx emissions.

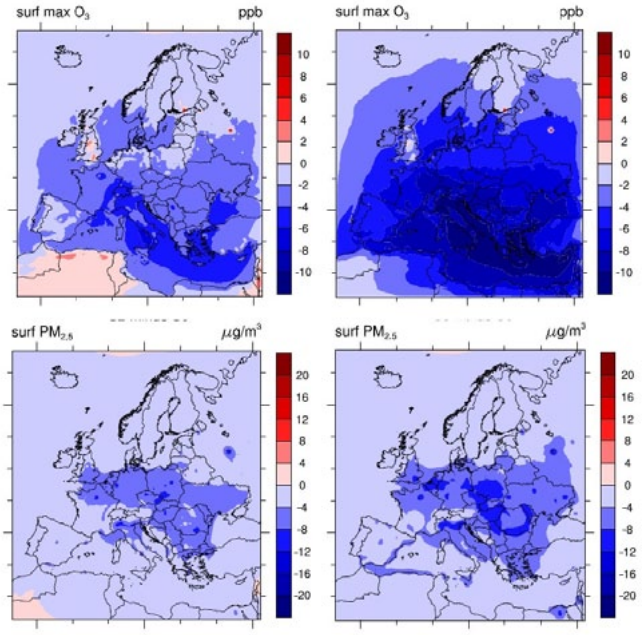

Figure 4. (EMEP Report 1/2010) Change in daily maximum surface ozone (top plots) and change in surface concentration of PM2.5 (bottom plots) under scenario 1 (left) and scenario 2 (right) relative to current (2000-2010) conditions. Scenario 1 assumes full implementation of all current and planned air pollution legislation world-wide until 2030, but no specific climate change or energy access policies are implemented. Scenario 2 assumes the same implementation of air pollution legislation as scenario 1, in addition to stringent climate policy corresponding to a 2- degree global temperature target and a moderate energy access policy corresponding to microfinance and 20% fuel subsidy.

• Under climate conditions expected for 2030, model simulations predict an overall reduction in PM2.5 concentrations, as projected reductions in anthropogenic emissions of aerosols and aerosol precursors outweigh indirect increases in concentrations due to climate change (Figure 4). In the case of particulate matter (PM2.5), climate change will lead to increases over large parts of Western and Southern Europe as well as the Mediterranean, mainly because of changes in precipitation and wash-out. Reductions are modelled in Eastern Europe. Similarly to the ozone case, the projected reductions in anthropogenic emissions (aerosols and aerosol precursors) overcompensate for the effect from climate change (Benedictow et al., 2010). The model predicts an overall reduction in PM2.5 concentrations when both climate change and emission reductions are taken into account. In summary, CityZen has made significant progress into understanding and quantifying the impacts of megacities in Europe, the near East, and China on air quality, and the impacts of climate change on air quality in densely populated areas. The measurements and models in combination have shown that there are strong regional characteristics affecting the megacity regions focused on in CityZen. The East Mediterranean, Europe, and China hot spot regions all have vastly different meteorology and dominating influences, and yet face similar air quality and climate change challenges in the future. Understanding these differences and what tools are necessary to do so will provide important input for future planning and decision-making for air quality and climate policy. As the project finishes, targeted special topics summaries will be issued that provide focused messages summarizing the findings from CityZen that are most relevant for scientific policy underpinning.

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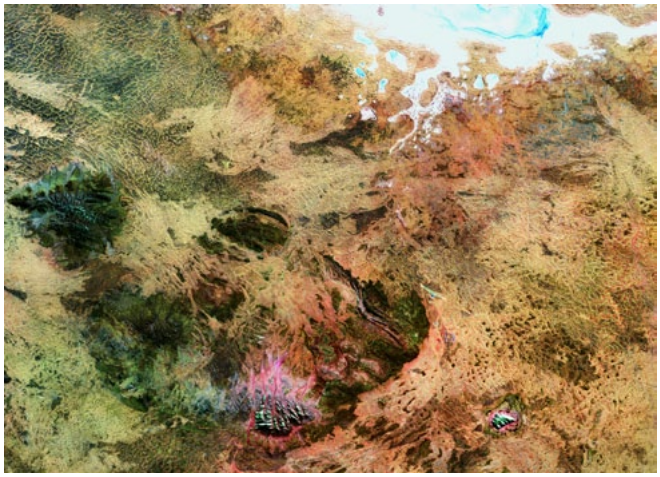
Image of the Earth: Sacred stones of the outback



This Landsat 5 image, acquired on 18 May 2011, takes us to the Amadeus Basin in the heart of the Australian outback. Two large rock formations are visible on the lower section of the image. The group of 36 domed rock formations to the west (left) is the Kata Tjuta with the tallest dome, Mount Olga, reaching 1066 m above sea level. Forty kilometres east of Kata Tjuta is Ayers Rock, known to the Aboriginals as Uluru. The white area at the top of the image is the salt-crusted Lake Amadeus. ESA supports the Landsat series as a Third Party Mission, meaning it uses its ground infrastructure and expertise to acquire, process and distribute Landsat data to users. Credits: USGS

9 September 2011.- This Landsat image takes us to the Amadeus Basin in the heart of the Australian outback.

Two large rock formations are visible on the lower section of the image. Sacred to the local Aboriginal people, the Anangu, these sandstone 'bornhardts' are the main features of the Uluru-Kata Tjuta National Park, a UNESCO World Heritage site.

The group of 36 domed rock formations to the west (left) is the Kata Tjuta with the tallest dome, Mount Olga, reaching 1066m above sea level.

Forty kilometres east of Kata Tjuta is Ayers Rock, known also as Uluru. Surrounding the formation are springs, waterholes, caves and ancient paintings.

Local legend claims that misfortune will fall on those who remove rocks from Uluru. It has been reported that many who had taken this risk later attempted to mail the rocks back to lift the curse.

The white area at the top of the image is the salt-crusted Lake Amadeus. Although it contains hundreds of millions of tonnes of salt, the remote location renders it nearly impossible for harvesting.

This area in the southern part of the Northern Territory is home to a variety of animals, including the red kangaroo, emu, marsupial mole, various bats and over 70 species of reptiles.

ESA

Steep increase in global CO2 emissions

despite reductions by industrialised countries with binding Kyoto targets

21 September 2011.- Global emissions of carbon dioxide (CO2) increased by 45 % between 1990 and 2010, and reached an all-time high of 33 billion tonnes in 2010. Increased energy efficiency, nuclear energy and the growing contribution of renewable energy are not compensating for the globally increasing demand for power and transport, which is strongest in developing countries.

This increase took place despite emission reductions in industrialised countries during the same period. Even though different countries show widely variable emission trends, industrialised countries are likely to meet the collective Kyoto target of a 5.2 % reduction of greenhouse gas emissions by 2012 as a group, partly thanks to large emission reductions from economies in transition in the early nineties and more recent reductions due to the 2008-2009 recession. These figures were published today in the report "Long-term trend in global CO2 emissions", prepared by the European Commission's Joint Research Centre and PBL Netherlands Environmental Assessment Agency.

The report, which is based on recent results from the Emissions Database for Global Atmospheric Research (EDGAR) and latest statistics for energy use and other activities, shows large national differences between industrialised countries. Over the period 1990-2010, in the EU-27 and Russia CO2 emissions decreased by 7% and 28% respectively, while the USA's emissions increased by 5% and the Japanese emissions remained more or less constant. The industrialised countries that have ratified the Kyoto Protocol (so called 'ratifying Annex 1 countries') and the USA, in 1990 caused about two-thirds of global CO2 emissions. Their share of global emissions has now fallen to less than half the global total.

The full report can be downloaded from: edgar.jrc.ec.europa.eu or www.pbl.nl/en.

European Commission, Joint Research Centre (JRC)

Sewage contains the greatest diversity of unidentified viral populations known to date

21 October 2011.- Raw sewage provides a perfect ecosystem for studying the diversity of viral populations that remain uncharacterized. This is one of the principal conclusions of a study published in the journal mBio by a team from the UB's Laboratory of Water and Food Viral Pollution, Washington University and the University of Pittsburgh, under the direction of James Pipas. The study, which applies metagenomics to the analysis of viral populations present in sewage, reveals that the viral universe is larger than previously thought.

Some 3000 different viruses are currently recognized, but it is believed that this represents only a small proportion of the real number of viruses in nature. This new study analyses viral diversity through the examination of nucleic acid sequences from sewage samples from Pittsburgh (USA), Barcelona (Spain) and Addis Ababa (Ethiopia). According to the lecturer Rosina Gironès, co-author of the study and head of the Laboratory of Water and Food Viral Pollution at the University of Barcelona, "this is the greatest diversity of viral populations revealed in any research study, many of which infect humans. We have also seen that current databases are not always fully correct: you have to be extremely thorough when analysing these new sequences to make sure that homologies with known virus groups are in fact reliable".

Metagenomics: opening new ground in virology Metagenomics is a powerful new technique that enables scientists to study the genetic diversity of microorganisms in different environmental surroundings. The metagenomic approach, initially used to study viral diversity in oceans, arctic lakes, faecal matter and other environments, is broadening the scope of research to discover a level of viral diversity unknown to scientists. The article describes the identification of 234 known viruses belonging to 26 taxonomic families, 17 of which infect humans. However, the majority of the viral genomes detected bear little or no resemblance to known viruses. According to the experts behind the study, the most abundant types are plant viruses and bacteriophages (which infect bacteria). "People may not be aware of the large proportion of viruses that are founds in plants", says Rosina Gironès. "In fact, we can transmit viral plant pathogens via sewage". The study also reveals the presence of skin-tropic viral species that can be excreted, such as the human papillomavirus 112 and the recently described human polyomavirus 6. The paper published in mBio establish a new framework for improving our knowledge of viral diversity and the origin of emerging pathogens. The team now intends to conduct further study of the newly detected viruses and their pathogenicity and fine-tune the metagenomic approach to improve sequence analyses. "We know there are viruses that we have been unable to detect, but we will be able to identify them with the right techniques. By using the novel metagenomic approach, which is generating a substantial volume of data on specific viral genome segments, we will be able to refine results on newly detected viruses, the diversity of the families observed and their impact on human health", explains Rosina Gironès.

Viruses: more than infectious agents The Laboratory on Water and Food Viral Pollutants, coordinated by Rosina Gironès, is an authority on the study of pathogens (hepatitis A and E), enteroviruses, adenoviruses, emerging human viruses, prions and various viruses indicative of faecal contamination. The projects carried out by the laboratory team have contributed to the discovery of new viruses with a bearing on human health and have reshaped the accepted paradigm of viral infection. "We have confirmed that human viruses are always present in sewage from human populations. In other words, we excrete viruses regularly, not simply during periods of widespread infection. The concept of what viruses are has changed. We no longer consider them simply as pathogenic agents; viruses form part of the microbiome of the human body, of nature in general, and can also have positive effects on the body, as recent studies have shown. I am sure that once we have definitively identified the role of viruses in the human microbiome we will obtain a clearer picture of their effects and benefits", concludes Gironès.

Reference

Gantalupo, Paul G.; Calgua, Byron; Zhao, Guoyan; Hundesa, Ayalkibet; Wier, Adam D.; Katz, Josh P.; Grabe, Micahle; Hendrix, Roger W.; Gironès, Rosina; Wang, David; Pipas, James M., Raw Sewage Harbors Diverse Viral Populations, mBio, 2011, vol. 2, núm. 3, e00180-11.

UNIVERSITY OF BARCELONA

Lunar skylightl compass obscured by urban light pollution

During clear moonlit nights a compass-like pattern of polarized light that is invisible to the human eye stretches across the sky

27 October 2011.- Urban light pollution has been shown to reduce the visibility of not only the stars, but also of an important navigational signal for some nocturnal animals. During clear moonlit nights, a compass-like pattern of polarized light that is invisible to the human eye stretches across the sky. The nighttime skyglow over major cities renders this celestial compass unobservable over large areas, according to a new study by a group of physicists and ecologists at Freie Universität Berlin and the Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB). The report, which is currently in press in the Journal of Geophysical Research, cautions that screening of the celestial compass may reduce the evolutionary fitness of certain nocturnal animals, including species of beetles, moths, crickets, and spiders, possibly leading to disruption of food webs and affecting entire ecosystems.

"The visibility of the celestial compass is related to the degree of polarization of skylight" says the lead author of the study, Dr. Christopher Kyba, physicist at the Institute for Space Sciences of Freie Universität. "In a natural area with clean air, the degree of polarization of skylight is typically around 70-80%, and in Berlin aerosols reduce this to around 55%. We measured the sky polarization at night using a digital camera equipped with a linear polarizing filter, and found that inside the city light pollution reduced it further, to 11%" says the lead author of the study, Dr. Christopher Kyba. "Because light can travel so far in clear air, this depolarization effect extends far outside of cities. In a rural area outside of Berlin we found that the degree of polarization was still only 30%, even though the sky appeared dark to our eyes".

Reference

Kyba CCM, Ruhtz T, Fischer J, Hölker F (2011) Lunar Skylight Polarization Signal Polluted by Urban Lighting. Journal of Geophysical Research. doi: 10.1029/2011JD016698

Discovery of giant Pleistocene landslides

highlights tsunami risk

13 October 2011.- Three giant underwater landslides, which took place up to half a million years ago, have been discovered off the coast of Southern Chile by researchers at the Leibniz Institute of Marine Sciences (IFM-GEOMAR) in Kiel and the Federal Institute for Geosciences and Natural Resources in Hanover.

The largest of the three landslides moved nearly 500 cubic kilometres of rock material and sediment, making them some of the biggest ever found at active continental plate boundaries.

'The main hazard of such an event is the tsunami that would be generated' says Jacob Geersen of the Leibniz Institute. 'But there are others: slides can destroy offshore installations like cables and oil platforms, or affect populated shorelines'.

The giant landslides – which moved 253, 388 and 472 km3 of sediment – occurred at the edge of the South American plate, where the Nazca plate subducts beneath it. The slope gradient of the seafloor from the shelf to the deep sea can be as high as 30 degrees, which researchers believe was the main cause of the landslides. While slope failure is highly likely to recur in future, it is difficult to predict.

The landslides took place during the Pleistocene period – a time when humans were evolving into their present form. Woolly mammoths, sabre toothed tigers and cave bears also emerged during the period, which saw repeated glaciations.

'The slides may have been triggered by one of the strong earthquakes that characterise this region' says Geersen, 'but we can't be sure of that. Strong earthquakes with magnitudes close to 9 occur in the area every 100-200 years, and the time interval between these slides is 200,000 years, so earthquakes obviously do not always cause giant landslides'.

Landslides are responsible for about 15% of all tsunamis worldwide. With the data suggesting that each landslide was one event, rather than multiple failures, the Pleistocene slides would have caused very large tsunamis. Tsunami amplitudes are hard to determine after the event - but a comparatively small slide which took place in 1998 off Papua New Guinea, displacing around 5 – 10 km3, caused a local tsunami-wave of up to 15 m height which killed around 2,200 people.

The research, published in the Journal of the Geological Society on 17 October, used high frequency acoustic signals to map the seafloor, and low frequency signals to investigate subsurface structures, which enabled them to identify the landslide debris. The Leibniz Institute of Marine Sciences has carried out several research trips over the last 20 years to identify giant landslides, and hope to carry out more surveys.

Reference

J. Geersen, D. Volker, J. H. Behrmann, C. Reichert & S. Krastel., 'Pleistocene giant slope failures offshore Arauco Peninsula, Southern Chile', Journal of the Geological Society, London, Vol. 168, 2011, pp. 1 - 12.

The Geological Society of London

Pesticides in European waterbodies

list of chemicals to be monitored should be updated immediately

13 October 2011.- Pesticides are a bigger problem than had long been assumed. This is the conclusion of a study in which scientists analysed data on 500 organic substances in the basins of four major European rivers. It was revealed that 38 per cent of these chemicals are present in concentrations which could potentially have an effect on organisms. According to scientists writing in the journal "Science of the Total Environment", this conclusion clearly shows that contamination by organic chemicals is a problem throughout Europe. Most of the substances classified as a risk to the environment in the study were pesticides; the majority of these are not on the European list of priority substances which have to be monitored regularly. They therefore believe that the list of chemicals specified by the EU Water Framework Directive as having to be monitored by national authorities urgently needs to be revised.

The aim of the EU Water Framework Directive is that surface water and groundwater bodies should reach a good environmental and chemical status by 2015. The chemical status will be assessed based on a list of 33 so-called priority pollutants. As over 14 million chemicals are on the market and over 100,000 of these are produced on an industrial scale, the authorities have to confine their monitoring to a manageable number of pollutants. Throughout Europe scientists are therefore working on methods to establish which pollutants these should be.

An important contribution to this has now been made by a study completed by the Helmholtz Centre for Environmental Research (UFZ) together with colleagues in France, Slovakia, Belgium and Spain. They analysed a database compiled for the EU MODELKEY research project which contains five million records on physicochemical data. The study focused on organic pollutants recorded in over 750,000 entries of water analyses in the basins of the Elbe (Czech Republic/Germany), the Danube (10 neighbouring European countries), the Schelde (Belgium) and the Llobregat (Spain) rivers. According to the European Commission, this is the first study which has developed a system which has classified organic pollutants on the basis of assessment criteria and the need for action.

One of the most frequently registered compounds was diethylhexyl phthalate (DEHP), a chemically-produced softener which may impair fertility and is therefore banned in the EU from 2015. This is followed by another softener bisphenol A (BPA), which may also impair fertility, and diclofenac and ibuprofen, two pharmaceutical substances used commonly in painkillers.

The scientists classified a total of 73 compounds as potential priority pollutants. Around two thirds of these are pesticides, i.e. products used in agriculture to protect crops against disease, pests and weeds. The most problematic pesticides were diazinon, which is already no longer allowed in Germany and Austria, as well as azoxystrobin and terbuthylazine, which are still allowed in Central Europe. "Neither of these pesticides is on the list of 33 priority pollutants, which have to be monitored by authorities throughout the EU", explains UFZ researcher Dr. C. Peter von der Ohe. "Terbuthylazine is a compound that is structurally closely related to the priority pollutants simazine and atrazine, which may not be applied any more. This is a nice example how small structural modifications of chemical products may apparently improve the chemical status without mitigating any hazards to the aquatic ecosystems". Thus, the scientists strongly support that the priority pollutant list is regularly updated. Today the majority of the substances currently presenting problems are not listed, while many of the chemicals being monitored have been banned for some time and are no longer used. "We were also surprised that substances previously classified as harmless, such as HHCB, which is used as a synthetic musk fragrance in personal care products, are present in the environment in alarming concentrations," adds Dr. Werner Brack of the UFZ, who advises the European Commission in various committees and projects on the revision of the list of priority pollutants. "In our opinion the development of the Water Framework Directive should ensure that in future not only the presence of chemical substances but also their effects are monitored," suggests Brack.

For all of the criticism that the water authorities in Europe are currently paying too little attention to pesticides and that the list of priority pollutants should be revised, in the opinion of the scientists the study also reveals the first successes of the Water Framework Directive. One third of the pollutants classified as priority a few years ago by the EU now no longer present a risk to the rivers studied.

Reference

Von der Ohe PC, Dulio V, De Deckere E, Slobodnik J, Kühne R, Ebert R-U, Schüürmann G, Brack W 2011. A new risk assessment approach for the prioritization of 500 classical and emerging organic microcontaminants as potential river basin specific pollutants under the European Water Framework Directive. Sci. Total Environ. 409: 2064-2077., http://dx.doi.org/10.1016/j.scitotenv.2011.01.054

Helmholtz Centre for Environmental Research (UFZ), URL: http://www.ufz.de/index.php?en=22196

Fungal virulence at the time of the end-Permian biosphere crisis?

fossil remains show great similarity to resting structures of modern soil fungi such as Rhizoctonia

One of the most remarkable phenomena related to worldwide ecological crisis and associated mass extinction at the Permian-Triassic transition, about 250 million years ago, is the prolific occurrence of filamentous microfossils in latest Permian sediments. Earlier, these chains of cells, known as Reduviasporonites, have been controversially identified as either fungi or algae.

Henk Visscher of Utrecht University and colleagues have discovered that the fossil remains show near-identity to resting structures of modern soil-borne fungi, such as Rhizoctonia. These fungi produce hyphae of robust-walled cells, which may fuse together into aggregates called sclerotia. The end-Permian crisis is marked by a dramatic decline of woody vegetation. Previously, mass occurrences of Reduviasporonites had been ascribed to wood-rotting fungi utilizing the excessive abundances of dead wood. Visscher et al.'s findings of Rhizoctonia-like resting structures now suggest a much more aggressive role for fungi. Modern Rhizoctonia include ubiquitous plant pathogens, causing root, stem, and foliar diseases in many plants. Pathogenic fungi are particularly aggressive on plants already weakened by environmental stress. Therefore, in harmony with patterns of present-day forest mortality, it is likely that fungal disease had accelerated latest Permian woodland deterioration, initially triggered by the adverse environmental effects of massive volcanic activity in Siberia.

Henk Visscher et al., doi: 10.1130/G32178.1.

ESA opens Landsat archives

over 30 years of archived data

23 November 2011.- Over 30 years of archived data from the US Landsat Earth-observing satellites are now available, free of charge. The majority of these products are unique to ESA's archive and have never before been accessible anywhere else by the scientific user community.

In its archives, ESA holds around two million products that cover Europe and North Africa. The total amount of data available is worth about 450 terabytes – that's equivalent to about 900 000 hours of audio recorded at CD quality.

ESA has been acquiring Landsat data at European stations since the 1970s.

ESA revised its Earth observation data policy in 2010 to adapt to the 'Joint Principles for a Sentinel Data Policy'. This policy was approved by ESA Member States participating in the GMES Space Component Programme, and supports the concept of providing free and open access to data.

By revising the data policy, ESA followed the same path as the US Geological Survey, who began making its Landsat data available free of charge in 2009.

The ESA archives opens access to all products from the Thematic Mapper and Enhanced Thematic Mapper instruments aboard the Landsats. Data from the older Multispectral Scanner will be made available at a later stage.

To access the data, users can go to the Earth Observation Principal Investigator Portal to submit a brief project description and request data.

The Landsat series goes back to 1972, with Landsat-5 and -7 currently in orbit. Landsat-8 is due for launch by early 2013.

The 40-year-old Landsat programme is jointly managed by NASA and the US Geological Survey. ESA supports the Landsat series as a Third Party Mission, meaning it uses its ground infrastructure and expertise to acquire, process and distribute Landsat data to users.

ESA

MEDCOAST's Rhodes Declaration

The Tenth International Conference on the Mediterranean Coastal Environment, MEDCOAST 11 was organised in Rhodes, Greece during 25 – 29 October 2011. Manuscripts of ninety-three papers, covering a wide range of subjects related to coastal and marine management were published in 2 volume-conference proceedings totalling 996 pages. The papers were presented in keynote, oral and poster sessions.

We, one hundred and seventeen participants of MEDCOAST 2011 conference, representing twenty-five countries, in appreciation of the charms of the Island and Town of Rhodes and warm Greek hospitality and;

Being aware of uniqueness and fragility of the Mediterranean and the Black Sea coastal environment and importance of these areas for economic development of the riparian countries and the wealth of the populations;

Noting the efforts of the Mediterranean countries under the framework of the UNEP's Mediterranean Action Plan (MAP) and of the Black Sea countries through the Bucharest Convention towards regional collaboration for improving integrated coastal management capabilities and being encouraged by the Barcelona Convention's new ICZM Protocol for the Mediterranean and its entering into force in a short time span;

Appreciating the interests of the European Union and the GEF for contributing to capacity enhancement of the non-EU

states of the Mediterranean and Black Sea countries in order to better manage their coastal and marine areas and witnessing the significant progress achieved by PEGASO, the project financially supported by the EU under the FP7 scheme and the MedPartnership project of GEF, both aiming to enhance ICZM in regional context;

Observing that motivations for economic development often overtaking conservation and protection concerns and resulting in unrecoverable, important losses especially in developing countries thriving for fast economic growth;

Being concerned by low levels of decentralised collaboration for environmental protection and management of coastal areas over both basins and by insufficient involvement of the scientific community in the governmental and inter-governmental programs and projects;

Congratulating the bronze jubilee (the tenth event) of the bi-annual conference series on the Mediterranean Coastal Environment and applauding the twenty-year long MEDCOAST efforts for sharing of data, information, knowledge and experience over two basins and her region-wide capacity building activities that have contributed to advancement of integrated coastal management in the Mediterranean and Black Sea countries;

Unanimously agree to highlight the following observations and recommendations for attention of national, regional and international institutions dealing with coastal and marine issues, and of concerned individuals:

1. As it was recommended also by MEDCOAST's Alexandria Declaration in 2007, collaboration over the Mediterranean and the Black Sea basins must be extended beyond the intergovernmental programs. Creation and functioning of decentralised networks aiming at cooperative efforts to improve coastal and marine management practices should be encouraged by the international programs and donor institutions. In this context, collaboration schemes similar to the Mediterranean programs of the European Union that created a significant momentum in the region for decentralised co-operation in the first half of the 1990's, should be reinstated. The effort for setting up the Medposidonia programme is welcomed in this context. Instruments need to be developed to substantiate interaction of the Mediterranean and the Black Sea institutions and networks as it has been realized by MEDCOAST since her first event in 1993.

2. Since the ICZM Protocol for the Mediterranean implies significant challenges and obligations to the riparian countries for bringing their management schemes and practices to conform to the regional legislation, the timely and successful application of the Action Plan to be pursued by the Mediterranean Action Plan for implementation of the ICZM protocol is of extreme importance. Collaboration with national and other regional actors including the scientific community and NGOs for applying effective actions in the implementation process must be sought. Progress and achievements in management schemes must be closely monitored and compliance of the riparian countries with the regional legislation in general and with the ICZM Protocol in particular must be effectively enforced.

3. Public awareness and human resources are essential prerequisites for initiating and implementing local and national ICZM programs. Regional projects that focus on training and education on ICZM specific to the Mediterranean and the Black Sea should be given priority for financial support by the European Union and other donor institutions. Pan-Mediterranean and Black Sea graduate programs on ICZM should be developed and implemented by networks involving institutions from both EU and non-EU countries. Short term training of public employees involved in ICZM related activities would facilitate the timely and effective implementation of the ICZM Protocol for the Mediterranean. The MEDCOAST Institute that has been providing such an opportunity for both the Mediterranean and the Black Sea regions since 1994 is a worthy example of this type of training.

4. The pristine coastal and marine sites that possess important ecological, cultural and aesthetic values must be strictly protected against destructive development, and some of these areas should be left aside for the benefit of future Mediterranean and Black Sea communities. Further coastal and marine protected areas must be created and managed by using the ecosystem approach in both basins. Progress of maritime spatial planning and networks of coastal and marine protected areas would no doubt be effective developments to enhance the practice of coastal and marine conservation.

5. Development of tools and techniques for coastal and marine management and generation of the essential data and information at the basin scale should be promoted. Collaboration of basin wide scientific institutions through existing or new networks should be encouraged. The PEGASO project of the European Union is a significant collaborative effort in this direction. Successful development of this project will no doubt encourage the follow up initiatives. The mechanism of the PEGASO project is especially noteworthy since the wide consortium behind the project includes institutions from the non-EU countries.

ERS satellite missions complete

after 20 years in service

13 September 2011.- After a final thruster firing last week to deplete its remaining fuel, ESA's venerable ERS-2 observation satellite has been taken out of service. The mission ended on 5 September, after the satellite's average altitude had already been lowered from 785 km to about 573 km. At this height, the risk of collision with other satellites or space debris is greatly reduced.

The final critical step was to 'passivate' ERS-2, ensuring that all batteries and pressurised systems were emptied or rendered safe in order to avoid any future explosion that could create new space debris.

This primarily consisted of burning off the fuel, disconnecting the batteries and switching off the transmitters.

"As soon as we saw fuel depletion occurring, a series of commands was sent to complete passivation, before shutting the satellite down for good. The last command was sent at 13:16 GMT on 5 September", said Frank Diekmann, ERS-2 Operations Manager.

Atmospheric burn up

With the effects of natural atmospheric drag, ERS-2 is predicted to

enter and largely burn up in the atmosphere in about 15 years.

End of 16-year mission

ERS-2 was launched in 1995, four years after ERS-1, the first European Remote Sensing satellite. The missions paved the way for the development of many new Earth observation techniques.

"ERS-1 and -2 delivered 20 years of continuous high-quality data covering the oceans, land, ice and atmosphere", said Wolfgang Lengert, ERS-2 Mission Manager.

ESA

Land use change influences continental water cycle

Origin and fate of atmospheric moisture over continents

28 June 2011.- Forests, and tropical forests in particular, play an important role in the global water cycle. Delft University of Technology PhD researcher Ruud van der Ent (TU Delft, The Netherlands) has recently shown that evaporation from the Amazon forest is for more than 50% responsible for the rainfall in Peru, Bolivia, Argentina, Uruguay, Paraguay and southern Brazil, where it feeds crops and rivers. Similarly in Africa, the Congo forest exports tons of water through the atmosphere to the West-African countries. Van der Ent also shows that land use changes such as irrigation, dams, and deforestation can alter evaporation patterns in a region, potentially affecting water resources in distant regions. With his research, Van der Ent has won the 2011 WMO (World Meteorological Organization) Research Award for Young Scientists.

Van der Ent won the WMO prize for his Water Resources Research paper 'Origin and fate of atmospheric moisture over continents', co-authored by Huub Savenije, Bettina Schaefli and Susan Steele-Dunne (all TU Delft). The paper shows that water falling as precipitation in one region may have originated in a distant region, or that it may be recycled moisture that originated as evaporation within the region. Global wind patterns, topography, and land cover all play a role in moisture recycling patterns and the distribution of global water resources. Land use changes such as irrigation, dams, and deforestation can alter evaporation patterns in a region, potentially affecting water resources in distant regions.

Van der Ent et al. created global maps showing the sources of atmospheric moisture for various regions. The researchers estimate that on average 40% of terrestrial precipitation originates from land evaporation, and 57% of all terrestrial evaporation returns as precipitation over land. They found that some regions rely on recycled water from within the region, while others get moisture from different regions. For instance, water evaporating from Eurasia is responsible for 80% of China's water resources, and the Rio de la Plata basin in South America gets 70% of its water from evaporation from the Amazon.

Reference:

Rudi J. van der Ent, 'Origin and fate of atmospheric moisture over continents' in Water Resources Research, Vol. 46, W09525, 2010.

Delft University of Technology
Reference URL: http://tudelft.nl/en/current/latest-news/article/detail/ontbossing-beinvloedt-waterhuishouding-continenten/

Volcanic sulphur microbe

converts CS2 into H2S

17 October 2011.- In a microorganism that flourishes in hot, acidic vulcanic mud, a previously unknown protein has been discovered by microbiologist Prof. Mike Jetten and his team. The protein breaks down organic sulphur compounds. The gene that codes for this protein has been traced and the protein structure elucidated. That results in a publication in Nature on October 20.

The microorganism Acidianus is an archaeon found in the hot and highly acidic mud of the Campi Flegrei, the 'burning fields' of the Solfatara volcano to the north of Naples. It is a unicellular organism that feasts on carbon disulphide (CS2) which it converts with water into the toxic gas H2S. This chemical conversion process makes Acidianus an interesting candidate for industrial applications, especially in removing CS2 during viscose production from cellulose.

The Nijmegen researchers who discovered this volcanic resident found out that 30% of its cell is made up by a special protein, CS2 hydrolase. It is most unusual that such a large part of an organism consists of a single protein.

It is very similar to a protein that regulates an ancient and more frequently occurring reaction in nature, namely the formation of carbonate from carbon dioxide and water.

Reference

Marjan J. Smeulders, Thomas R.M. Barends, Arjan Pol, Anna Scherer, Marcel H. Zandvoort, Anikó Udvarhelyi, Ahmad F. Khadem, Andreas Menzel, John Hermans, Robert L. Shoeman, Hans J.C.T. Wessels, Lambert P. van den Heuvel, Lina Russ, Ilme Schlichting, Mike S.M. Jetten and Huub J.M. Op den Camp.

Effects of ocean acidification

on Arctic and Mediterranean ecosystems

11 May 2011.- The Arctic region, which is already affected by climate change more than anywhere else in the world, will be particularly threatened by ocean acidification within the next decade. Only stringent CO2 mitigation measures would limit ocean acidification and global warming. The increase in acidity in the surface waters of the ocean is a consequence of the CO2 emissions caused by human activities and it may severely threaten the existence of various marine species. These are some of the findings of the 6.5 million EUR EU funded "European Project on Ocean Acidification" (EPOCA), presented on the 13th of May in Brussels in a dedicated "Information day". The event was the occasion to show also the prize-winning documentary on ocean acidification, "Tipping point".

Ocean acidity has increased by 30% in the past 200 years and could increase by at least another 100% by 2100. This is due to the uptake of 25% of the human-produced CO2 by the oceans and seas (about 24 millions tons CO2 every day). While this uptake partly mitigates climate change, ocean acidification threatens marine biodiversity and could affect economically important marine resources, including fish, shellfish and coral reefs.

Among other findings, EPOCA discovered that the uptake of CO2 released by humans will make regions of the Arctic Ocean corrosive to shells and skeletons of organisms which play an important role in the food chain and functioning of Arctic marine ecosystems. In particular, project results indicate that 10% of Arctic surface waters will become corrosive to some forms of calcium carbonate in less than 10 years and that half will become corrosive by mid-century.

According to researchers involved in the project, only stringent, but economically feasible, carbon emission mitigation measures would limit ocean acidification over this century: projected 21st century changes in pH and global mean surface warming are much smaller in emission mitigation (pH change: -0.04 to -0.19 units; Temperature change: 1.1 to 2.1°C) than in the business-as-usual scenarios (-0.21 to -0.36 pH units; 2.4 to 4.2°C).

Another consequence analysed by EPOCA is the effect of ocean acidification on the Mediterranean Sea. About 30% of marine plants and animals could be lost from Mediterranean costal habitats by the end of this century. Efforts are needed to protect costal habitats so their natural systems can better withstand the effect of acidification and continue to support food production and provide services such as protection of the coastline from erosion.

For more information: http://www.epoca-project.eu/

EC Press office

Productivity of land plants may be greater than previously thought

recommendations on the reworking of global carbon models

29 September 2011.- The global uptake of carbon by land plants may be up to 45 per cent more than previously thought. This is the conclusion of an international team, based on the variability of heavy oxygen atoms in the carbon dioxide of the atmosphere driven by the El Niño effect. As the oxygen atoms in carbon dioxide were converted faster than expected during the El Niño years, current estimates for the uptake of carbon by plants are probably too low. These should be corrected upwards, say the researchers in Nature. Instead of 120 petagrams of carbon, the annual global vegetation uptake probably lies between 150 and 175 petagrams of carbon. The reworking of this so-called global primary productivity would have significant consequences for the coupled carbon cycle-climate model used in climate research to predict future climate change.

Lisa Welp of the Scripps Institution of Oceanography at the University of California in San Diego and her colleagues evaluated the data for the global isotopic composition of the greenhouse gas CO2 over the last 30 years. This analysis indicated regular fluctuations between years and a connection with the El Niño phenomenon in the Pacific. Overall, El Niño years are warmer. They are also characterised by greater precipitation in South America and less intensive monsoons in Southeast Asia. The researchers found a more rapid recovery of the isotopic ratios following the El Niño events than assumed, indicating a shorter conversion time for CO2 in the terrestrial biosphere. On the basis of these data, the authors calculate the global primary productivity (GPP).

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The darkest known exoplanet

distant gas giant the size of Jupiter

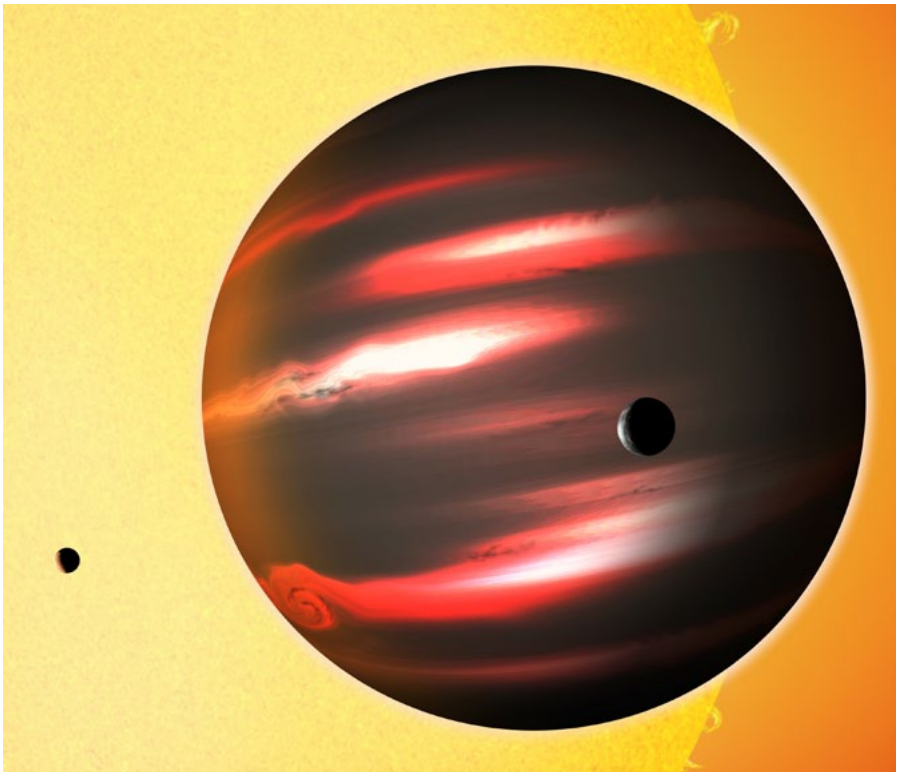
11 August 2011.- Astronomers have discovered the darkest known exoplanet – a distant, Jupiter-sized gas giant known as TrES-2b. Measurements show that TrES-2b reflects less than one percent of the sunlight falling on it, making it blacker than coal or any planet or moon in our solar system.

TrES-2b orbits its star at a distance of only five million kilometres. The star's intense light heats TrES-2b to a temperature of more than 1000 degrees Celsius. Its exotic atmosphere contains light-absorbing chemicals like vaporized sodium and potassium, or gaseous titanium oxide. Yet none of these chemicals fully explain the extreme blackness of TrES-2b.

"It's not clear what is responsible for making this planet so extraordinarily dark", stated co-author David Spiegel of Princeton University. "However, it's not completely pitch black. It's so hot that it emits a faint red glow, much like a burning ember or the coils on an electric stove".

Kipping and Spiegel determined the reflectivity of TrES-2b using data from NASA's Kepler spacecraft. Kepler is designed to measure the brightnesses of distant stars with extreme precision.

TrES-2b orbits the star GSC 03549-02811, which is located about 750 light-years away in the direction of the constellation Draco.



The distant exoplanet TrES-2b, shown here in an artist's conception, is darker than the blackest coal. This Jupiter-sized world reflects less than one percent of the light that falls on it, making it blacker than any planet or moon in our solar system. Astronomers aren't sure what vapours in the planet's superheated atmosphere cloak it so effectively. Credit: David A. Aguilar (CfA)

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"Detection of visible light from the darkest world", Kipping D. M. and Spiegel D. S., Monthly Notices of the Royal Astronomical Society, in press.

Royal Astronomical Society (RAS)

This research has been accepted for publication in the Monthly Notices of the Royal Astronomical Society and is available online. A preprint can be seen at ***http://www.astro.princeton.edu/~dsp/PrincetonSite/Home_files/darkest_world.pdf***

Plate tectonics may control reversals in the Earth's magnetic field

21 October 2011.- The Earth's magnetic field has reversed many times at an irregular rate throughout its history. Long periods without reversal have been interspersed with eras of frequent reversals. What is the reason for these reversals and their irregularity? Researchers from CNRS and the Institut de Physique du Globe(1) have shed new light on the issue by demonstrating that, over the last 300 million years, reversal frequency has depended on the distribution of tectonic plates on the surface of the globe. This result does not imply that terrestrial plates themselves trigger the switch over of the magnetic field. Instead, it establishes that although the reversal phenomenon takes place, in fine, within the Earth's liquid core, it is nevertheless sensitive to what happens outside the core and more specifically in the Earth's mantle. This work is published on 16 October 2011 in Geophysical Research Letters.

The Earth's magnetic field is produced by the flow of liquid iron within its core, three thousand kilometers below our feet. What made researchers think of a link between plate tectonics and the magnetic field? The discovery that convective liquid iron flows play a role in magnetic reversals: experiments and modeling work carried out over the last five years have in fact shown that a reversal occurs when the movements of

molten metal are no longer symmetric with respect to the equatorial plane. This "symmetry breaking" could take place progressively, starting in an area located at the core-mantle boundary (the mantle separates the Earth's liquid core from its crust), before spreading to the whole core (made of molten iron).

Extending this research, the authors of the article asked themselves whether some trace of initial symmetry breakings behind the geomagnetic reversals that have marked the Earth's history, could be found in the only records of large-scale geological shifts in our possession, in other words the movements of continents (or plate tectonics). Some 200 million years ago, Pangaea, the name given to the supercontinent that encompassed almost all of the Earth's land masses, began to break up into a multitude of smaller pieces that have shaped the Earth as we know it today. By assessing the surface area of continents situated in the Northern hemisphere and those in the Southern hemisphere, the researchers were able to calculate a degree of asymmetry (with respect to the equator) in the distribution of the continents during that period.

In conclusion, the degree of asymmetry has varied at the same rhythm as the magnetic reversal rate (number of reversals per million years). The two curves have evolved in parallel to such an extent that they can almost be superimposed. In other words, the further the centre of gravity of the continents moved away from the equator, the faster the rate of reversals (up to eight per million years for a maximum degree of asymmetry).

What does this suggest about the mechanism behind geomagnetic reversals? The scientists envisage two scenarios. In the first, terrestrial plates could be directly responsible for variations in the frequency of reversals: after plunging into the Earth's crust at subduction zones, the plates could descend until they reach the core, where they could modify the flow of iron. In the second, the movements of the plates may only reflect the mixing of the material taking place in the mantle and particularly at its base. In both cases, the movements of rocks outside the core would cause flow asymmetry in the liquid core and determine reversal frequency.

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CNRS (Délégation Paris Michel-Ange)

Olympia hypothesis

Tsunamis may have buried the cult site on the Peloponnese

10 July 2011.- Professor Andreas Vött of Johannes Gutenberg University Mainz presents new results of geomorphological and geoarcheological investigations on the sedimentary burial of Olympia.

Olympia, site of the famous Temple of Zeus and original venue of the Olympic Games in ancient Greece, was presumably destroyed by repeated tsunamis that travelled considerable distances inland, and not by earthquake and river floods as has been assumed to date. Evidence in support of this new theory on the virtual disappearance of the ancient cult site on the Peloponnesian peninsula comes from Professor Dr Andreas Vött of the Institute of Geography of Johannes Gutenberg University Mainz, Germany. Vött investigated the site as part of a project in which he and his team are studying the paleotsunamis that occurred along the coastlines of the eastern Mediterranean over the last 11,000 years. According to his account, the geomorphological and sedimentological findings in the area document that Olympia and its environs were destroyed by tsunami impact. The site of Olympia, rediscovered only some 250 years ago, was buried under a massive layer of sand and other deposits that is up to 8 meters deep.

"Both the composition and thickness of the sediments we find in Olympia do not go with the hydraulic potential of the Kladeos River and the geomorphological inventory of the valley. It is highly unlikely that this could have been the work of this creek", states Vött. To date, it has been assumed that the cult site was finally destroyed by an earthquake in 551 AD and later covered by flood deposits of the Kladeos River. In this scenario, however, it remains mysterious how the tiny Kladeos that passes by could first have buried Olympia under several meters of sediment, only to subsequently get incised by 10 to 12 meters down to the flow level used in ancient times. Working in collaboration with the local Ephorate for Classical Antiquities, the German Archaeological Institute, and colleagues from the universities of Aachen, Darmstadt, Freiburg, Hamburg, and Cologne, Vött and his team examined the location using geomorphological and geoarcheological methods and techniques.

The results indicate that Olympia was repeatedly hit by catastrophic floods during its history resulting in the site being buried under huge masses of sediment. The presence of mollusc and gastropod shells and the remains of abundant micro-organisms such as foraminifera are clear evidence of a marine origin of the sediment. The sediments were obviously transported inland at high velocity and high energy, reaching Olympia although the site lies some 33 meters above sea level. The most probable explanation is that tsunami waters overflowed the narrow range of hills between Olympia and the sea through low-lying saddles.

"In earlier times, Olympia was not 22 kilometers away from the sea as it is today. Back then, the coastline was located eight or perhaps even more kilometers further inland", explains Vött. In his scenario, tsunamis came in from the sea and rushed into the narrow Alpheios River valley, into which the Kladeos River flows, forcing their way over the saddles behind which Olympia is located. The cult site was thus flooded. Vött assumes that the flooding decreased only slowly because the outflow of the Kladeos through the Alpheios valley was blocked by incoming tsunami waters and corresponding deposits. The analysis of the various layers of sediments in the Olympia area suggests that this scenario came true on several occasions during the last 7,000 years. It was during one of the more recent of these events in the 6th century AD that Olympia was finally destroyed and buried.

The Olympia tsunami hypothesis is further supported by the fact that high-energy sediments of undoubtedly tsunamigenic origin were found on the seaward side of the hill range and these deposits are identical to those in Olympia itself. Vött points out that "the sediments around Olmypia have the same signature as the tsunamite in the lower Alpheios valley". Vött says that the cause of Olympia's destruction could not have been an earthquake because in this case the fallen fragments of the columns of the Temple of Zeus would directly lie on top of each other, but in fact they are "floating" in sediment. All the sedimentological, geochemical, geomorphological, and geoarcheological findings obtained by the study support the new and sensational hypothesis that Olympia was destroyed by tsunamis. Detailed analyses of associations, origin, and age of microfauna as well as geochronological studies are currently in progress.

http://www.uni-mainz.de/eng/14389.php

View to the west of the central Kladeos River valley and the range of hills which separate Olympia from the wider coastal area. In the background the narrow Apheios River valley (left) and the coast of the Gulf of Kyparissia can be seen. The site of ancient Olympia was hit by tsunami impact and buried under a massive layer of sand and other deposits in the 6th century AD. (photo: Andreas Vött)

Responsibilities of scientists

Principle of Universality of Science by ICSU

30 September 2011.- The General Assembly of the International Council for Science (ICSU) today reaffirmed the universal values that should guide the conduct of science. It explicitly recognized the key social responsibilities of the scientific community that need to accompany the free practice of science. While the focus of the Principle of Universality of Science – which is central to ICSU's statutes and a basic condition of worldwide membership of the ICSU family – has been on the preservation of scientific freedoms, ICSU is mindful of the need for scientists to pay equal attention to their responsibilities.

The new wording of the Principle was approved today by the membership of ICSU at its General Assembly in Rome. It reads as follows:

The Principle of Universality (freedom and responsibility) of Science

The free and responsible practice of science is fundamental to scientific advancement and human and environmental well-being. Such practice, in all its aspects, requires freedom of movement, association, expression and communication for scientists, as well as equitable access to data, information, and other resources for research. It requires responsibility at all levels to carry out and communicate scientific work with integrity, respect, fairness, trustworthiness, and transparency, recognising its benefits and possible harms.

In advocating the free and responsible practice of science, ICSU promotes equitable opportunities for access to science and its benefits, and opposes discrimination based on such factors as ethnic origin, religion, citizenship, language, political or other opinion, sex, gender identity, sexual orientation, disability, or age.

Promoting good scientific conduct and preventing misconduct is critical for science as a whole, and for this reason ICSU's CFRS was also heavily engaged in the organization of the second World Conference on Research Integrity in Singapore in July 2010. The Singapore Statement on Research Integrity, which stemmed from the event, was presented to the Assembly in Rome. The statement emphasizes the need for honesty in all aspects of research, accountability in the conduct of scientific research, professional courtesy and fairness in working with others, and good stewardship of research on behalf of others.

Gustafsson adds: "As our world evolves, there are continually changing challenges to the freedoms of scientists, and an increased onus on the scientific community to articulate and embrace its responsibilities. Whilst there can be national, and even disciplinary, differences in the way research is actually carried out, there are certain principles and responsibilities that are fundamental to 'good science'. Given the unique position of scientists as the gate-keepers of new knowledge in today's knowledge societies, respect for these values is critically important if confidence in science is to be maintained".

Reference

URL: http://www.icsu.org/general-assembly/press-room/press-releases/Press%20Release%20Universality.pdf/view

ICSU

The seasonal potato

new gravity field model

29 June 2011.- The Potsdam Gravity potato, as this representation of terrestrial gravity has become known, can for the first time display gravity variations that change with time. The seasonal fluctuations of the water balance of continents or melting or growing ice masses, i.e. climate-related variables, are now included in the modeling of the gravity field. "EIGEN-6C" is the name of this latest global gravity field model of the GFZ German Research Centre for Geosciences. It was recently calculated in Potsdam in cooperation with the Groupe de Recherche de Géodésie Spaciale from Toulouse. This new gravity field model is based on measurements of the satellites LAGEOS, GRACE and GOCE. These were combined with ground-based gravity measurements and data from the satellite altimetry. EIGEN-6C has a spatial resolution of about 12 kilometres. Compared to the last version of the Potsdam potato, this is a four-fold increase.

"Of particular importance is the inclusion of measurements from the satellite GOCE, from which the GFZ did its own calculation of the gravitational field" says Dr. Christoph Foerste, who together with his colleague Dr. Frank Flechtner directs the gravitaty field work group at the GFZ. The ESA mission GOCE (Gravity Field and Steady-State Ocean Circulation Explorer) was launched in mid-March 2009 and since then measures the Earth's gravitational field using satellite gradiometry. "This allows the measurement of gravity in inaccessible regions with unprecedented accuracy, for example in Central Africa and the Himalayas" adds Dr. Flechtner. In addition, the Earth's gravity field in the vastness of the oceans can be measured much more accurately with GOCE than with previous satellite missions such as GFZ-CHAMP and GRACE. Amongst other advantages, this allows a more faithful determination of the so-called dynamic ocean topography, i.e. the deviation of the ocean surface from the equilibrium with the force of gravity. This ocean topography is essentially determined by ocean currents. Therefore, the gravity field models calculated with GOCE measurements are of great interest for oceanography and climate research.

Besides GOCE, long-term measurement data from the twin-satellite mission GRACE (Gravity Recovery and Climate Experiment) of the GFZ were included in the new EIGEN-6C. GRACE allows the determination of large-scale temporal changes in the gravitational field caused for example by climate-induced mass displacements on the Earth's surface. These include the melting of large glaciers in the Polar Regions and the seasonal variation of water stored in large river systems. Temporal gravity changes determined with GRACE are included in the EIGEN-6C model. Therefore, the new Potsdamer potato is for the first time no longer a solid body, but a surface that varies over time. Particularly in order to record these climate-related processes for the long term, a follow-on mission for the GRACE mission that ends in 2015 is urgently needed. A comparison of the various "Potsdamer potatoes" since 1995 clearly shows the leaps in quality.

Helmholtz Centre Potsdam - GFZ German Research Centre for Geosciences

Global plant database

for biodiversity and Earth-system sciences research

The world's largest database on plants' functional properties, or traits, has been published. Scientists compiled three million traits for 69,000 out of the world's ~300,000 plant species. The achievement rests on a worldwide collaboration of scientists from 106 research institutions. The initiative, known as TRY, is hosted at the Max Planck Institute for Biogeochemistry in Jena (Germany). Jointly coordinated with the University of Leipzig (Germany), IMBIV-CONICET (Argentina), Macquarie University (Australia), CNRS and University of Paris-Sud (France), TRY promises to become an essential tool for biodiversity research and Earth-system sciences.

Plant traits – their morphological and physiological properties – determine how plants compete for resources, e.g. light, water, soil nutrients, and where and how fast they can grow. Ultimately they determine how plants influence ecosystem properties such as rates of nutrient cycling, water use and carbon dioxide uptake.

A major bottleneck to modelling the effects of climate change at ecosystem and whole-earth scales has been a lack of trait data for sufficiently large numbers of species. The first release of the TRY database was published this week in the journal Global Change Biology. "After four years of intensive development, we are proud to present the first release of the global database", says Jens Kattge, senior scientist at the Max Planck Institute for Biogeochemistry and lead author of the publication.

"This huge advance in data availability will lead to more reliable predictions of how vegetation boundaries and ecosystem properties will shift under future climate and land-use change scenarios", points out Dr Ian Wright from Macquarie University. "The TRY global database also promises to revolutionise biodiversity research, leading to a new understanding of how not only the numbers of species (biodiversity) but also the variation among species in their traits (functional diversity) together effect ecosystem functions and services".

The TRY initiative was developed under the auspices of IGBP (International Geosphere-Biosphere Programme) and DIVERSITAS (International Programme of Biodiversity Science).

Steering Committee:

- Jens Kattge, Max Planck Institute for Biogeochemistry,
- Christian Wirth, University of Leipzig,
- Gerhard Bönisch, Max Planck Institute for Biogeochemistry,

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Reference:

TRY – a global database of plant traits

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DOI: 10.1111/j.1365-2486.2011.02451.x
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Max Planck Institute for Biogeochemistry

Water can flow below -130°C

28 June 2011.- When water is cooled below zero degrees, it usually crystallizes directly into ice. Ove Andersson, a physicist at Umeå University, has now managed to produce sluggishly flowing water at -130°C under high pressure – 10,000 times higher than normal pressure. It is possible that this sluggishly fluid and cold water exists on other heavenly bodies.

Water is difficult to chill in a way that makes it sluggishly flowing. Ove Andersson has accomplished this by exposing crystalline ice, in which the atoms are arranged in an orderly manner, to increased pressure at temperatures below -130°C. The order of the molecules and the ice collapsed into amorphous ice, with random order among the water molecules. "When I then raised the temperature, the ice transformed into sluggishly flowing water. This water is like regular water but its density is 35 percent higher, and the water molecules move relatively slowly, that is, the viscosity is high".

Water has a great number of properties that deviate from normal behaviors. For example, in super cooled water, i.e. when the temperature drops below zero, the density decreases when the temperature is lowered and increases when it is raised.

Some theories are predicated upon water existing in two different liquid phases, one with low density and another with high density. The theories revolve around the transition between the phases taking place at low temperature and high pressure. When water cools and approaches this zone, there can be a gradual transformation that affects the properties and lends water its abnormal properties. Unfortunately this transformation is difficult to study, since water normally crystallizes. An alternative way to approach the zone is first to create amorphous ice. The new findings show that amorphous ice probably converts into sluggishly flowing water when it is warmed up under high pressure.

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Umeå universitet

International Code of Nomenclature for algae, fungi and plants

gone through a landmark change

14 September 2011.- Botanical taxonomy, which extends to include the formal scientific naming of all plants, algae and fungi has gone through a landmark change in the procedure scientists need to follow when they describe new species. Details of the forthcoming changes to the newly-named 'International Code of Nomenclature for algae, fungi and plants' are laid out by Dr Sandra Knapp and colleagues in an article published in BioMed Central's open access journal

BMC Evolutionary Biology. It has been suggested that perhaps only 10% of all species in the world have been named, and new species are discovered on a daily basis. Currently, the names and descriptions of all new species of algae, fungi and plants still must be lodged as printed copies at the libraries of several botanical institutions.

This existing, requirement for printed descriptions of new species to be deposited in relevant institutions has been a frustrating requirement of the code for scientists choosing to publish in online-only journals, such as BMC Evolutionary Biology. They have had to ensure that a printed copy of their article is also archived at several relevant institutions in addition to the version available online. This has become an impediment to science, not to mention creating a great deal of administrative hassle in the more efficient digital age. When the cost to scientists and institutions of subscribing to hard copies of journals is becoming prohibitive, not to mention the delays between article acceptance and publication inherent to publishing in print, why should online-only journals be penalised by the Code?

Changes to the international Code for naming algae, fungi or plants are decided on every six years at the International Botanical Congresses (IBC). Earlier this year, at the XVIII IBC held in Melbourne, Australia, it was decided that from 1 January 2012 scientists who describe new taxa (species, genera, families) will be able to publish their discoveries entirely online. Dr Sandra Knapp, from the Natural History Museum in London explained that, "From January, authors will be able to use either Latin or English to distinguish their new taxon from all others, and authors describing new plants, algae and fungi will be able to publish these novelties in appropriately registered electronic-only journals or books. This does not mean that new names can appear on websites or in ephemeral on-line resources. It does mean that new names will be more accessible, and that publication of new species in algae, fungi and plants will now be keeping pace with the exciting changes happening in the publishing world. Botanists and mycologists will have to work closely with the editors and publishers of these types of articles to be sure the rules of the Code are followed, but these new changes will bring names of organisms treated under the Code to wider audiences and will increase accessibility of biodiversity information when we need it most in order to help conserve what is rapidly being lost".

Reference:

Sandra Knapp, John McNeill and Nicholas J Turland, "Changes to publication requirements made at the XVIII International Botanical Congress in Melbourne - what does e-publication mean for you?", BMC Evolutionary Biology, 2011 (in press).

BioMed Central (http://www.biomedcentral.com/)

Venus has an ozone layer too

06 October 2011.- ESA's Venus Express spacecraft has discovered an ozone layer high in the atmosphere of Venus. Comparing its properties with those of the equivalent layers on Earth and Mars will help astronomers refine their searches for life on other planets. The results are being presented today at the Joint Meeting of the European Planetary Science Congress and the American Astronomical Society's Division for Planetary Sciences.

Venus Express made the discovery while watching stars seen right at the edge of the planet set through its atmosphere. Its SPICAV instrument analysed the starlight, looking for the characteristic fingerprints of gases in the atmosphere as they absorbed light at specific wavelengths.

According to computer models, the ozone on Venus is formed when sunlight breaks up carbon dioxide molecules, releasing oxygen atoms.

These atoms are then swept around to the nightside of the planet by winds in the atmosphere: they can then combine to form two-atom oxygen molecules, but also sometimes three-atom ozone molecules.

It may also offer a useful comparison for searching for life on other worlds. Ozone has only previously been detected in the atmospheres of Earth and Mars. On Earth, it is of fundamental importance to life because it absorbs much of the Sun's harmful ultraviolet rays. Not only that, it is thought to have been generated by life itself in the first place.

The build-up of oxygen, and consequently ozone, in Earth's atmosphere began 2.4 billion years ago. Although the exact reasons for it are not entirely understood, microbes excreting oxygen as a waste gas must have played an important role.

Along with plant life, they continue to do so, constantly replenishing Earth's oxygen and ozone. As a result, some astrobiologists have suggested that the simultaneous presence of carbon dioxide, oxygen and ozone in an atmosphere could be used to tell whether there could be life on the planet.

This would allow future telescopes to target planets around other stars and assess their habitability. However, as these new results highlight, the amount of ozone is crucial.

The small amount of ozone in Mars' atmosphere has not been generated by life. There, it is the result of sunlight breaking up carbon dioxide molecules. Venus too, now supports this view of a modest ozone build-up by non-biological means. Its ozone layer sits at an altitude of 100 km, about four times higher in the atmosphere than Earth's and is a hundred to a thousand times less dense.

Theoretical work by astrobiologists suggests that a planet's ozone concentration must be 20%of Earth's value before life should be considered as a cause. These new results support that conclusion because Venus clearly remains below this threshold.

Yet, even if there is no life on Venus, the detection of ozone there brings Venus a step closer to Earth and Mars. All three planets have an ozone layer.

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EUROPLANET

Enceladus weather

Snow flurries and perfect powder for skiing

02 October 2011.- Global and high resolution mapping of Enceladus confirms that the weather forecast for Saturn's unique icy moon is set for ongoing snow flurries. The superfine ice crystals that coat Enceladus's surface would make perfect powder for skiing, according to Dr Paul Schenk of the Lunar and Planetary Institute (Houston, Texas), who will present the results at the EPSC-DPS Joint Meeting 2011 in Nantes, France on Monday 3rd October.

Mapping of global colour patterns and measurements of surface layer thicknesses show that ice particles fall back onto the surface of Enceladus in a predictable pattern. Mapping of these deposits indicate that the plumes and their heat source are relatively long-lived features lasting millennia and probably tens of million years or more, and have blanketed areas of the surface in a thick layer of tiny ice particles.

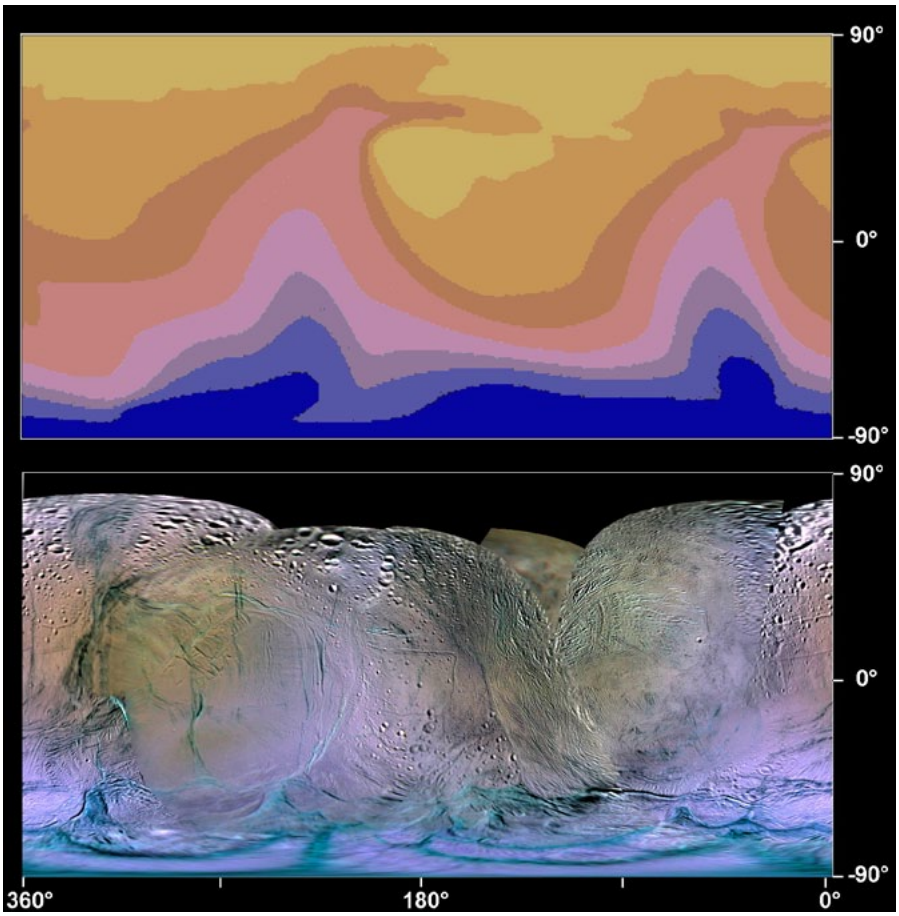
"The discovery by instruments aboard the Cassini orbiter that there's a currently active plume of icy dust and vapour from Enceladus has revolutionized planetary science", says Schenk. "Earlier this year, we published work that showed material from Enceladus's plumes coats the surfaces of Saturn's icy moons. Now, we've uncovered two lines of evidence that point to thick deposits of plume material coating the surface of Enceladus itself".

Models of plume particle trajectories under the influence of Saturn's gravity show that some particles return to Enceladus in a distinctive pattern. This work by Dr Sasha Kempf of the Max Planck Institute and Dr Juergen Schmidt and colleagues at the University of Potsdam published in 2010, predicts that the heaviest accumulation will be along two longitudes on opposite sides of the satellite. Global colour mapping of Enceladus by Schenk and colleagues also shows a globally symmetric pattern of bluish material along two longitudes on opposite sides of the satellite. Comparison of these two maps shows a very close correspondence in the predicted and observed patterns, confirming the prediction of particle deposition on the surface of Enceladus.

Confirmation of plume fallout led Schenk and colleagues to search for physical evidence of plume particle accumulation on the surface. They examined the highest resolution images north of the plume formation sites; the best of these has a resolution of 12 meters. The image reveals unusually smooth terrains with ghost-like topographic undulations indicating burial of older fractures and craters. Mapping the topography of the site at high resolution, they also found changes in slope along the rims of many of the deeper fractures, or canyons. The larger of these canyons are 500 meters (1650 feet) deep and 1.5 kilometres across, not unlike the Black Canyon of the Gunnison in Colorado. These breaks in slope occur approximately 75 to 125 meters below the rims of the canyon walls and correspond to elevations where more rugged crustal material is exposed part way down the canyon walls.

The ghost-like features on the plains and the slope breaks on steep canyon walls are interpreted as due to the formation of a loose poorly-consolidated material lying on top of more solid crustal ices (the craggy rugged exposures part way down the canyon walls). This layer is believed to be the accumulated plume deposits observed in the global colour mapping, forming a mantling blanket across the terrain. The layer is on average roughly 100 meters (350 feet or so) deep in this area. At least 3 additional sites show similar evidence of burial but the resolution of these images is not as good and measurements of thicknesses there are not yet possible.

So, given what we now know, what might conditions be like on Enceladus itself? The models of plume deposition indicate that the rate of deposition on Enceladus is extremely slow by Earth standards, less than a thousandth of a millimetre per year. To accumulate 100



Global signature of frost deposition on Enceladus revealed in colour mapping. The top map shows a colorized map of the predicted pattern of fallout from Enceladus's icy plumes (bus represent thicker accumulations), with the global colour patterns observed by Cassini imaging camera. The bottom map is the global 3-color map of Enceladus showing areas that are relatively bluer. These areas correspond very well with areas predicted to have a deeper accumulation of plume-generated ice particles, or

meters of deposits would require a few tens of millions of years or so. This is important as it suggests that the thermal heat source required to drive the plumes and maintain any liquid water under the icy crust would also have to be similarly long-lived. Without replenishment, the E-ring formed by ejected plume particle would dissipate in hundreds to thousands of years.

What about the surface itself? Could we go skiing on Enceladus?

"Bulky space suits and extremely low gravity aside (the surface gravity there is only roughly 1% that of Earth's), the particles themselves are only a fraction of a millimetre in size, roughly a micron or two across, even finer than talcum powder. This would make for the finest powder a skier could hope for", says Schenk, who admits he has never been on the slopes himself.

While much smaller than the typical snowflake, the persistence of this "flurry" of tiny icy particles gently snowing down from the plumes to the far south is directly responsible for the very slow but steady accumulation of very fine ice particulates, or "snow", across large areas of Enceladus today. Although long suspected, the global colour patterns and high resolution observations are the first direct confirmation and indication of how and where this fallout onto the surface of Enceladus occurs. This accumulation will have important implications for our future understanding of the internal heating mechanism driving the plumes, and for the insulating properties of the surface we see today. Additional work necessary to understanding this phenomenon will require new high resolution images during encounters with Enceladus planned for 2012 and 2015 during Cassini's extended mission.

EUROPLANET

The world's water cycle

final report of the Water and Global Change programme

12 October 2011.- The final report of the Water and Global Change programme (WATCH), an extensive analysis of the world's water resources, is made available today, significantly expanding our understanding of climate change and land use impacts on the global hydrological cycle.

WATCH results provide the first assessment of the global hydrological cycle on a daily time-frame at 50km grid scale resolution for the past (20th century) and future (21st century), as well as a new global analysis of water scarcity.

The four-year programme, funded by the European Union Framework Six Programme, was coordinated by the UK's Centre for Ecology & Hydrology, and brought together a team from 25 research centres in 14 European countries.

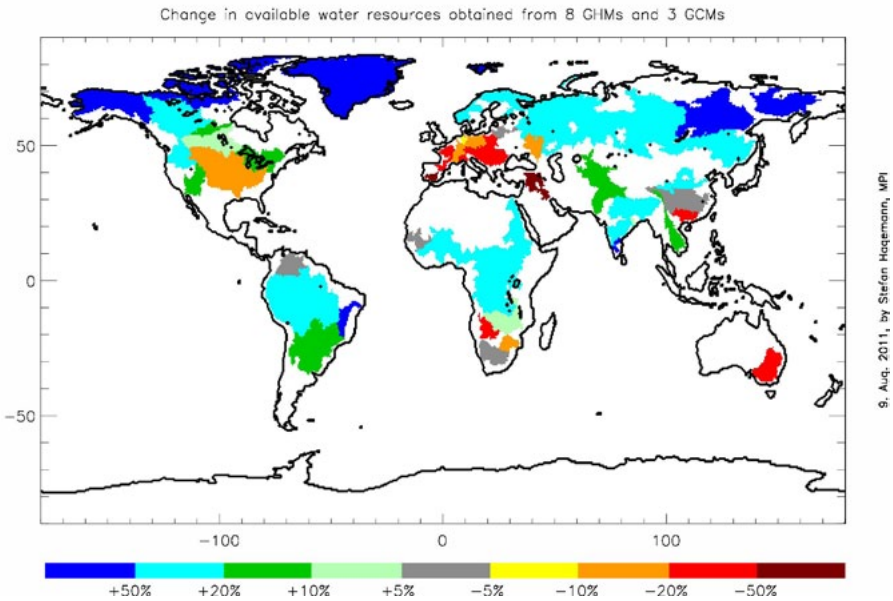
The WATCH programme:

- highlighted the importance of land use change, which is at least as important as climate change to water resource issues
- identified the potential vulnerability of water supply in sub-tropical catchments where changes in climate, landuse and increasing consumption combine to produce future decreases in available water by up to 30%
- provided new insights on the importance of evaporation for the global water cycle
- investigated whether global anthropogenic greenhouse gas emissions substantially increase the risk of flood occurrence.

Dr Richard Harding from the Centre for Ecology & Hydrology, coordinator of WATCH, said, "WATCH has produced the most extensive analysis ever of future water resources for the entire world, confirming that the hydrological cycle is changing. WATCH has shown that although there is still substantial uncertainty in our modelling of the future water cycle, as we develop understanding of the driving processes, we will be able to make more confident assessments for the future. The next challenge is to communicate and apply these results within the wider global user community".

In addition to scientific outputs and release of data, an outreach portal and educational website have been created to allow researchers, policymakers and the general public to learn more about the global water cycle. It is hoped the new website will act as an educational and information access point to enable learning, with maps and environmental data on the world's water resources. Rainfall, soil moisture, evapotranspiration rates and river catchment data are presented in 3D maps, with 18 of the world's biggest river systems covered in detail.

Project URL: http://www.eu-watch.org



Changes (2071 – 2100 compared to 1971 – 2000) in available water resources projected by an ensemble of eight global hydrology models using data from three global climate models. The available water resources were derived by taking into account the total runoff for selected large-scale river basins minus an estimate of the environmental flow requirements in the respective basins.

Centre for Ecology and Hydrology, NERC

EGU Election Autumn 2011

The EGU Election Autumn 2011 for the next EGU President as well as for the next EGU General Secretary was closed on 01 December 2011. We sincerely thank all those EGU members who used their voting right. We would also like to thank each of the candidates for their initiative in standing for the office of President and General Secretary. Active participation in elections ensures continuation of the well-established bottom-up structure of our Union!

In total, we received 2192 ballots for the EGU president and General Secretary elections, respectively. Please see the results at http://www.egu.eu/elections/.

Günter Blöschl is the elected EGU President for the term 2012–2016. He will be inaugurated as President-Elect (Vice-President) for one year term (2012-2013) during the plenary meeting of the next EGU General Assembly 2012 in Vienna, Austria. He will then serve as the Union President during two years (2013-2015) starting from the plenary meeting of the EGU General Assembly 2013. Lastly, he will serve as the Past-President (Vice-President) for one more year (2015-2016).

Mioara Mandea is the next EGU General Secretary for the term 2012–2014. She will be inaugurated during the plenary meeting of the next EGU General Assembly 2012 in Vienna, Austria.

Accumulation of aerosols over the Indo-Gangetic plains and southern slopes of the Himalayas

distribution, properties and radiative effects during the 2009 pre-monsoon season

The authors examine the distribution of aerosols and associated optical/radiative properties in the Gangetic-Himalayan region from simultaneous radiometric measurements over the Indo-Gangetic Plains (IGP) and the foothill/southern slopes of the Himalayas during the 2009 pre-monsoon season. Enhanced dust transport extending from the Southwest Asian arid regions into the IGP, results in seasonal mean (April–June) aerosol optical depths of over 0.6 – highest over Southern Asia. The influence of dust loading is greater over the Western IGP as suggested by pronounced coarse mode peak in aerosol size distribution and spectral single scattering albedo (SSA). Transported dust in the IGP, driven by prevailing westerly airmass, is found to be more absorbing (SSA550 nm<0.9) than the near-desert region in Northwestern (NW) India suggesting mixing with carbonaceous aerosols in the IGP. On the contrary, significantly reduced dust transport is observed over eastern IGP and foothill/elevated Himalayan slopes in Nepal where strongly absorbing haze is prevalent, as indicated by lower SSA (0.85–0.9 at 440–1020 nm), suggesting presence of more absorbing aerosols compared to IGP. Additionally, their observations show a distinct diurnal pattern of aerosols with characteristic large afternoon peak, from foothill to elevated mountain locations, associated with increased upslope transport of pollutants – that likely represent large-scale lifting of absorbing aerosols along the elevated slopes during pre-monsoon season. In terms of radiative impact of aerosols, over the source region of NW India, diurnal mean reduction in solar radiation fluxes was estimated to be 19–23 Wm−2 at surface (12–15% of the surface solar insolation). Furthermore, based on limited observations of aerosol optical properties during the pre-monsoon period and comparison of their radiative forcing estimates with published literature, there exists a general spatial heterogeneity in the regional aerosol forcing, associated with the absorbing aerosol distribution over northern India, with both diurnal mean surface forcing and forcing efficiency over the IGP exceeding that over Northwestern India. Finally, the role of the seasonal progressive buildup of aerosol loading and water vapor is investigated in the observed net aerosol radiative effect over Northwestern India. The radiative impact of water vapor is found to amplify the net regional aerosol radiative forcing suggesting that the two exert forcing in tandem leading to enhanced surface cooling. It is suggested that water vapor contribution should be taken into account while assessing aerosol forcing impact for this region and other seasonally similar environments.

The full paper is available free of charge at http://www.atmos-chem-phys.net/11/12841/2011/acp-11-12841-2011.pdf

Gautam, R., Hsu, N. C., Tsay, S. C., Lau, K. M., Holben, B., Bell, S., Smirnov, A., Li, C., Hansell, R., Ji, Q., Payra, S., Aryal, D., Kayastha, R., and Kim, K. M.: Accumulation of aerosols over the Indo-Gangetic plains and southern slopes of the Himalayas: distribution, properties and radiative effects during the 2009 pre-monsoon season, Atmos. Chem. Phys., 11, 12841-12863, doi:10.5194/acp-11-12841-2011, 2011.

Effect of ocean acidification on early life stages of Atlantic herring (Clupea harengus L.)

research on the factors influencing these stages are of great interest for fisheries

Due to atmospheric accumulation of anthropogenic CO2 the partial pressure of carbon dioxide (pCO2) in surface seawater increases and the pH decreases. This process known as ocean acidification might have severe effects on marine organisms and ecosystems. The present study addresses the effect of ocean acidification on early developmental stages, the most sensitive stages in life history, of the Atlantic herring (Clupea harengus L.). Eggs of the Atlantic herring were fertilized and

incubated in artificially acidified seawater (pCO2 1260, 1859, 2626, 2903, 4635 uatm) and a control treatment (pCO2 480 uatm) until the main hatch of herring larvae occurred. The development of the embryos was monitored daily and newly hatched larvae were sampled to analyze their morphometrics, and their condition by measuring the RNA/DNA ratios. Elevated pCO2 neither affected the embryogenesis nor the hatch rate. Furthermore the results showed no linear relationship between pCO2 and total length, dry weight, yolk sac area and otolith area of the newly hatched larvae. For pCO2 and RNA/DNA ratio, however, a significant negative linear relationship was found. The RNA concentration at hatching was reduced at higher pCO2 levels, which could lead to a decreased protein biosynthesis. The results indicate that an increased pCO2 can affect the metabolism of herring embryos negatively. Accordingly, further somatic growth of the larvae could be reduced. This can have consequences for the larval fish, since smaller and slow growing individuals have a lower survival potential due to lower feeding success and increased predation mortality. The regulatory mechanisms necessary to compensate for effects of hypercapnia could therefore lead to lower larval survival. Since the recruitment of fish seems to be determined during the early life stages, future research on the factors influencing these stages are of great importance in fisheries science.

The full paper is available free of charge at http://www.biogeosciences.net/8/3697/2011/bg-8-3697-2011.pdf

Franke, A. and Clemmesen, C.: Effect of ocean acidification on early life stages of Atlantic herring (Clupea harengus L.), Biogeosciences, 8, 3697-3707, doi:10.5194/bg-8-3697-2011, 2011.

Potential inundation of Lisbon downtown by a 1755-like tsunami

10 m resolution tsunami flooding maps for Lisbon downtown and the Tagus estuary

In this study, the authors present 10 m resolution tsunami flooding maps for Lisbon downtown and the Tagus estuary. To compute these maps they use the present bathymetry and topographic maps and a reasonable estimate for the maximum credible tsunami scenario. Tsunami modeling was made with a non-linear shallow water model using four levels of nested grids. The tsunami flood is discussed in terms of flow depth, run-up height and maximum inundation area.

The results show that, even today, in spite of the significant morphologic changes in the city river front after the 1755 earthquake, a similar event would cause tsunami flow depths larger than one meter in a large area along the Tagus estuary and Lisbon downtown. Other areas along the estuary with a high population density would also be strongly affected. The impact of the tide on the extent of tsunami inundation is discussed, due to the large amplitude range of the tide in Lisbon and compared with the historical descriptions of the 1755 event. The results presented here can be used to identify the potential tsunami inundation areas in Lisbon; this identification comprises a key element of the Portuguese tsunami emergency management system.

The full paper is available free of charge at http://www.nat-hazards-earth-syst-sci.net/11/3319/2011/nhess-11-3319-2011.pdf

Baptista, M. A., Miranda, J. M., Omira, R., and Antunes, C.: Potential inundation of Lisbon downtown by a 1755-like tsunami, Nat. Hazards Earth Syst. Sci., 11, 3319-3326, doi:10.5194/nhess-11-3319-2011, 2011.

Primary vs secondary contributions to particle number concentrations in the European boundary layer

a major source of uncertainty in CCN-sized particles in polluted European air is the emitted size of primary carbonaceous particles

It is important to understand the relative contribution of primary and secondary particles to regional and global aerosol so that models can attribute aerosol radiative forcing to different sources. In large-scale models, there is considerable uncertainty associated with treatments of particle formation (nucleation) in the boundary layer (BL) and in the size distribution of emitted primary particles, leading to uncertainties in predicted cloud condensation nuclei (CCN) concentrations. Here the authors quantify how primary particle emissions and secondary particle formation influence size-resolved particle number concentrations in the BL using a global aerosol microphysics model and aircraft and ground site observations made during the May 2008 campaign of the European Integrated Project on Aerosol Cloud Climate Air Quality Interactions (EUCAARI). They tested four different parameterisations for BL nucleation and two assumptions for the emission size distribution of anthropogenic and wildfire carbonaceous particles. When they emit carbonaceous particles at small sizes (as recommended by the Aerosol Intercomparison project, AEROCOM), the spatial distributions of campaign-mean number concentrations of particles with diameter >50 nm (N50) and >100 nm (N100) were well captured by the model (R2≥0.8) and the normalised mean bias (NMB) was also small (−18% for N50 and −1% for N100). Emission of carbonaceous particles at larger sizes, which they consider to be more realistic for low spatial resolution global models, results in equally good correlation but larger bias (R2≥0.8, NMB = −52% and −29%), which could be partly but not entirely compensated by BL nucleation. Within the uncertainty of the observations and accounting for the uncertainty in the size of emitted primary particles, BL nucleation makes a statistically significant contribution to CCN-sized particles at less than a quarter of the ground sites. Their results

show that a major source of uncertainty in CCN-sized particles in polluted European air is the emitted size of primary carbonaceous particles. New information is required not just from direct observations, but also to determine the "effective emission size" and composition of primary particles appropriate for different resolution models.

The full paper is available free of charge at http://www.atmos-chem-phys.net/11/12007/2011/acp-11-12007-2011.pdf

Reddington, C. L., Carslaw, K. S., Spracklen, D. V., Frontoso, M. G., Collins, L., Merikanto, J., Minikin, A., Hamburger, T., Coe, H., Kulmala, M., Aalto, P., Flentje, H., Plass-Dülmer, C., Birmili, W., Wiedensohler, A., Wehner, B., Tuch, T., Sonntag, A., O'Dowd, C. D., Jennings, S. G., Dupuy, R., Baltensperger, U., Weingartner, E., Hansson, H.-C., Tunved, P., Laj, P., Sellegri, K., Boulon, J., Putaud, J.-P., Gruening, C., Swietlicki, E., Roldin, P., Henzing, J. S., Moerman, M., Mihalopoulos, N., Kouvarakis, G., Ždímal, V., Zíková, N., Marinoni, A., Bonasoni, P., and Duchi, R.: Primary versus secondary contributions to particle number concentrations in the European boundary layer, Atmos. Chem. Phys., 11, 12007-12036, doi:10.5194/acp-11-12007-2011, 2011.

Where microorganisms meet rocks in the Earth's Critical Zone

a review of the factors controlling where terrestrial CZ microbes live and what is known about their diversity and function

The Critical Zone (CZ) is the Earth's outer shell where all the fundamental physical, chemical, and biological processes critical for sustaining life occur and interact. As microbes in the CZ drive many of these biogeochemical cycles, understanding their impact on life-sustaining processes starts with an understanding of their biodiversity. In this review, the authors summarize the factors controlling where terrestrial CZ microbes (prokaryotes and micro-eukaryotes) live and what is known about their diversity and function. Microbes are found throughout the CZ, down to 5 km below the surface, but their functional roles change with depth due to habitat complexity, e.g. variability in pore spaces, water, oxygen, and nutrients. Abundances of prokaryotes and micro-eukaryotes decrease from 1010 or 107 cells g soil−1 or rock−1, or ml water−1 by up to eight orders of magnitude with depth. Although symbiotic mycorrhizal fungi and free-living decomposers have been studied extensively in soil habitats, where they occur up to 103 cells g soil−1, little is known regarding their identity or impact on weathering in the deep subsurface. The relatively low abundance of micro-eukaryotes in the deep subsurface suggests that they are limited in space, nutrients, are unable to cope with oxygen limitations, or some combination thereof. Since deep regions of the CZ have limited access to recent photosynthesis-derived carbon, microbes there depend on deposited organic material or a chemolithoautotrophic metabolism that allows for a complete food chain, independent from the surface, although limited energy flux means cell growth may take tens to thousands of years. Microbes are found in all regions of the CZ and can mediate important biogeochemical processes, but more work is needed to understand how microbial populations influence the links between different regions of the CZ and weathering processes. With the recent development of "omics" technologies, microbial ecologists have new methods that can be used to link the composition and function of in situ microbial communities. In particular, these methods can be used to search for new metabolic pathways that are relevant to biogeochemical nutrient cycling and determine how the activity of microorganisms can affect transport of carbon, particulates, and reactive gases between and within CZ regions.

The full paper is available free of charge at http://www.biogeosciences.net/8/3531/2011/bg-8-3531-2011.pdf

Akob, D. M. and Küsel, K.: Where microorganisms meet rocks in the Earth's Critical Zone, Biogeosciences, 8, 3531-3543, doi:10.5194/bg-8-3531-2011, 2011.

The role of orbital forcing, carbon dioxide and regolith

in 100 kyr glacial cycles

The origin of the 100 kyr cyclicity, which dominates ice volume variations and other climate records over the past million years, remains debatable. Here, using a comprehensive Earth system model of intermediate complexity, the authors demonstrate that both strong 100 kyr periodicity in the ice volume variations and the timing of glacial terminations during past 800 kyr can be successfully simulated as direct, strongly nonlinear responses of the climate-cryosphere system to orbital forcing alone, if the atmospheric CO2 concentration stays below its typical interglacial value. The existence of long glacial cycles is primarily attributed to the North American ice sheet and requires the presence of a large continental area with exposed rocks. They show that the sharp, 100 kyr peak in the power spectrum of ice volume results from the long glacial cycles being synchronized with the Earth's orbital eccentricity. Although 100 kyr cyclicity can be simulated with a constant CO2 concentration, temporal variability in the CO2 concentration plays an important role in the amplification of the 100 kyr cycles.

The full paper is available free of charge at http://www.clim-past.net/7/1415/2011/cp-7-1415-2011.pdf

Ganopolski, A. and Calov, R.: The role of orbital forcing, carbon dioxide and regolith in 100 kyr glacial cycles, Clim. Past, 7, 1415-1425, doi:10.5194/cp-7-1415-2011, 2011.

Annual cycles of chlorophyll-a, non-algal suspended particulate matter

and turbidity observed from space and in-situ in coastal waters

Sea surface temperature, chlorophyll, and turbidity are three variables of the coastal environment commonly measured by monitoring networks. The observation networks are often based on coastal stations, which do not provide a sufficient coverage to validate the model outputs or to be used in assimilation over the continental shelf. Conversely, the products derived from satellite reflectance generally show a decreasing quality shoreward, and an assessment of the limitation of these data is required. The annual cycle, mean, and percentile 90 of the chlorophyll concentration derived from MERIS/ESA and MODIS/NASA data processed with a dedicated algorithm have been compared to in-situ observations at twenty-six selected stations from the Mediterranean Sea to the North Sea. Keeping in mind the validation, the forcing, or the assimilation in hydrological, sediment-transport, or ecological models, the non-algal Suspended Particulate Matter (SPM) is also a parameter which is expected from the satellite imagery. However, the monitoring networks measure essentially the turbidity and a consistency between chlorophyll, representative of the phytoplankton biomass, non-algal SPM, and turbidity is required. In this study, the authors derive the satellite turbidity from chlorophyll and non-algal SPM with a common formula applied to in-situ or satellite observations. The distribution of the satellite-derived turbidity exhibits the same main statistical characteristics as those measured in-situ, which satisfies the first condition to monitor the long-term changes or the large-scale spatial variation over the continental shelf and along the shore. For the first time, climatologies of turbidity, so useful for mapping the environment of the benthic habitats, are proposed from space on areas as different as the southern North Sea or the western Mediterranean Sea, with validation at coastal stations.

The full paper is available free of charge at http://www.ocean-sci.net/7/705/2011/os-7-705-2011.pdf

Gohin, F.: Annual cycles of chlorophyll-a, non-algal suspended particulate matter, and turbidity observed from space and in-situ in coastal waters, Ocean Sci., 7, 705-732, doi:10.5194/os-7-705-2011, 2011.

Characterisation of corona-generated ions

used in a Neutral cluster and Air Ion Spectrometer (NAIS)

The authors characterized size and chemical composition of ions generated by a corona-needle charger of a Neutral cluster and Air Ion Spectrometer (NAIS) by using a high resolution differential mobility analyzer and a time-of-flight mass spectrometer. Their study is crucial to verify the role of corona-generated ions in the particle size spectra measured with the NAIS, in which a corona charger is used to charge aerosol particles down to the size range overlapping with the size of generated ions. The size and concentration of ions produced by the corona discharging process depend both on corona voltage and on properties and composition of carrier gas. Negative ions were <1.6 nm (0.8 cm2 V−1 s−1 in mobility) in all tested gas mixtures (nitrogen, air with variable mixing ratios of water vapour), whereas positive ions were <1.7 nm (0.7 cm2 V−1 s−1). Electrical filtering of the corona generated ions and not removing all charged particles plays an important role in determining the lowest detection limit. Based on their experiments, the lowest detection limit for the NAIS in the particle mode is between 2 and 3 nm.

The full paper is available free of charge at http://www.atmos-meas-tech.net/4/2767/2011/amt-4-2767-2011.pdf

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GIFT workshop in Penang (Malaysia)

in connexion with the Alexander von Humboldt Topical conference on Ocean Acidification

The GIFT workshop in Penang took place over 2 days, at the same time as the last two days of the AvH7 topical conference.

Speakers were selected among those already present in Penang for AvH7, and included Jelle Bijma, Richard Zeebe, R.D. Schuiling, Zulphigar Yasin, Sam Dupont, Uta Passow and Rodelio Subade. Most of the scientific problems of Ocean Acidification were discussed, as GIFT during the general assembly 2011 in Vienna Poster session "Science in tomorrow's classroom" as well as some of the socio-economic impacts and economic valuation towards appropriate policies. The last half day of the workshop was organized in common with the AvH7, so that the teachers could assist with the Joint AOGS, JpGU and EGU statement on Ocean Acidification.

Thanks to the work of the local organizing Committee (and particularly to Aileen Tan Shau Hwai and Foong Swee Yeok) the attendance was very good, with 42 teachers present, as many as scientists in the Topical Conference. The number of questions asked after each conference is a clear indication of the interest of the teachers for this workshop. It has actually been the first workshop of this kind, organized in parallel with a scientific conference, and where breakfast, the different meals and the coffee breaks were taken in common by the teachers and the scientists.

A brochure, similar to the ones produced for the Vienna GIFT workshops, has been made and has been uploaded on the GIFT webpage. A report written by the Local Organizing Committee (Aileen Tan Shau Yeok) was aslo prepared.

In parallel with the workshop, the possibility for two Malaysian teachers to participate to the GIFT workshop in Vienna in 2012 was also discussed. The agreement is that EGU will meet living expenses and registration fees, while on the Malaysian side a solution must be found for the plane ticket to Vienna. The Local Organizing Committee also expressed its interest in having two Malaysian teachers on board the Marion Dufresne, should this research vessel have a scientific cruise in the South China Sea in the future.

Carlo Laj
EGU Committee on Education Chair

GIFT Distinguished Lectures Series

new EGU Committee on Education Programme

The EGU Committee on Education inaugurated earlier this year an annual series of Geosciences Information For Teachers (GIFT) Distinguished Lectures, to be given by top scientists who have previously participated as speakers in GIFT workshops during the EGU General assemblies. High school teachers, high school directors and educators for teachers from the European area are welcome to request a lecture, for which the EGU Committee on Education will cover the travel and subsistence costs of the speaker.

The deadline for 2011 has been in September. Three applications were received this first year, each one being fulfilled:

The first lecture is planned in Barcelona, for the XII meeting of Teachers of Earth and Environmental Sciences, planned at the Cosmo Caixa Science Museum on Friday, January 27, 2012. Anny Cazenave, member of the French Academy of Sciences who has already been a GIFT speaker twice, has been invited and has accepted to give the lecture. Sandrine Gayrard, a teacher from the Lycée Monteil in Rodez, France, has been invited to participate to a round table discussion. Sandrine Gayrard has participated to GIFT-2011 and has received an award for her poster presented in the "Science in Tomorrow's Classroom" session at the 2011 EGU.

The second application has been received from Grzegorz Lorek, a Polish teacher who has attended GIFT-2011. He has asked to have a GIFT speaker address the teachers attending the XIII Polish Forum of Science Teachers, which will take place on Sept. 15-16, 2012. The EGU Committee on Education has approved his application and Yvon Le Maho, member of the French Academy of Sciences and speaker at GIFT-2011, has accepted to give a talk at this conference.

The third application is from Xavier Juan, Vice President of the Spanish association of Earth Sciences teachers (AEPECT) who has asked to have Mathias Harhauser, Head of the Paleontology Department of the Vienna Museum of Natural Sciences, as a GIFT Distinguished speaker to give a talk on the occasion of "Simposio sobre la Enseñanza de la Geología" of the AEPECT, in July 2012 at Huelva, Spain. This conference will have an expected attendance of 300 teachers. The Committee has accepted this proposal and Mathias Harzhauser has accepted to give a talk at the conference.

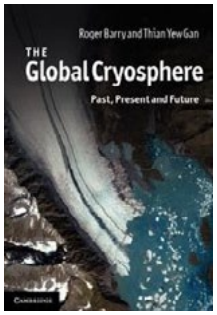
You can follow up this new EGU COmmittee on Education Programme at the GIFT homepage, http://www.egu.eu/media-outreach/gift/home.html.

Ichnology

Authors: Luis A. Buatois and M. Gabriela Mángano
Publisher: Cambridge University Press
ISBN: 9780521855556
YEAR : 2011
EDITION : 1st
PAGES : 358
PRICE : 57.00 €
Hardback

Ichnology is the study of traces created in the substrate by living organisms. This is the first book to systematically cover basic concepts and applications in both paleobiology and sedimentology, bridging the gap between the two main facets of the field. It emphasizes the importance of understanding ecologic controls on benthic fauna distribution and the role of burrowing organisms in changing their environments. A detailed analysis of the ichnology of a range of depositional environments is presented using examples from the Precambrian to the recent, and the use of trace fossils in facies analysis and sequence stratigraphy is discussed. The potential for biogenic structures to provide valuable information and solve problems in a wide range of fields is also highlighted. An invaluable resource for researchers and graduate students in paleontology, sedimentology and sequence stratigraphy, this book will also be of interest to industry professionals working in petroleum geoscience.

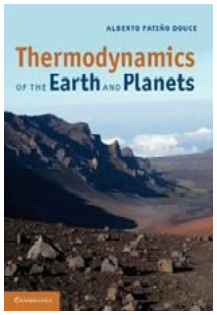
The Global Cryosphere



Authors: Roger Barry, Thian Yew Gan
Publisher: Cambridge University Press
ISBN: 9780521156851
YEAR : 2011
EDITION : 1st
PAGES : 472
PRICE : 49.00 €
Paperback

This is the first textbook to address all the components of the Earth's cryosphere – all forms of snow and ice, both terrestrial and marine. It provides a concise but comprehensive summary of snow cover, glaciers, ice sheets, lake and river ice, permafrost, sea ice and icebergs – their past history and projected future state. It is designed for courses at upper undergraduate and graduate level in environmental science, geography, geology, glaciology, hydrology, water resource engineering and ocean sciences. It also provides a superb up-to-date summary for researchers of the cryosphere. The book includes an extensive bibliography, numerous figures and color plates, thematic boxes on selected topics and a glossary. The book builds on courses taught by the authors for many decades at the University of Colorado and the University of Alberta. Whilst there are many existing texts on individual components of the cryosphere, no other textbook covers the whole cryosphere.

Thermodynamics of the Earth and Planets



Authors: Alberto Patiño Douce
Publisher: Cambridge University Press
ISBN: 9780521896214
YEAR : 2011
EDITION : 1st
PAGES : 709
PRICE : 57.00 €
Hardback

This textbook provides an intuitive yet mathematically rigorous introduction to the thermodynamics and thermal physics of planetary processes. It demonstrates how the workings of planetary bodies can be understood in depth by reducing them to fundamental physics and chemistry. The book is based on two courses taught by the author for many years at the University of Georgia. It includes 'Guided Exercise' boxes; end-of-chapter problems (worked solutions provided online); and software boxes (Maple code provided online). As well as being an ideal textbook on planetary thermodynamics for advanced students in the Earth and planetary sciences, it also provides an innovative and quantitative complement to more traditional courses in geological thermodynamics, petrology, chemical oceanography and planetary science. In addition to its use as a textbook, it is also of great interest to researchers looking for a 'one stop' source of concepts and techniques that they can apply to their research problems.

4th International Summer School on Radar / SAR - (Course)

13/07/2012 - 20/07/2012 - Bonn, Germany

One of Europe's most renowned radar institutes Fraunhofer FHR cordially invites you to join us for our 4th International Summer School on Radar / SAR. We offer the unique opportunity to gain an in-depth education on radar and synthetic aperture radar (SAR) techniques by distinguished international lecturers. Our programme covers a wide range from radar fundamentals over state-of-the-art Radar/SAR systems to sophisticated array signal processing techniques.

As a student at the International Summer School you are welcome to a stimulating academic environment in a vibrant atmosphere among international radar specialists and experts. Our intellectually rewarding courses (< 35 students) are accompanied by excursions as well as cultural and social events, introducing you to UNESCO's World Heritage, the Upper Middle Rhine Valley and to the famous city of Cologne.

The 4th International Summer School on Radar/SAR takes place at Haus Humboldtstein in Remagen-Rolandseck, which is located about 15 km south of Bonn.

Application for 4th Int. Summer School 2012 will open: December 2011. Deadline for Application 2012: 18 March 2012. Notification of Acceptance: 30 March 2012.

http://www.radarsummerschool.fraunhofer.de/summerschool/

2nd International School on Least Squares Approach to Modelling the Geoid based on KTH method - (Course)

27/02/2012 - 02/03/2012 - Johor Bahru, Malaysia

After the successful experiences in the determinations and evaluations of precise local geoid models in different countries as well as the very well met First International Geoid School at Yildiz Technical University, Istanbul, in September 2010, we plan to arrange the Second International Geoid School based on the KTH approach. (KTH is a Swedish abbreviation for Royal Institute of Technology, Stockholm, Sweden). The school is planned to be arranged at UTM, from 27 February to 2 March 2012, to be hosted by the Department of Geomatic Engineering, Faculty of Geoinformation and & Real Estate, Universiti Teknologi Malaysia (UTM), Johor Bahru, Malaysia.

The KTH approach to geoid determination is unique in the sense that it uses least squares technique in the spectral domain to combine the data in an optimum way by considering the errors of the EGM, the gravity data and the truncation of Stokes' integral to a cap around the computation point. Another feature that distinguishes the KTH method from others is the way corrections for topography, atmosphere and ellipsoidal shape of the earth are applied: all corrections are added as separate additive corrections. This method was successfully applied in the determination of several regional geoid models: over Sweden, the Baltic countries, Greece, Iran, Sudan, Zambia, Ethiopia, Tanzania and, finally, in the 2009 test project for the comparison of up-to-date methods of geoid modelling in Auvergne, France.

The school will be organized with theoretical lectures in the mornings followed by computer exercises in the afternoons, where the software available at KTH will be used. Computers will be simultaneously available for the exercises. Since the Geoid School has a full-week intensive program, it can be counted as an external full graduate course.

The school is offered only for university students and personnel from public organizations, and the software package is available only for training of students and scientific works.

The poster of Geoid School is available by http://www.infra.kth.se/geo/events/IGS2012_Poster.pdf. Please contact the organizers or Mohammad Bagherbandi (mohbag@kth.se) for additional questions.

Deadline: 01 December 2011

Organizer:

Lars E. Sjöberg, Head of Geoid School, Division of Geodesy and Geoinformatics, Royal Institute of Technology, SE- 100 44 Stockholm, SWEDEN, Email: lsjo@kth.se.

Zainal Abidin Md Som, Head of Local Organizing Committee, Dept of Geomatic Engineering, Universiti Teknologi Malaysia, 81310 Skudai Johor, MALAYSIA, Email: zainalabidin@utm.my

http://www.infra.kth.se/geo/events/IGS-2012.pdf

Conference on Natural Disasters, Global Change and the Preservation of World Heritage Sites - (Meeting)

12/11/2012 - 16/12/2012 - Cusco, Peru

We kindly inform you that the First Circular announcing the 8th EGU Alexander von Humboldt Conference on "Natural Disasters, Global Change, and the Preservation of World Heritage Sites", to be held in Cusco, Peru, November 12th - 16th, 2012.

Further details related to the venue, milestones, registration fees, accommodation and other items of interest will be given in the "Second Circular and Call for Abstracts" which will be sent out later this year. If you wish to receive it or if you have specific requests please contact fabian@wzw.tum.de.

Please display this circular and/or make it available to other colleagues who might be interested.

Organizer:

EGU

http://meetings.copernicus.org/avh8/avh8_first_circular.pdf

XVIII International Symposium Atmospheric and Ocean Optics. Atmospheric Physics - (Meeting)

02/07/2012 - 06/07/2012 - Irkutsk, Russia

The XVIII International Symposium "Atmospheric and Ocean Optics. Atmospheric Physics" will be held at V.E. Zuev

Institute of Atmospheric Optics of the Siberian Branch of the Russian Academy of Sciences (SB RAS),city Irkutsk, July 2 - 6, 2012. The Symposium is a traditional meeting of atmospheric and ocean optics and atmospheric physics community, which has a long history as a successor of the symposiums on Laser Propagation in Atmosphere and Laser Remote Sensing of Atmosphere beginning in the early seventies and organized by academician Vladimir Zuev. This Symposium is dated for forty-year anniversary of Institute of Atmospheric Optics of the Siberian Branch of the Russian Academy of Sciences.

Symposium Chairs

Gelii A. Zherebtsov,
Gennadii G. Matvienko

Organizing Institutions

V.E. Zuev Institute of Atmospheric Optics SB RAS, Tomsk
Institute of Solar-Terrestrial Physics SB RAS, Irkutsk

Call for papers

It is planned to organize four conferences (A, B, C, D) in frame of the Symposium.

A. Molecular Spectroscopy and Atmospheric Radiative Processes

Topics: Molecular Spectroscopy of Atmospheric Gases. Absorption of Radiation in Atmosphere and Ocean. Radiative Regime and Climate Problems. Models and Databases for Atmospheric Optics and Physics.

B. Optical Radiation Propagation in the Atmosphere and Ocean

Topics: Wave Propagation in Random Inhomogeneous Media. Adaptive Optics. Nonlinear Effects at Radiation Propagation in Atmosphere and Water Media. Multiple Scattering in Optical Remote Sensing. Image Transfer and Processing.

C. Optical Investigation of Atmosphere and Ocean

Topics: Optical and Microphysical Properties of Atmospheric Aerosol and Suspension in Water Media. Transport and Transformation of Aerosol and Gas Components in the Atmosphere. Laser and Acoustic Sounding of Atmosphere and Ocean. Diagnostics of State and Functioning of Plants' Biosystems and Biological Objects.

D. Atmospheric Physics

Topics: Structure and Dynamics of the Lower and Middle Atmosphere. Dynamics of the Atmosphere and Climate of the Asian Region. Physical Processes and Phenomena in the Earth's Thermosphere and Ionosphere. Radio and Optic Techniques for Probing the Terrestrial Atmosphere and Underlying Surface.

Working languages of the Symposium are English and Russian.

Registration and Paper Submission

Authors should submit an original paper (4 pages) and registration form using the on-line submission procedure on the site http://symp.iao.ru/en/aoo/18/register or by e-mail: symp2012@iao.ru. Registration and submission will be opened January 15, 2012.

Submission Guidelines

Your submission should include the following information:

1. Presentation Title.
2. Names of Authors (principal author first).
3. Affiliation, mailing address, telephone, fax, and e-mail address for each author.
4. Keywords (five keywords maximum).
5. Abstract text (approximately 100 words, English language).
6. Text of the paper (4-pages, English language)

Text format is MS-WORD (Family.rtf , Times New Roman, 12 pt). The form will be accessible on the page for this symposium of the site.

Registration by e-mail.

Your submission should include the following information also:

1. Conference (A, B, C, D).
2. Type of presentation (Oral or/and Poster).

Symposium Location

Symposium will take place in city Irkutsk. Irkutsk - a large economic, scientific and cultural center of Eastern Siberia, was founded in 1686, about 500 thousand inhabitants, six universities, 12 institutes of theAcademy of Sciences, theaters, museums and art galleries.

Lake Baikal is a deep tectonic depression in the center of Asia at an altitude of 456 m above sea level, surrounded by mountain ranges. Lake Baikal - the deepestcontinental body of water on the globe, the average depth of 730 m, maximum depthof 1620 m, 1 / 5 of the world's fresh surface water, rich and diverse flora and fauna. In early July in Irkutsk sunny and warm, the air temperature of 20 °, the temperature of water in the lake of 10 °.

Excursions

Travel to the Lake Baikal for 1-2 days including a visit to Baikal Astrophysics Observatory and Baikal Museum is planned.

Data required for Russian visa application:

1) scanned copy of passport for traveling abroad with date of issue and date of expiry;
2) assumed arrival in Russia: from and till;
3) itinerary (in Russia);
4) family name, first name, middle name;
5) date of birth;
6) sex;
7) citizenship;
8) state of birth, place of birth;
9) state of constant residence, region;
10) place of getting visa, country and city with Russian Consulate;
11) affiliation (exact name);
12) exact address of institute;
13) your position or title at your place of work;
14) series of passport and number.

Additional information:

More information about registration fees, travel and accommodation, social program and tours will be available late on web-site.

Looking forward to seeing you among the participants of the Symposium!

Organizer:

Vladimir I. Kurkin, CoChair
Oleg A. Romanovskii, CoChair

Marina Chernigovskaya, Scientific secretary
Semen Yakovlev, Scientific secretary

V.E. Zuev Institute of Atmospheric Optics SB RAS
1, Zuev square, Tomsk, 634021, Russia
Phone: +7(3822) 490462, +(7)9138774097
Fax: +7(3822)492086
e-mail: symp2012@iao.ru

http://symp.iao.ru/en/

2012 ACCENT-IGACGEIA Conference. Emissions to Address Science and Policy Needs - (Meeting)

11/06/2012 - 13/06/2012 - Toulouse, France

GEIA is organizing its next conference to exchange expertise and information on the latest advances towards improved anthropogenic and natural emissions estimates. GEIA invites the scientific, regulatory, and operational emission communities to join in a discussion of our capabilities to produce better emission information in support of science and policy.

The purpose of this GEIA conference is to demonstrate the potential of improving emission inventories through the combined used of different methodologies. The capability of improving the accuracy of emission data is considerably enhanced at present by the possibility of using inverse modeling techniques and near-real-time observations. Emission data may be evaluated through a combination of bottom-up methodologies, in-situ and satellite observations, and modeling data. Progress has been made to better quantify emissions from a variety of source types, including fossil fuel production and combustion, biomass burning, agriculture, and the biosphere. The shared expertise of the scientific, regulatory, and operational emissions communities represents the most powerful tool to improve our knowledge of the emissions of climate and air quality relevant species.

Conference Topics:

• Multi-scale evaluation of surface emissions
• Improvement and evaluation of emissions using in-situ and remote-sensing observations
• Evaluation and improvement of emissions using inverse modeling
• Emission information in near-real time
• Down-scaling of emissions
• Use of bottom-up emission methodologies in fine resolution inventories
• Emission needs for air quality forecasting
• Impacts and implications of improved emissions estimates
• Creating community-driven interoperable emissions databases.

You are kindly invited to submit oral and poster abstracts on these topics. Submissions should be made through http://geiacenter.org/. Abstract submission deadline: 20th January 2012.

http://geiacenter.org/

IGAC / SPARC Global Chemistry-Climate. Modeling and Evaluation Workshop - (Meeting)

21/05/2012 - 25/05/2012 - Davos, Switzerland

Background:

Increasingly, the chemistry and dynamics of the stratosphere and troposphere are being modeled as a single entity in global models. Tropospheric and stratospheric global chemistry-climate models are continuously being challenged by new observations and model intercomparisons. There is a need to better coordinate the previously separate activities addressing these two domains and to assess scientific questions in the context of comprehensive stratosphere-troposphere resolving models with chemistry (and increasingly a coupled ocean). Accordingly, we invite participation in the IGAC / SPARC Global Chemistry-Climate Modeling and Evaluation Workshop.

Workshop Goals:

We seek to encourage discussion of new observations and new methods that can be used to evaluate and inter-compare CCMs, and discuss progress in the evaluation and analysis of current chemistry-climate models (CCMs) in the stratosphere and troposphere. We also seek to link stratospheric and tropospheric coupled modeling efforts. Topics of the workshop include:

• Improvements in process-oriented evaluation and understanding of CCMs (incl. CCMVal),
• Trends and variability in atmospheric composition and oxidizing capacity,
• Circulation/chemistry response to ozone depletion/recovery and climate change,
• Chemical and dynamical connections between the troposphere and stratosphere,
• Chemistry, dynamics and transport in the upper troposphere / lower stratosphere (UTLS),
• Stratospheric aerosols and impacts on climate,
• Emission based model simulations of long-lived ozone depleting substances.

Workshop Structure and Format:

This workshop will provide an open forum for presentations of science results and open questions on emerging chemistry-climate themes of the stratosphere and the troposphere via invited and contributed oral presentations and poster sessions. Sessions will also target new methods to optimize comparability between model simulations and observations (in situ, satellite, sonde and ground-based). Time will be allotted to discuss expansion of existing activities (e.g., CCMVal, ACCMIP, AC&C hindcast and HTAP), definition of community-wide simulations and process-oriented model evaluation benchmarks.

Registration and Abstract Submission:

Abstracts will be due in March 2012.

The workshop is being held under the auspices of the International Global Atmospheric Chemistry (IGAC) Project and the WCRP's (World Climate Research Programme) SPARC (Stratospheric Processes and their Role in Climate) core project.

Scientific Organizing Committee:

Veronika Eyring (DLR), Jean-Francois Lamarque (NCAR),

Arlene Fiore (LDEO/Columbia University), Andrew Gettelman (NCAR), Peter Hess (Cornell University), Paul Monks (University of Leicester), Steven Pawson (NASA), Thomas Peter (ETH), Ted Shepherd (University of Toronto), Kengo Sudo (Nagoya University), Darryn Waugh (JHU), and Tong Zhu (Peking University).

Local Organizing Committee:

Werner Schmutz, Sonja Degli Esposti, Eugene Rozanov, Stephanie Ebert, Tatiana Egorova (PMOD/WRC), and Andrew Gettelman (NCAR).

9th International Planetary Probe Workshop (IPPW-9) - (Meeting)

18/06/2012 - 22/06/2012 - Toulouse, France

The goal of the workshop is to bring together scientists, technologists, engineers, mission designers, and policy makers interested in the technological challenges and scientific opportunities in the exploration of Solar System atmospheres and surfaces using atmospheric entry and descent probes, aerial vehicles. The 9th workshop will build on the success of the previous workshops to promote international cooperation in probe missions to solar system bodies, and to provide the opportunity for students – the next generation of planetary explorers – as well as spacecraft engineers, technologists, mission planners, and policy makers to participate in these endeavors.

The preliminary list of session topics includes: outlook for probe missions; science and technology of probes, landers and penetrators; science instrumentation; entry, descent and landing; site selection, terminal descent and trajectory reconstruction; sample return capsules, aerial mobility, and drag, aerobraking and aerocapture techniques.

Abstract deadline: 1 March 2012.

http://www.planetaryprobe.eu/

International Conference on 'Demographic and Climate Challenges in the City' - (Meeting)

18/04/2012 - 20/04/2012 - Aachen, Germany

'Demographic and Climate Challenges in the City' provides an interdisciplinary forum open to anyone with an interest in urban research. We invite scholars, researchers, planners and students to share results of ongoing or currently concluding projects as either oral presentations or posters. We accept contributions from the fields of sociology, medicine, geography, history, environmental science, engineering, meteorology, architecture, and related disciplines. The scope of this event is to initiate an interdisciplinary exchange on current issues and open questions in this field of research.

The interdisciplinary team of City2020+, organising the conference at RWTH Aachen University, Germany, researches on urban spaces, especially the present and future challenges that arise from demographic and climatic change. Particular objectives of our research are the identification of interrelations between urban microclimates and their impact on human health and the urban structure, the rating of risks for the individuals who have to work and live under these conditions, as well as the presentation of new adaptation strategies to meet future needs and opportunities.

For more information on the project visit: http://www.humtec.rwth-aachen.de/city2020.

Important Dates:

Abstract submission: 1 December 2011 – 31 January 2012
Notification of acceptance: 13 February 2012
Preregistration deadline: 1 March 2012
Latest registration for presenters: 31 March 2012

For more information on the City2020+ project as well as updates on the conference, please visit our website: http://www.humtec.rwth-aachen.de/city2020conference.

Please subscribe to our newsletter for automatic updates by sending an e-mail with your name. If you have any fur- ther questions, please contact us via: city2020.conference@humtec.rwth-aachen.de.

http://www.humtec.rwth-aachen.de/city2020conference

Tectonics, Structural Geol., Statigr., Sedimentology, Paleontology, Geomorphology-Academic

Faculty position in Quaternary Environmental Change

Company: Division of Earth Sciences at Nanyang Technological University, Singapore
Location: Singapore-Singapore
Date Posted: 27/10/2011
[show details...]

Interdisciplinary / Other-Academic

Tenure-track position in Planetary Physics

Company: University of Toronto Scarborough
Location: Canada-Toronto
Date Posted: 17/11/2011
[show details...]

Energy Resources and the Environment-Academic

Tenure - Track Faculty Position in Sustainable Environmental Systems Engineering: Water, Energy and the Environment

Company: Cornell University - School of Civil and Environmental Engineering
Location: United States-Ithaca, New York
Date Posted: 18/11/2011
[show details...]

Tectonics, Structural Geol., Statigr., Sedimentology, Paleontology, Geomorphology-Academic

STRUCTURAL GEOLOGY / ACTIVE TECTONICS (DIVISION OF EARTH SCIENCES)

Company: Division of Earth Sciences at Nanyang Technological University, Singapore
Location: Singapore-Singapore
Date Posted: 27/10/2011
[show details...]

Cryospheric Sciences-Academic

PhD position at University of Rochester

Company: University of Rochester
Location: USA-Rochester
Date Posted: 27/10/2011
[show details...]

Tectonics, Structural Geol., Statigr., Sedimentology, Paleontology, Geomorphology-Academic

R.S. Yeats Professor of Earthquake Geology and Active Tectonics

Company: Oregon State University
Location: USA-Corvallis, ORegon
Date Posted: 16/11/2011
[show details...]

Interdisciplinary / Other-Academic

Research Specialist Postdoctoral-level Position

Company: Earth Research Institute and Department of Geography, University of California
Location: USA-California, Santa Barbara
Date Posted: 05/12/2011
[show details...]

Geodynamics and Seismology-Academic

Assistant/Associate Professor
Company: School of Meteorology, University of Oklahoma
Location: United States-Norman, OK
Date Posted: 06/12/2011
[show details...]

Interdisciplinary / Other-Academic

Postdoc Position on Identification of N2O source processes by laser spectroscopy

Company: Empa
Location: Switzerland-Dübendorf
Date Posted: 14/12/2011
[show details...]

More details on these jobs can be found online at www.the-eggs.org (click on the button "Job Positions" on the left). Job positions online are updated twice a week.