

Space for Sustainable Development

Pierre-Philippe Mathieu – Vienna 5 May 2010 Directorate of Earth Observation Programs, ESA





European Space Agency Agence spatiale européenne We came all this way to discover the moon, and the most important thing is that we discovered the Earth Bill Anders, 1968



"If you cannot measure it, You cannot manage it"

Lord Kelvin





Agence spatiale européenne

Welcome to Music World



Vital to ensure Return On Investment!



Welcome to Digi World





Earth Observation in support of Science, Weather Forecast, & Climate Monitoring

iving Planet



Paradigm Shift





FRANKLIN'S GULF STREAM MAP (230yrs ago)

Qualitative knowledge of the ocean derived from experience with postal service & whaling captain Timothy Folger

DIGITAL OCEAN (today) (Virtual Laboratory)

Quantitative knowledge giving a

synthetic 4D picture based on

first principles and data.

We learned more over last 15yrs than in 15 centuries

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Courtesy LEGI

Living Pla





Surface (Wind), Top (Cloud height)



European Space Agency Agence spatiale européenne "EO is now the single most important component of the global observing system for NWP " Jean-Noel Thepaut , Head of Data Analysis, ECMWF (European Center for Medium-Range Forecast)

8 Millions radiance assimilated per day representing 95% of total data used! and 6% of total data screened.







Global Sea Level Rise



European Space Agency Agence spatiale européenne Global Sea Level Rise 3mm/yr from altimetry





Regional Sea-Level Rise & Warming

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Ice Melting

Collapse of Larsen B ice shelf, Antarctica



© NASA, NSDIC

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Melting of Greenland ice sheet



Courtesy Eric Rignot

Melting / Thinning of sea-ice





Earth Observation in support of Societal **Applications**





Towards EO Applications





Clean Energy





Offshore Wind Energy







High-res Regional Radar





Low-res Global Scattero meter



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Living Planet Courtesy RISOE



Supporting Hydropower

Digital Elevation Model Land Cover (ENISAT/SAR)



Snow Cover Extent (ENVISAT/MERIS)



Weather Condition (MSG)





Hydrological Model











Hydropower Dams, Suez, Brazil



Definition of indices for Sustainability reporting In line with GRI guidelines to quantify forest fragmentation





Tractele Engineering











CONTROL CONTROL CONTR





Food & Water Management





Agriculture, Food Security



HR Land cover map 2005 (Moselle / Sarre catchment)







Chile is becoming key producer of salmon in the world (\$1 billion/yr) Industry report in Chile estimated the losses to the industry from Harmful Algee Bloom (HABs) are \$50 Million USD/year (2004).

NRT EO data have been integrated in a hydrodynamic model to provide via internet a **HAB Early Warning Service**.

"To obtain the amount of information covered with the EO data, alternative methods will be of considerable higher cost. With in situ measurements you cannot produce a gradient map as obtained with EO images. The value of this information is the area and resolution obtained in a single didactic image."

Francisco Puga, Manager, Mainstream Group Development







Forest & Biodiversity



Forest Monitoring



1990 (baseline)



Non-Forest - No ChangeForest - No ChangeForest 2002 - Settlement/Mine 1989Forest 2002 - Grassland 1989Forest 2002 - Cropland 1989Forest 1989 - Settlement/Mine 2002Forest 1989 - Grassland 2002Forest 1989 - Cropland 2002Forest 1989 - Water 2002

Standardised High Resolution EO Products

2002 (Landsat)



GMES Forestry service in Europe (e.g. change detetction)

and also

REDD pilot projects , for example in Cameroon (member State of COMIFAC (Central African Forestry Commission)







Illegal Logging, Congo

Landsat, GPS vs EO



Road Detection detail using SAR (PALSAR)

CIB





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Courtesy SARMAP, AON



UNESCO World Heritage, Congo



European Space Agency Agence spatiale européenne United Nations Educational, Scientific and Cultural Organization



"These maps make our efforts more effective, we can also clarify the exact location of our national park boundaries, improve our biological inventories of the parks, and plan out gorilla eco-tourism."

Eulalie Bashige, Director General of the Institut Congolais pour la Conservation de la Nature (ICCN) of the Democratic Republic of Congo (DRC).



Widlife Habitat Monitoring







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UNCBD COP9 Bonn, May 2008 ESA side event





Managing Hazards & Risks





International Space Charter



- Aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorized users
- Authorized users are a civil protection, rescue, defense or security body from the country of a Charter member
- Each member agency has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life and property
- Members are: ESA, CNES, CSA, NOAA, ISRO,... ect ...



Cyclone Nargis, Myanmar





Glacial Lake Outburst, Nepal

1985 Dig Tsho outburst



GMES service delivered to International Centre for Integrated Mountain Development⁴.



On average, air temperatures in the Himalayas are 1°C higher now than in the 1970s.

European Space Agency Agence spatiale européenne 2000+ glacial lakes in Nepal out of which a few are estimated to be potentially dangerous.





Atmospheric Pollution

From GLOBAL ...



- "The airTEXTs help me immensely, especially as my heart and lung condition has worsened over the last 18 months and my exercise tolerance is very poor. So thank you for the continuing hard work and keeping people like myself informed."
- •"When I get the alerts in the evening I stay indoors next day. I only go out two days a week."
- •"I think airTEXT is a great service and has helped my daughter a great deal."
- •"I am grateful to you all for all you do to help us."

CROYDON COUNCIL www.croydon.gov.uk Image of global tropospheric NO2 as derived from GOME / ERS and SCHIAMACHY / ENVISAT.

Street Map in London

to LOCAL ...



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Conclusions





Expanding European Capability







More Data (e.g. new obs, crowd sourcing) + More Access through new Technologies (e.g. internet, smart phone, virtual globe, grid) + More Skills ... & Good will (e.g. Education) + ???

More Environmental Information Democracy (e.g. free, open, transparent access to information)

For Better Stewardship of the Planet





Rosetta Earth night

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The ESA Earth Observation programmes

... understanding our planet ... securing our environment ... benefiting our economy

