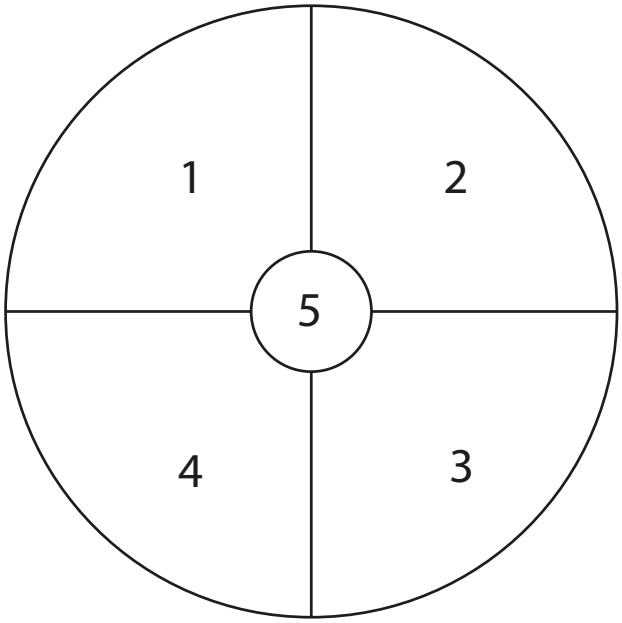
European Geoscience Union
GIFT – Geoscience Information for Teachers

GIFT 2024

THE CHANGING CLIMATE OF OUR PLANET

Vienna, Austria, 14-17 April 2024



1. https://www.flickr.com/photos/dullhunk/14205015878
2. https://pixabay.com/it/illustrations/lora-della-terra-4776711/
3. https://pixabay.com/it/photos/il-riscaldamento-globale-ecologia-2034896/
4. https://pixabay.com/it/photos/globale-riscaldamento-clima-cambia-3371528/
5. Photo: ©ESA

Welcome to the 2024 GIFT workshop!

The general theme of this year's GIFT workshop is "The Changing Climate of Our Planet". The many events that have affected our Earth these last two years (huge fires in California, Greece and Canada, floods over Europe, North Africa and China, severe droughts almost all over the globe) have clearly shown that the climate of our Earth is changing. The events have been highlighted in the press, of course, but usually in a journalistic way, not really focusing on the origin**s** of them.

This has certainly motivated the choice of our general theme, with the objective of giving you scientific information about what the main causes for these climate changes might be, particularly which fraction can be attributed to human activities and which other fraction may arise from natural sources.

We are well aware that the many aspects of climate change cannot be explored in the two and a half days workshop. But we hope to explore at least the main factors affecting climate, and, therefore, we have secured a panel of top scientists to address you.

The workshop will start with a panel, led by two scientists who have had a major role in the Intergovernmental Panel on Climate Change (IPCC), Valérie Masson-Delmotte and Joeri Rogelj, who will in turn address you on different aspects before answering your questions.

We then will have a presentation of the ICOS (Integrated Carbon Observation System) project by Elena Saltikoff, who is the Head of Operation of this programme. As you certainly know, the increase in concentration of carbon dioxide in the atmosphere is one of the major causes of the elevation of its temperature, but maybe you don't know how this concentration is continuously measured worldwide, and this is precisely the aim of this presentation.

The importance of studying past climate changes will then be the object of a presentation by Fátima Abrantes, with the study of marine sediments collected off the continental margin of Portugal.

Fabio d'Andrea will take us a bit into the future, describing the way in which we can now predict possible future climate changes, in particular the occurrence of extreme events.

The way in which the ocean and the clouds react to global warming is crucial to understand the sensitivity of the climate system to CO_2 increase. Sabrina Speich will introduce us to this aspect of climate change which is usually rather unknown by the general public.

We will then examine the macroecological and conservation perspective of subterranean ecosystems presented by Ana Sofia Reboleira.

We will also welcome Julia Pongratz who will introduce us to the effects of the global land use on our climate.

Our final presentation will be given by Koen De Ridder who will examine some of the effects of climate change on urban climate, a topic of very high interest, when considering the increasing fraction of world's population living in cities and megacities.

Following a tradition of the GIFT workshops, the presentations will be intermixed with hands-on activities demonstrated by Davide Faranda, Sally Soria-Deng, the EDUMED Observatory and our team of Geosciences Education Field Officers.

And, of course, we will have presentations of posters by those of you who wish to present 'Teaching climate change at school', and by the various scientists participating to the General Assembly of EGU, who have an interest in education.

As every year, and prior to the workshop, GIFT participants are most welcome to a guided tour at the Vienna Museum of Natural History by Mathias Harzhauser and Oleg Mandic on Sunday afternoon.

And at the end of the GIFT 2024 session, do not forget to fill out the evaluation form. The success of future workshops also depends on you.

Ready to start?

The Education Committee of EGU

Acknowledgements

The GIFT-2024 workshop has been organised by the EGU Education Committee. EGU has supported the major share of the expenses, but the workshop has also benefited from the help of:

We would also like to thank all the speakers who have contributed to this educational workshop and their institutions.

EGU Education Committee

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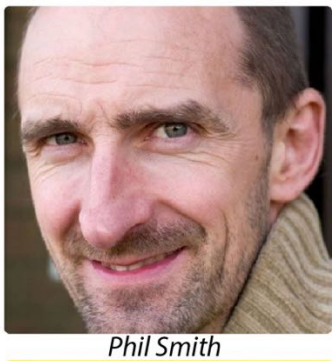


Phil Smith

Stavros Stathopoulos

Stephen Macko

Teresita Gravina

On April 11, 2023, our friend and colleague Herbert Summesberger passed away unexpectedly at the age of 83.

Herbert earned his degrees from the University of Vienna. His PhD thesis deals with structural geology, stratigraphy and palaeontology in the Northern Calcareaous Alps. He organised several international symposia and was the leader of the Working Group on Geosciences, Education and Public Relations of the Austrian Geological Society. Retired since 2004, he was a member of the Board of the Friends of the Museum of Natural History, and organised exhibitions and seminars for high school teachers. He has also written high school books and a Vienna city guide for buildings and decorative stones.

Since the EGU General Assemblies moved to Vienna, he contributed immensely to the organisation, attractiveness and overall success of the GIFT workshops for teachers. From the very beginning he has worked with the Austrian Ministry of Education to obtain official recognition of the GIFT workshops, so that Austrian teachers are officially encouraged to participate by the Ministry. Herbert also provided a private guided tour of the Museum of Natural History in Vienna on the afternoon of the Sunday preceding the workshop.

Not only did Herbert personally address the teachers during the workshops (presentation of pedagogical tools such as GEOLAB). In addition he added a field trip at the end of the workshop, out of the conference hall and into real geology. In one the most memorable of these trips, we were surprised by a heavy rain, but Herbert quickly led us in a very nice wine bar, near Beethoven's house, and so introduced us not only to the geology around Vienna, but also to the Grinzing white wine, roasts, cheeses and cakes, a wonderful custom of Viennese people!

The 2011 Union Service Award was awarded to Herbert Summesberger for his invaluable and unselfish contribution to the organisation, the attractiveness and the success of the GIFT workshops for the last 7 years.

Today, when we visit the Natural History Museum at the beginning of the GIFT workshop, we are still with you, Herbert. Thank you!

Programme

EUROPEAN GEOSCIENCES UNION – GENERAL ASSEMBLY

Geosciences Information for Teachers Workshop (GIFT) 2024

14-17 April 2024

'THE CHANGING CLIMATE OF OUR PLANET'

Sunday, 14 April 2024

16:00-18:00 **GUIDED TOUR OF THE NATURAL HISTORY MUSEUM VIENNA**

(optional) **Welcome to the teachers and attendees of GIFT**

Mathias Harzhauser and Oleg Mandic

(Natural History Museum Vienna, Austria)

18:30-20:00 **Ice breaker party at Austria Center Vienna**

(optional)

Monday, 15 April 2024

Chairperson: Carlo Laj and Jean-Luc Berenguer (Education Committee EGU)

US2 Proposal (Union Symposium Presentation 2)

Yellow Level 0 – GROUND FLOOR - ROOM E1

8:30-10:15 **FROM UNDERSTANDING THE SCIENCE OF CLIMATE CHANGE TO SAVING THE WORLD**

Valérie Masson-Delmotte Laboratoire des Sciences du Climat et de l'Environnement, IPSL, France)

Joeri Rogelj (Centre for Environmental Policy, Imperial College London, United Kingdom)

Presentations followed by questions from the public

10:15-10:45: COFFEE BREAK

→ ***MOVE TO THE GIFT ROOM (Purple Level -2 – BASEMENT - ROOM 2.31)***

Chairpersons: Jean-Luc Berenguer and Teresita Gravina (Education Committee EGU)

10:45-11:00 **WELCOME**

Irina M. Artemieva (EGU President)

Jean Luc Berenguer (Chair of the Education Committee)

11:00-11:45 **DATA FROM ICOS - AN OPPORTUNITY TO PEEK INTO THE CAUSES OF CLIMATE CHANGE**

Elena Saltikoff (Head of Operations ICOS Helsinki, Finland)

11:45-12:00 **INSTRUCTIONS FOR THE POSTER SESSION EOS**

Annegret Schwarz and Stephen A. Macko (Education Committee, Poster Session Conveners)

12:00-12:20 **PRESENTATION OF EDUCATION COMMITTEE GOALS AND THE ACTION PLAN**

Jean-Luc Berenguer (Education Committee Chair)

12:20-13:30 LUNCH (SANDWICHES)

Chairperson: Jean-Luc Berenguer (Education Committee EGU)

13:30-17:00 **HANDS-ON ACTIVITIES**

Purple Level 2 – BASEMENT - ROOMS 2.31 and .33 (2 groups alternating; 2 sessions x 1,5 hours)

WS 1: TEACHING CLIMATE CHANGE: EVIDENCE AND EFFECTS

EGU Geoscience Education Field Officers

WS 2: INTRODUCING CARBON DIOXIDE REMOVAL (CDR) FROM

THE ATMOSPHERE IN THE CLASSROOM: HELPFUL MATERIALS FOR

DOING IT

Sally Soria-Dengg (Ludwig-Maximilian-University Munich; GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel, Germany)

17:30-19:00 **TOUR OF THE EGU EXHIBITION**

Chairpersons: Giuliana Panieri, Stavros Stathopoulos, Teresita Gravina (Education Committee), Solmaz Mohadjer, Lisa Wingate in cooperation with Outreach and EDI Committees

19:00-20:00 **TOWNHALL MEETING**

Room G2

THE EDUCATIONAL ACTIVITIES ORGANISED WITHIN SEVERAL COMMITTEES AT EGU

Robyn Pickering (University of Cape Town, South Africa)

Tuesday, 16 April 2024

Purple Level -2 – BASEMENT - ROOM 2.31

Chairpersons: Gina Pereira Correia, Anna Anglisano Roca, Hélder Pereira

(Education Committee EGU)

8:30-9:15 **THE IMPORTANCE OF THE INFORMATION FROM THE PAST FOR A PLANET UNDER PRESSURE: CASE STUDIES FROM THE PORTUGUESE MARGIN**

Fátima Abrantes (Instituto Português do Mar e da Atmosfera, Portugal)

9:15-10:00 **PREDICTING WEATHER, PREDICTING CLIMATE**

Fabio d'Andrea (Laboratoire de Météorologie Dynamique, Paris, France)

10:00-10:30 COFFEE BREAK (AND GIFT 2024 GROUP PICTURE!)

10:30-12:30 **HANDS-ON ACTIVITIES**

Purple Level -2 – BASEMENT - ROOM 2.31 and 2.33 (2 groups alternating; 2 sessions x 1h)

WS 3: EU DEEPICE PROJECT. ICE CORES FOR TEACHERS: AN EDUCATIONAL KIT FOR TEACHING CLIMATE AND GEOSCIENCES
Marie Kazeroni (Laboratoire des Sciences du Climat et de l'Environnement, LSCE, CEA, CNRS, UVSQ, France)

WS 4: GAME CLIMATRIS'Q
Davide Faranda (Laboratoire des Sciences du Climat et de l'Environnement, LSCE, CEA, CNRS, UVSQ, France)

12:30-13:30: LUNCH (SANDWICHES)

Purple Level -2 – BASEMENT - ROOM 2.31

Chairpersons: Annegret Schwarz and Stephen A. Macko (Education Committee EGU)

13:30-14:15 **INVESTIGATING TWO MAJOR UNKNOWNS IN THE CLIMATE EQUATION**

Sabrina Speich (Laboratoire de Météorologie Dynamique - École Normale Supérieure, Paris, France)

14:15-14:30 **PLANET PRESS**

14:30-15:45 **POSTER SESSION PART 1:**

'TEACHING CLIMATE CHANGE AT SCHOOL'

15:45-16:15 COFFEE BREAK

16:15-18:00 **POSTER SESSION PART 2:'TEACHING CLIMATE CHANGE AT SCHOOL'**

18:00-19:00 **NETWORKING EVENT IN THE POSTER HALL**

Wednesday, 17 April 2024

Purple Level -2 – BASEMENT - ROOM 2.31

Chairpersons: Francesca Funiciello and Konstantinos Kourtidis (Education Committee EGU)

8:30–9:15	**SUBTERRANEAN ECOSYSTEMS – MACROECOLOGICAL AND CONSERVATION PERSPECTIVE** Ana Sofia Reboleira (Universidade de Lisboa, Portugal)
9:15–10:10	**MANAGING CLIMATE BY MANAGING LAND** Julia Pongratz (Ludwig-Maximilian-University Munich, Germany)
10:10–10:15	**GIFT CERTIFICATES DISTRIBUTION**
10:15-10:45	**COFFEE BREAK**
10:45–11:30	**URBAN CLIMATE RESEARCH AS A SUPPORT TO RESILIENT CITY PLANNING** Koen De Ridder (VITO – Flemish Institute for Technological Research, Belgium)
11:30–12:15	**GENERAL SESSION AND CONCLUDING REMARKS**

GOOD BYE!

GUIDED TOUR OF THE NATURAL HISTORY MUSEUM VIENNA

Mathias Harzhauser and Oleg Mandic

Natural History Museum Vienna

Standing on each side of the bronze elephant (an artwork of the Viennese artist Gottfried Kumpf) in front of the entrance, our two hosts for the visit to the Natural History Museum Vienna (NHMW):

Mathias Harzhauser, on the right, Head of the Geological-Paleontological Department at the NHMW, and Professor at the University Graz (Austria) earned his degrees from the University of Vienna and has been employed by the NHM after his Master's thesis. He is interested in integrated stratigraphy and paleogeography of the Neogene Paratethys Sea and is a specialist for fossil gastropods. He is a corresponding member of the Austrian Academy of Sciences and is engaged in the popularization of science.

Oleg Mandic, on the left, is researcher and curator in the Geological-Paleontological Department at the NHMW and teaches at the University Vienna (Austria). He is an expert for Eurasian Oligocene and Miocene stratigraphy and paleobiogeography and is a specialist for fossil bivalves. Oleg Mandic has worked at the NHMW since 2008 and is responsible for the collection of regional Tertiary geology.

Valérie Masson-Delmotte

Climate scientist

Senior scientist, CEA, Laboratoire des Sciences du Climat et de l'Environnement / Institut Pierre Simon Laplace

Université Paris Saclay, France

RESEARCH INTERESTS

My initial background is in fluid physics, and my research area is related to quantifying and understanding the mechanisms of climate and atmospheric water cycle changes, using reconstructions based on stable isotopes from natural archives (ice cores and tree rings), modelling, and monitoring of water stable isotopes in precipitation and vapour.

My professional activity has three main dimensions related to advances in climate sciences grounded in basic scientific research; climate change expertise, to inform climate action; and climate outreach, to strengthen climate literacy.

I was the Co-Chair of the Working Group I (Physical Science Basis) of the Intergovernmental Panel on Climate Change (IPCC) for the 6th Assessment Cycle (2015-2023) with inputs for several advisory science committees (e.g. Région Ile de France; One Planet Polar Summit, 2023).

I am engaged to strengthen climate literacy, through training sessions with e.g. journalists, teachers, government advisors, civil servants, city decision makers. I am also very active in the dissemination of the state of knowledge on climate science towards decision makers and the general public. I have written several books for children and the general public related to climate change and climate science (e.g. Greenland, climate, ecology and society, CNRS, 2015; Climate in 30 questions, La Documentation française, 2022 – in French) and actively used Twitter / X to disseminate IPCC findings.

TRACK RECORD

- Member of the French national climate change committee (hautconseilclimat.fr) (2018-2024)
- Member of the French national ethics consultative committee (since 2022)
- Co-author of 256 publications in the peer-reviewed literature (h-index 83, 301000 citations. Full publication list available here : https://www.webofscience.com/wos/author/record/G-1995-2011
- Highly Cited Researcher in the Geosciences (2014-2019) and Cross-Field (2020-2022)
- Supervision of 22 PhD student and 5 post-doctoral early career scientists. Member of 20 PhD and habilitation theses committees (France, Netherlands, Switzerland, Australia, UK, Russia).
- Doctor Honoris Causa from universities of Utrecht, KU Leuwen, Bern, and from the Tibetan Plateau Research Institute in Beijing
- Numerous scientific recognition awards: Descartes Prize from the European Commission (2008), Irène Joliot Curie (2013), Martha T. Muse for Antarctic Science (2015), Nature's 10 (2018), CNRS silver medal (2019), Academy of Agriculture (2019), EGU Milankovicz medal (2020), SCAR President medal (2020) and IUGG gold medal (2023)
- Member of Academia Europaea and French Academy of Technology

Joeri Rogelj

Professor of Climate Science and Policy

Centre for Environmental Policy
Imperial College London

j.rogelj@imperial.ac.uk

EDUCATION

Doktor der Wissenschaften (Dr. Sc. ETH) — ETH Zurich (CH) 2010—2013
Master in Cultures and Development Studies — KU Leuven (B) 2003—2005
Burgerlijk Werktuigkundig-Elektrotechnisch Ingenieur (Ir.) — KU Leuven (B) 1998—2003

CAREER

2020—present	Director of Research—Grantham Institute – Climate Change & Environment, Imperial College London (UK)
2018—present	Professor in Climate Science & Policy (formerly, Lecturer and Reader) Centre for Environmental Policy, Imperial College London (UK)
2014—2018	Research Scholar— Energy Program, IIASA (A)
2013—2014	Postdoctoral Researcher—Climate Physics Groups, ETH Zurich (CH)
2009—2010	Researcher—PRIMAP, Potsdam Institute for Climate Impact Research (D)

RESEARCH INTERESTS

Climate change solutions, societal transformation, future scenarios, international climate policy, carbon budgets, emission pathways in line with 1.5°C and 2°C of global warming, net zero emission targets, interactions between climate, sustainable development and climate justice.

PUBLICATIONS AND SERVICES (selection)

- Rogelj *et al*. (2013) Probabilistic cost estimates for climate change mitigation, Nature, DOI: 10.1038/nature11787
- Rogelj *et al.* (2016) Paris Agreement climate proposals need a boost to keep warming well below 2°C, Nature, DOI: 10.1038/nature18307
- Rogelj *et al*. (2019) Estimating and tracking the remaining carbon budget for stringent climate targets, Nature, DOI: 10.1038/s41586-019-1368-z
- Rogelj *et al.* (2019) A new scenario logic for the Paris Agreement long-term temperature goal, Nature, DOI: 10.1038/s41586-019-1541-4
- Rogelj *et al.* (2023) Credibility gap in net-zero climate targets leaves world at high risk, Science, DOI: 10.1126/science.adg6248

EDITORIAL & ADVISORY ROLES and SERVICE

2022—present	Member European Scientific Advisory Board on Climate Change (ESABCC)
2019—present	Science (AAAS) — Board of Reviewing Editors
2018—2021	Lead Author — Intergovernmental Panel on Climate Change (IPCC) AR6
2016—2018	Coordinating Lead Author — IPCC Special Report on Global Warming of 1.5°C
2016—present	Environmental Research Letters (IOP) — Editorial Board Member
2010—present	Lead Author — Emission Gap Reports, UN Environment Program (UNEP)

AWARDS AND HONORS

2021	Early Career Scientist Award (Europe)— International Science Council
2016	Inaugural Piers Sellers Award for world leading climate research contributions
2014	ETH Silver Medal — ETH Zurich (CH)

FROM UNDERSTANDING THE SCIENCE OF CLIMATE CHANGE TO SAVING THE WORLD

Valérie Masson-Delmotte[1] and Joeri Rogelj[2]

[1]*Laboratoire des Sciences du Climat et de l'Environnement*

[2]*Imperial College London*

Climate science now unequivocally states that human activities have caused the global warming that is observed today. This state of knowledge builds on centuries of scientific advances in the understanding of the climate system, from multiple lines of evidence - observations, theory, process understanding, and numerical modelling. This presentation will build on key findings from the Sixth Assessment Cycle of the Intergovernmental Panel on Climate Change (IPCC). It will place the current scientific understanding in this context of climate science history and lay out what is the current state of climate, with the observed intensification of global and regional changes, and what are physically plausible futures, unpacking how science underpins the understanding of the climate emergency.

We will encompass the scientific understanding of the human influence on the global carbon cycle, its sources and sinks of greenhouse gases, of human influence on observed climates (attribution), and insights from past climate evidence (paleoclimatology). We will explain how advances in the understanding of the Earth system are crucial to inform climate action through the understanding of current and future changes in global and regional climatic impact-drivers, as a function of human influence and global warming levels, and through the understanding of the geophysical constraints for halting global warming, in particular the specific roles of cumulative emissions of carbon dioxide and short-lived climate forcings.

Finally, we will provide a physical climate science perspective on the current state of climate action, following the outcomes of the United Nations Framework Convention on Climate Change 28th Conference of Parties (COP28).

Elena Saltikoff

Head of Operations

ICOS ERIC

Helsinki, Finland

elena.saltikoff@icos-ri.eu

EDUCATION

Studied meteorology at Helsinki University, MSc in 1992, PhD in 2011.

CAREER

Head of Operations at ICOS ERIC since September 2019.

I moved to ICOS from position of research scientist at Meteorological Research unit of the Finnish Meteorological Institute, FMI. I started my career at FMI as a weather forecaster. Since 1996 I have done research and made some development related to weather radars, including preparing on-the-job training for forecasters. I have been involved in organising several scientific conferences and EU funded projects, both in FMI time and now in ICOS.

During my scientific career I authored or co-authored more than 20 articles in peer-reviewed scientific journals and several congress proceedings, abstracts or scientific reports. I have also been one of the authors of four popular science books and two university textbooks. I have been a supervisor or a co-supervisor for 3 MSc thesis and one PhD thesis.

RESEARCH INTERESTS

In ICOS our work is related to climate change, greenhouse gases, and the entire carbon cycle including fluxes between atmosphere, oceans and terrestrial ecosystems. In recent projects we are focusing in extracting information about anthropogenic greenhouse gas emissions in urban areas and supporting the planned satellite measurements with in situ observations.

PUBLICATIONS AND SERVICES

Heiskanen, J., Brümmer, C., Buchmann, N., Calfapietra, C., Chen, H., Gielen, B., **Saltikoff, E**., & Kutsch, W. (2022). The integrated carbon observation system in Europe. *Bull. Am. Met. Soc.*, *103*(3), E855-E872.

Saltikoff, E., Friedrich, K., Soderholm, J., Lengfeld, K., Nelson, B., Becker, A., Hollmann, R., Urban, B., Heistermann, M. and Tassone, C., (2019). An overview of using weather radar for climatological studies: Successes, challenges and potential. *Bull. Am. Met. Soc*.

Karttunen H., Koistinen J., **Saltikoff E**. & Manner O. (2008): *Ilmakehä, sää ja ilmasto*. Ursa 2008. (505 pages, in Finnish) ISBN 978-952-5329-61-2.

AWARDS AND HONORS

Knight of the Order of the Lion of Finland, 2014

DATA FROM ICOS:
AN OPPORTUNITY TO PEEK INTO THE CAUSES OF CLIMATE CHANGE

Elena Saltikoff

Integrated Carbon Observation System

The Integrated Carbon Observation System, ICOS, provides standardised and open data from more than 170 measurement stations across 16 European countries. The stations observe greenhouse gas concentrations in the atmosphere as well as carbon fluxes between the atmosphere, the land surface and the oceans. Thus, ICOS is rooted in three domains: Atmosphere, Ecosystem and Ocean. We produce standardised, high-precision and long-term observations on greenhouse gases, used by scientists and decision makers in predicting and mitigating climate change.

Our data is FAIR and open, and available near real time. For school use, this means that the future scientists and decision makers can use the same up-to-date data in their studies, exercises and essays. As examples from the past few years, when NordStream pipeline exploded, the raising methane concentrations were seen in our data from stations in NW Europe. Comparing carbon dioxide fluxes from several years shows how uptake in photosynthesis slows down when the forests suffer from unfavourable conditions.

ICOS data can be previewed and downloaded from the ICOS Carbon portal. Alternatively, it can be used as part of Jupyter notebooks. Notebooks are interactive documents that can contain code, equations, visualisations, and narrative texts. The interactive nature and narrative approach of Jupyter notebooks contribute to making science topics more visual and easily understandable. Our Exploredata Jupyter hub includes notebooks that use ICOS data to introduce students to basic principles of climate science and programming.

In ICOS Cities project we have a task about school co-operation which connects the top greenhouse gas science with youth education. The goal is to increase the understanding of the youth about climate change, in particular about the role of the greenhouse gases, their sources and sinks. Another important goal is to teach the scientific methods that will build trust in science and in scientific facts: Giving first-hand experiences in science for the students will help fight fake climate claims and other types of “fake facts” spreading in diverse social media platforms popular with the youth. We will teach the teachers and get the students to make their own experiments and analyse real data. The material packages, intended to be used for students aged 13-16, are piloted in a few schools. In my talk I would like to share the first experiences of piloting this material: what worked well and what will be improved.

Useful links

https://www.icos-cp.eu/science-and-impact/education/icos-jupyter-notebooks-for-education

https://www.icos-cp.eu/data-services/tools/jupyter-notebook

https://www.icos-cp.eu/projects/icos-cities

Gina P. Correia

EGU Geoscience Education Field Officer for Portugal gina_maria@sapo.pt
https://orcid.org/0000-0002-0269-7564

Gina P. Correia is an EuroGeol, MSc in Environmental Education, PhD in Geology, and has been a Biology and Geology teacher at secondary school for over two decades. She is also a teacher trainer, integrates the research group 'Earth Dynamics' of the Earth and Space Research Centre, University of Coimbra, and is a EGU Education Committee member.

Since 2019 she has been the EGU Geoscience Education Field Officer for Portugal.

Giulia Realdon

EGU Geoscience Education Field Officer for Italy giulia.realdon@unicam.it

Giulia Realdon, BSc in Biology, MSc in Science Communication, PhD in Earth Sciences Education, has been teaching Natural Sciences in high school for many years. After retiring, she is working in education research within the University of Camerino, EMSEA - European Marine Science Educators Association and EuroScitizen COST Action, in non-formal science education and in teacher training.

Since 2019 Giulia has been the EGU Geoscience Education Field Officer for Italy.

Guillaume Coupechoux

EGU Geoscience Education Field Officer for France gcoupechoux21@gmail.com

Guillaume Coupechoux, MSc in Biology and Geology, has been teaching these subjects in French schools abroad, and now he is *Inspecteur Education Nationale - Circonscription de Gex*. He is also working at the organisation of sciences events in the South-Eastern part of France, and he has also one eye on Mars as a member of the Mars2020 & InSight Education Team.

Since 2019 he has been the EGU Geoscience Education Field Officer for France.

Pete Loader

EGU Geoscience Education Field Officer for the UK pete@earthlearningidea.co.uk

Pete Loader, FGS, BSc in Geology, is a retired secondary school geology teacher. He is the chair of A-Level geology examiners in the UK and a member of the Earthlearningidea team. He is a geoscience teacher trainer for the Earth Science Teachers' Association and the Geological Society of London.

Since 2022 Pete has been the EGU Geoscience Education Field Officer for the UK.

Xavier Juan

EGU Geoscience Education Field Officer for Spain xjuan03@gmail.com

Xavier Juan has been a secondary teacher for 37 years. He is a Mentor of the Spanish Olympic Team in the IESO, member of the staff of the Spanish Earth Science Teachers Association (AEPECT). He is also involved in the training of science teachers, especially through the Teachers' College of Catalonia.

Since 2019 Xavier has been the EGU Geoscience Education Field Officer for Spain.

TEACHING CLIMATE CHANGE: EVIDENCE AND EFFECTS

Giulia Realdon, Guillaume Coupechoux, Pete Loader, Xavier Juan, & Gina P. Correia

EGU Geoscience Education Field Officers

Climate change is real, with the evidence increasingly brought to our notice, particularly with extreme weather events. Whilst Earth's history is marked by natural cyclical change that has influenced biodiversity and sustainability in the past, the current rapid rates of change brought about by anthropogenic causes will certainly continue in the future unless global attitudes change. So, it is essential to include the topic of global climate change in lessons to enable students to understand its origins and to learn how we might live with and mitigate its effects.

In this workshop we will be presenting the evidence for climate change by modelling the way oxygen isotopes can record past Earth temperatures in the sedimentary and ice-core records (Fig.1). We will show how to stimulate classroom discussion by using a plastic cup analogue to demonstrate the processes that cause changes in global sea-level and relate these to the causes of current and predicted increases (Fig. 2). Another activity will focus on ocean acidification. The ocean is a carbon sink but since the Industrial Revolution atmospheric CO_2 has risen to about 420 ppm, which comes at a cost. We will simulate ocean acidification by blowing into distilled water containing pH indicator, and then try to mitigate the effect by adding crushed seashell to the solution. What will happen? (Fig.3). And finally, we ask the question, 'What could we measure to find out if climate change is happening in our own backyard or school grounds?' (Fig. 4.).

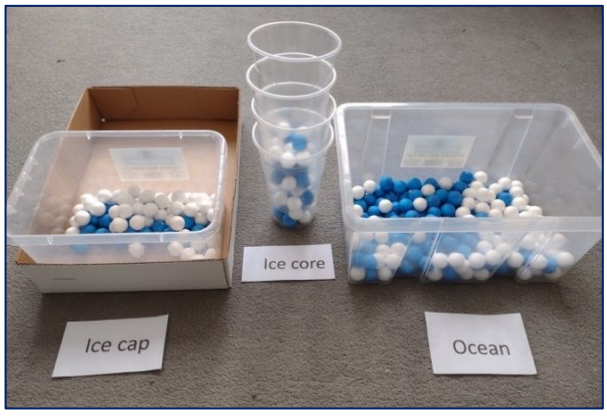


Figure 1. Isotope evidence

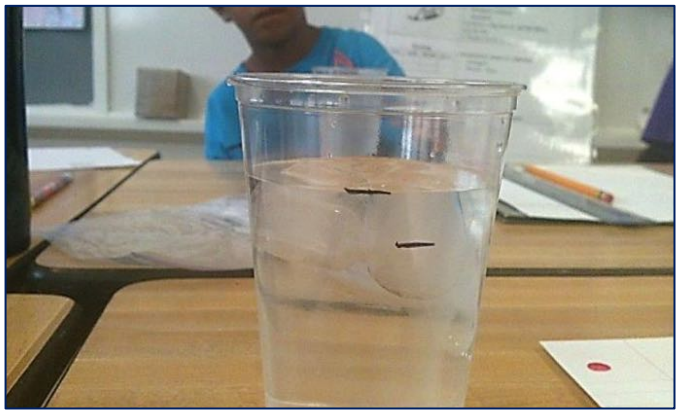


Figure 2. Sea-level changes

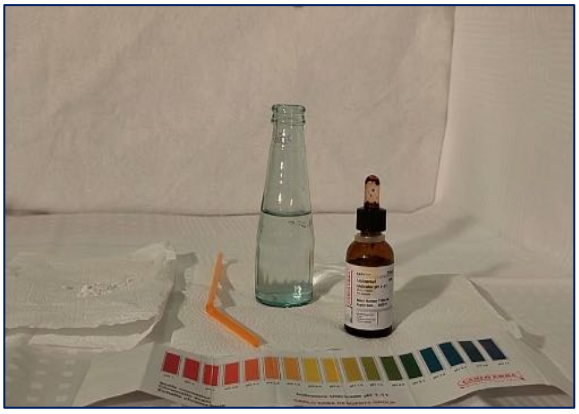


Figure 3. Ocean acidification

Figure 4. What evidence can we collect at school?

The activities performed are available at the Earth learning website (https://www.earthlearningidea.com/), a free online repository where it is possible to find more than 400 activities ready to use and translated in different languages. All are designed to develop students' critical thinking and research skills, while developing their knowledge and understanding of Earth processes and products.

EGU Geoscience Education Field Officers (GEFO) are a team of geoscience teachers and researchers who provide professional development to school teachers who have elements of geoscience in their teaching curricula, through interactive hands-on workshops. The team is supported by the European Geosciences Union Education Committee and is active in eleven countries around Europe. Please find more about the GEFO programme here: https://www.egu.eu/education/.

SALLY SORIA-DENGG

Education Officer

CDRSynTra

Ludwig Maximilian University of Munich

Germany

EDUCATION

B.S Zoology, University of the Philippines

M.S. Zoology, University of the Philippines

Ph.D. Marine Biology, Christian Albrechts University, Kiel, Germany

CAREER

Post-Doc GEOMAR Helmholtz Centre for Ocean Research Kiel

School Program CarboSchools, Coordinator for Kiel, Germany

School Program Coordinator, Colloborative Research Centre 754

Education Officer CDRterra (land based Carbon Dioxide Removal)

PUBLICATIONS AND SERVICES

Selection of education related publications:

Contributions to the Third educational booklet of CarboSchools: From research to the classroom
http://www.carboeurope.org/education/3rd-booklet-single.pdf

Experiments on ocean acidification for teachers and students
https://www.bioacid.de/wp-content/uploads/2017/04/BIOACID_Experiments_en.pdf

Oxygen in the ocean: School experiments (in German only)
https://www.geomar.de/fileadmin/content/entdecken/schule/Bilder_Schule/Materialien/SFB754/sfb754_schulbroschuere_web.pdf

Phillipp Fish Series (in German only)
Children's books explaining oxygen minimum zones in the oceans
https://www.geomar.de/schule/die-abenteuer-von-phillipp-fisch

INTRODUCING CARBON DIOXIDE REMOVAL (CDR) FROM THE ATMOSPHERE IN THE CLASSROOM: HELPFUL MATERIALS FOR DOING IT

Sally Soria-Dengg

Ludwig Maximilian University Munich, Germany

According to the UN IPCC report in 2022, despite the implementation of aggressive measures to reduce CO_2 emissions, the 1.5°C threshold will be exceeded in the coming decades. The likelihood that an "overshoot above 1.5°C" cannot be prevented before global temperatures start declining even if CO_2 emissions reduction measures are rigidly implemented and effective. In order to reach the 1.5°C target, additional instruments will have to be resorted to. One of these alternative methods is the active removal of CO_2 from the atmosphere (carbon dioxide removal, CDR). The methods involved have recently been given more attention in the global political debate because even now the 1.5°C limit has already been exceeded in some parts of the world.

What are these CDR methods? How do they work? In CDRterra, a research programme (https://cdrterra.de/en) in Germany funded by the Ministry of Education and Research, more than 200 scientists in different fields of the natural and social sciences work together to study CDR: How to make it most effective, what are the accompanying risks, which effects does the implementation of these measures have on the society, and what is the societal acceptance? Some of the CDR methods being studied are summarised in Fig. 1.

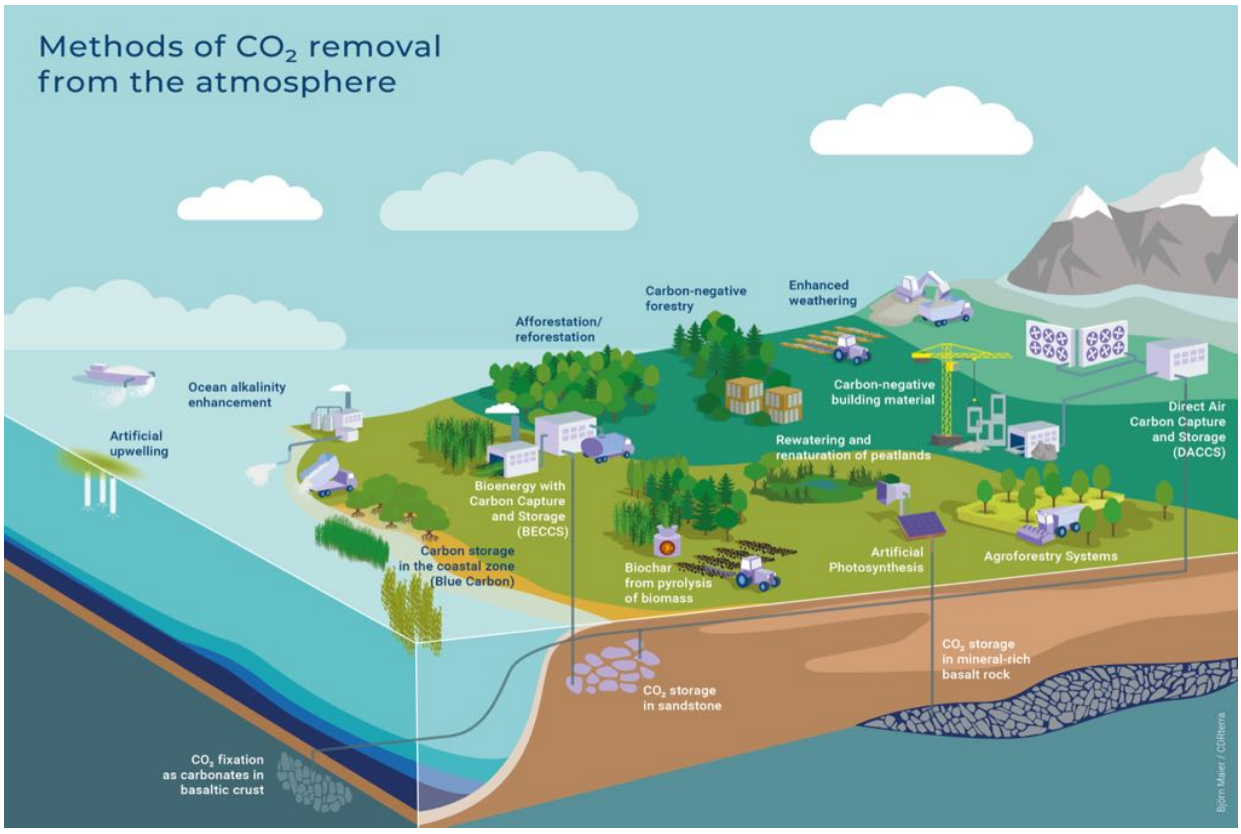


Fig. 1. Methods of CO_2 removal from the atmosphere

The school programme of CDRterra aims to bring CDR to schools. It provides teachers with tools with which they can introduce the topic in their classrooms. To this end, teaching materials for high school students

have been developed: experiments explaining the principles behind some of the CDR methods and games, which show how these methods can be implemented and what risks are involved in their implementation. These materials will be introduced and tested in the workshop. Using information cards (Fig. 2), land-based and ocean-based CDR methods are summarised and a CDR portfolio will be designed by the participants, testing the effectiveness of these portfolios in the face of changing environmental, political and ecological conditions due to climate change. The experiments are summarised in postcard form, which will be made available to the participants.

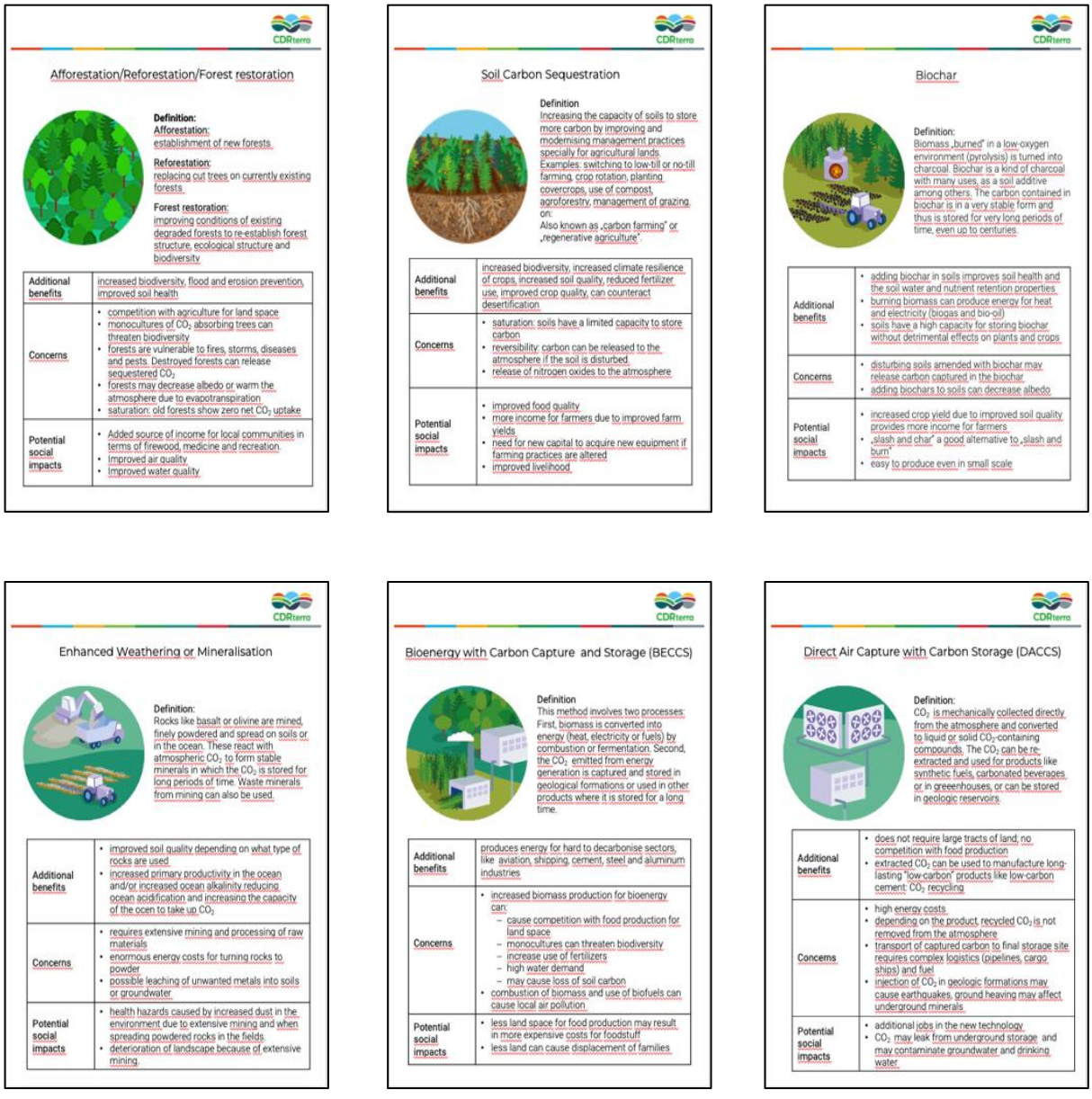


Fig. 2. Examples of information cards summarizing some CDR Methods

Townhall Meeting (Room G2)

THE EDUCATIONAL ACTIVITIES AND RESOURCES AT EGU

Giuliana Panieri[1], Solmaz Mohadjer[2], Lisa Wingate[3], Teresita Gravina[1], Stavros Stathopoulos[1], Robyn Pickering (confirmed speaker)

[1]Members of the EGU Education Committee
[2]Member of the Outreach Committee
[3] Member of the Equality, Diversity and Inclusion Committee

The townhall meeting informs and involves the EGU members in the educational activities undertaken by the Education, Outreach, and EDI (Equality, Diversity, and Inclusion) committee at EGU. We aim to strengthen the EGU community involvement and garner support for our ongoing and upcoming projects by presenting our achievements, challenges, and future plans. We will also present all available educational initiatives to our members to raise awareness about these exceptional resources.

Our EGU committees are driven by a deep commitment to enhancing educational opportunities in Geosciences within our community and beyond. The townhall meeting is dedicated to EGU community members, scientists, geoscience teachers and related fields in higher education, early career scientists and anyone interested in contributing to the educational growth of EGU.

Fátima Abrantes

Portuguese Institute for the Sea and Atmosphere (IPMA) &

Centre of Marine Sciences at University of Algarve (CCMAR)

Av. Doutor Alfredo Magalhães Ramalho 6, 1495-165 Algés, Portugal

fatima.abrantes@ipma.pt

EDUCATION

Agregação (Habilitation) in 2007 in Stratigraphy and Paleoecology from the New University of Lisbon;
PhD in Geological Oceanography in 1990 from the Graduate School of Oceanography of the University of Rhode Island with Final grade of A;
Training period at the Lamont-Doherty Geological Observatory of Columbia University (Lloyd Burkle, Constance Sancetta and Julianne Fenner in Aug. 19 - Dec. 18, 1982);
Graduation in Geology in 1980 from the University of Lisbon with a final grade of 16 in 20.

CAREER

1980: Geologist of the marine Geology section of the Geological Survey of Portugal, Directorate of Geology and Mines, and responsible for the Marine Geology Laboratory; in Jan. 1994 she becomes an *Investigador Auxiliar* and was promoted to *Investigador Principal* in 1998.
2000: She becomes the Director of the Marine Geology Department – Institute of Geology and Mining.
Sept. 2003 to Sept. 2004: Fátima Abrantes takes a Sabbatical at Corvallis University, College of Oceanic and Atmospheric Sciences, as Fulbright Fellow.
Sept. 2004 to 2008: She has the position of the Director of the Marine Geology Department of INETInovação, which changes its name to the Laboratório Nacional de Energia e Geologia (LNEG) in Sept. 2008. After defending her habilitation in 2007, she becomes an *Investigador Principal* with habilitation and Director of the Marine Geology Unit of LNEG.
July 2012: The Marine Geology Unit is moved to the Instituto Português do Mar e da Atmosfera (IPMA) and Abrantes becomes an *Investigador Principal* with habilitation of the Marine Geology and Georesouces Division; she is responsible for the Paleoclimate group.
June 2003: She starts collaborating with the Associated Laboratory CIMAR, and in 2014 launches the research group on Oceanography and Climate Change (OC^2) at the Centre of Marine Sciences (CCMAR), the CIMAR research center at the University of Algarve.

RESEARCH INTERESTS

Paleoceanographer with scientific interests focused on the challenges posed by paleoclimate reconstructions and in promoting the need of a full integration between modern and past ocean, the multidisciplinary approach that this implies, as well as, the link to climatology in order to better understand and relate atmospheric processes driving modern and past climate signals.

PUBLICATIONS AND SERVICES

Fátima Abrantes pioneered paleoceanography/paleoclimatology research in Portugal, she has participated in the education of more than 30 young researchers, and launched new research areas at the national level. With >150 ISI scientific papers and > 6,000 citations, she has also co-edited 2 books, 3 special journals and is associated editor for journals Progress in Oceanography and Oceans. Abrantes leads the Portuguese participation in European and International projects and has been a member of scientific and executive committees such as IMAGES, PAGES, IODP, JPIOceans, SCOR, and a member of ESF of the LESC core and standing committees.

AWARDS AND HONOURS

1985-1989 – Scientific Studies Fellowship INVOTAN – NATO; 1989-1990 - UNESCO Fellow; 2003-2004 – Fulbright Fellow; Honorary member of the “Phi Kappa Phi Society”; Invited member of the “New York Academy of Sciences”; GEOLOGY Exceptional Reviewer for 2021; AGU AMBASSADOR (2021); PAGES Fellow (2021); IODP EXP397 - Co-Chief (2022).

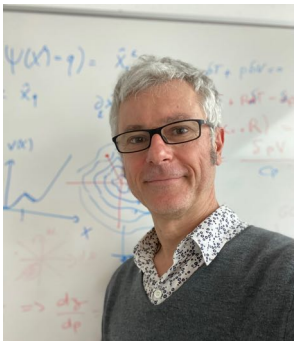
THE IMPORTANCE OF THE INFORMATION FROM THE PAST FOR A PLANET UNDER PRESSURE: CASE STUDIES FROM THE PORTUGUESE MARGIN

Fatima Abrantes

Portuguese Institute for the Sea and Atmosphere

The human impact on Earth is so substantial that a new geologic era, the Anthropocene, has been proposed. The debate around this proposal and its recognition promote the significance of Palaeosciences, how it has helped to understand the climate system better and redefined our comprehension of the involved processes. The instrumental climate record available to assess human impact on climate is much too short (100–150 yr) and includes many observations of an already changing world. As such, we must turn the geologic principle backward and consider that the past contains the key to the future. That means that only paleoclimate studies, by enormously extending the observations and modelling of climate changes back in time, can provide evidence of the physical changes and the ideas of how the organisms and vegetation reacted.

Archives of climate and the various proxies used to reveal past environmental conditions will be introduced, as well as examples of past natural climate variability at all scales, from tectonic and orbital to multidecadal. Case studies from marine sediment sequences from the Iberian margin will be presented since this is a region in which millennial climate variability records correlate to polar ice cores. Besides, the narrow continental shelf permits high sedimentation rates and rapid delivery of material from the nearby continent to the deep sea, thereby providing also a record of European terrestrial climate at the same location.



Fabio D'Andrea

Laboratoire de Meteorologie Dynamique

Institut Pierre Simon Laplace

Ecole Normale Superieure - PSL University

EDUCATION

Laurea in physics of the University of Milan (Italy)

PhD in Meteorology, Oceanography and Environnement of the University of Paris 6 (France)

CAREER

After a postdoc period at UCLA and MIT, I became staff researcher and then research director at CNRS. I've been head of the Climate variability group and since 2016 I have been deputy director of LMD.

RESEARCH INTERESTS

My main area of research is climate variability at midlatitudes from the intraseasonal to the decennial time scale, with particular attention at heat and drought events in midlatitude continents, large scale dynamics and local feedbacks. I also have collateral curiosities spanning from the theory of moist convection to coupled climate-economy and climate-ecology modelling.

PUBLICATIONS AND SERVICES

I teach two undergraduate courses on statistical methods and on the physics of climate. I have an intense activity of outreach towards the media, school and the general public.

So far, I have supervised 10 PhD students and 8 Postdocs. Most of them are pursuing a brilliant scientific career: I consider this my greatest professional success.

I have published 60+ research articles, plus a number of popular articles. The 5 most recent published or ongoing articles I co-authored:

D'Andrea F. et al. "Summer Deep Depressions Increase Over the North Atlantic" (2023), GRL submitted.

Vautard, R., et al. "Heat extremes in Western Europe are increasing faster than simulated due to missed atmospheric circulation changes." (2023). Nat Comm submitted.

Portal, A., F. D'Andrea, C. Pasquero, P. Davini, M. E. Hamouda Atmospheric response to wintertime Tibetan Plateau cold bias in climate models Weather Clim. Dynam, submitted (2023)

Portal, A., C. Pasquero, F. D'Andrea, P. Davini, M. E. Hamouda, and G. Rivière, 2022: Influence of Reduced Winter Land–Sea Contrast on the Midlatitude Atmospheric Circulation. *J. Climate*, 35, 6237–6251 (2022).

Riboldi, J., Rousi, E., D'Andrea, F., Rivière, G., and Lott, F.: Circumglobal Rossby wave patterns during boreal winter highlighted by space–time spectral analysis, Weather Clim. Dynam., 3, 449–469 (2022).

AWARDS AND HONORS

Prix of the Meteorological society of France for the best PhD thesis

PREDICTING WEATHER, PREDICTING CLIMATE

Fabio D'Andrea

Ecole Normale Supérieure, Paris, France

While the discovery of climate change brought it to the attention of society and politics, from the 1970s onwards the study of climate underwent a major scientific renewal. The idea of a stationary climate representing a kind of normality was replaced by a representation of the Earth's climate as a dynamical system, characterized by variations at a wide range of time scales.

The revolution brought about by the development of non-linear dynamics has changed all fields of science in those same years. Modern climate science is undoubtedly a consequence of this revolution, but it is also at its origin: the work of Ed Lorenz in the late 1960s is the very paradigm of the deterministic chaos theory.

In this context, what is forecasting? What is the uncertainty of prediction? In this conference - aimed at mid and high school teachers - I'll be looking at the way in which weather and climate forecasting is approached, the mathematical way in which the problem is posed, and the technical - particularly numerical - means employed to this end. I will present a few elements of the theory of predictability.

Deterministic weather forecasting is limited by the chaotic nature of the atmosphere. So, what can we hope to predict? We'll look at the tricks scientists use to overcome this predictability barrier, thanks to concepts borrowed from the dynamical systems theory and statistics.

We are in the era of the great numerical models of the Earth system, which integrate geophysics, geochemistry and biology, and are beginning to take economic and social systems into account. These models are the main tool we have at our disposal to inform the debate on the measures we need to take in order to safeguard the Planet. Understanding what this tool can predict - and what it cannot - helps us to use it correctly.

Marie KAZERONI

Engineer and Project Manager on Climate

Climate and Environment Sciences Laboratory (LSCE) – CNRS

EDUCATION

2021 – present:

CONTINUING EDUCATION IN CLIMATE SCIENCE AND SCIENTIFIC COMMUNICATION

2022 PALEOS summer school on paleoclimates and paleoenvironments

2021 Masterclass on scientific mediation organised by the TRACES association

September 2015 – August 2016:

URBAN GREEN SPACES ENGINEERING – AgroParisTech

Engineering green spaces in cities, urban agriculture and urban forestry studies

September 2009 – June 2014:

ENGINEERING DEGREE IN URBAN SYSTEMS– Compiègne University of Technology (UTC), France

Environmental planning and engineering studies

WORKING EXPERIENCE

January 2021 – present:

EUROPEAN PROJECT MANAGER – Climate and Environment Sciences Laboratory (LSCE) – CNRS

Management of the European H2020 MSCA ITN project DEEPICE – Innovative Training Network

involving 15 PhD students in glaciology and paleoclimate – 20 partners

November 2017 – January 2021:

ENERGY & SUSTAINABILITY PROGRAM OFFICER – WWF FRANCE, World Wide Fund for Nature

French office

Responsible of the energy and sustainability programme, climate & energy team

SCIENTIFIC COMMUNICATION AND OUTREACH

- Infographics development (infographics on ice core science); coordination of educative videos project about ice core science
- Conferences for pupils and lay audience; organisation of educative stands and games for science fairs

ICE CORES FOR TEACHERS:

AN EDUCATIONAL KIT FOR TEACHING CLIMATE AND GEOSCIENCES

Marie Kazeroni (LSCE-CNRS), Ailsa Chung (IGE-CNRS), Emilie Capron (IGE-CNRS), Piers Larkman (Ca'Foscari University of Venice), Lison Soussaintjean (University of Bern), Lisa Ardoin (Université Libre de Bruxelles), Inès Ollivier (University of Bergen)

Ice cores are cylinders of ice drilled from an ice sheet or glacier. Studying the ice can provide crucial insights into the evolution of the Earth's climate in the past. Ice core science is a highly interdisciplinary field combining (geo)chemistry, geology, physics, computer modelling and more. Ice cores are therefore an interesting teaching tool, as they can be used to teach about climate change, and theoretical knowledge from a number of scientific disciplines.

As part of the DEEPICE European doctoral training network, 15 doctoral students have developed a series of 15 educational videos on ice cores. These 3-minute videos introduce several aspects of ice core sciences, giving a comprehensive overview of the scientific methods/techniques and current challenges in ice core studies.

In this session, the DEEPICE network will present some of the videos in this series and how they can be used as an educational resource by teachers. In particular, we will focus on how we reconstruct past temperatures from the ice (water isotopes), how we measure the past atmosphere (greenhouse gas concentration) from air bubbles trapped in the ice, how the ice sheets move and how this affects the analysis of ice cores.

In addition to these educational videos, we'll be presenting complementary resources and short hands-on activities that can be used in the classroom to teach students about ice core science.

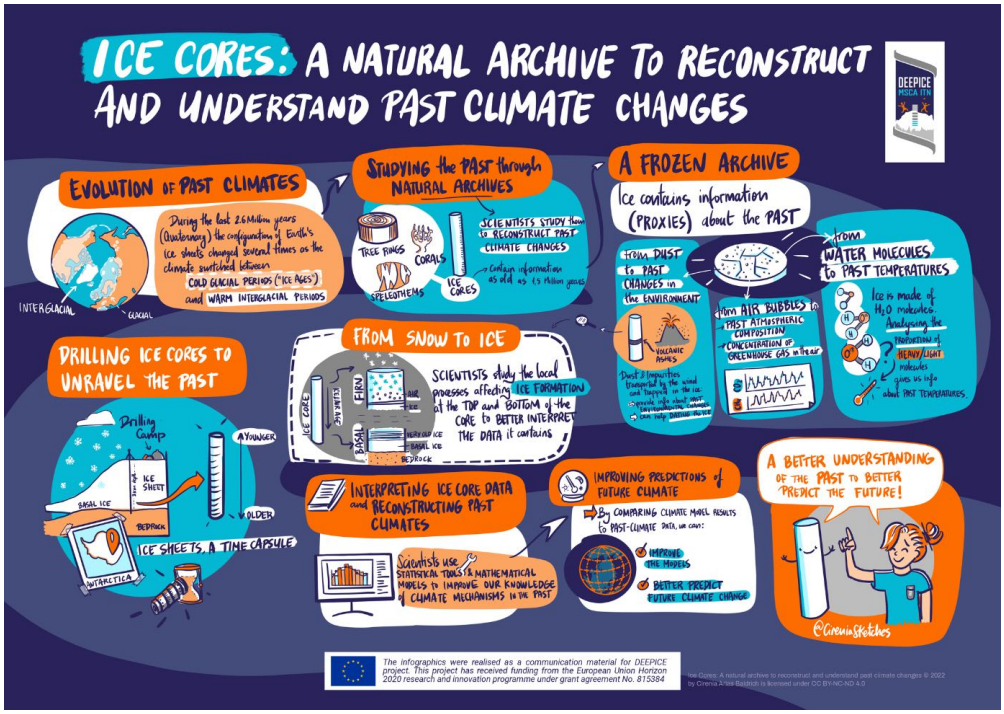


Figure 1 - Infographics about ice core studies developed under DEEPICE project (Cirenia Sketches)

Davide FARANDA
(Chargé de Recherche CNRS Laboratoire des Sciences du Climat et de l'Environnement)
CEA Saclay, L'Orme des Merisiers, 91191 Gif-sur-Yvette, Cedex France 01.69.08.85.41
davide.faranda@lsce.ipsl.fr
https://www.davide-faranda.com

EDUCATION

- 2020: HDR (Habilitation à diriger les Recherches), Earth Sciences -Sciences de la Terre
  UVSQ, St Quentin en Yvelines, France, November 2020. Thesis: Physique Statistique des Evenements Extremes Geophysiques. [ThesiPdF, Presentation PdF, Presentation Movie]
- 2013: PhD, Earth Sciences and Applied Mathematics
  Hamburg University, Hamburg, Germany Mention: 1.0/1.0 magna cum laude, January 2013 Thesis: Extreme Value Theory for geophysical flows. [.pdf] Supervisor: Prof. Valerio Lucarini

SHORT BIOGRAPHY

I started working in the theory of dynamical systems and its geophysical applications my PhD thesis entitled: "Extreme value theory for geophysical Flows", after two and a half years of thesis. My experience in France began in 2013 as part of a postdoctoral fellowship at CNRS under the supervision of B. Dubrulle and F. Daviaud at SPEC - CEA Saclay. In 2014, I started a second post-doctoral contract as part of an ERC climate project led by P Yiou at LSCE. The interdisciplinary training that I acquired during these first phases of my career allowed me to build a solid project for the CNRS, which I joined in 2015. Since my hiring, my activity has been part of the LSCE ESTIMR team. My research activity mainly focuses on the definition of digital tools to study extreme weather events, using statistical physics methods. The universality of these methods allows me to continue the collaboration with the SPEC and the study of turbulent flows, and to apply them to different fields such as Epidemiology and Earthquake dynamics. Within CEA Saclay, I am involved in the organisation of a Climat-Meca-Stat working group which links the skills of LSCE and SPEC while being enriched by the presence of other laboratories. My activity was recently recognized with the **Division Outstanding Early Career Scientists Award from the European Geosciences Union** . Since 2017 I am research fellow of the London Mathematical Laboratory (London UK) and since 2019 external fellow of the LMD-ENS Paris. I have obtained **my Habilitation à Diriger les Recherches (HDR)** in November 2020. Since December 2020 I am also **the ESTIMR Team coordinator (Group leader)**. I have supervised 3 Postdoctoral researchers, 10 master students and 2 PhD students. I have published about 70 articles, with an H-index of 19 and more than 1000 citations in 7 years (source google Scholar). I am currently PI of an **ANR-TERC research project BOREAS,** and French coordinator of the H2020-ITN project **EDIPI**. My outreach activities include the development of an Android / IOS game to understand the complexity of climate systems "**ClimarisQ**" and the participation in science courses (**ASTS**) with middle school classes.

CAREER

- 2020-Now: External Fellow @ LMD-ENS, Paris, France, Group coordinator (Group leader) ESTIMR (~15 members).
- 2017-Now: External Fellow @ London Mathematical Laboratory, London, UK.
- 2015-Now: Researcher (Chargé de Recherce) in Section 19 (Climate) and 52 (Interdisciplinary Science) @ LSCE-CNRS, Gif-sur-Yvette, France.

AWARDS AND HONORS

- 2019: Winner of the EGU Best Blog Posts of 2019 Competition
- 2018: European Geoscience Union Nonlinear Processes Division Outstanding Early Career Scientists Award

IMMERSE STUDENTS IN CLIMATE SCIENCE WITH CLIMARISQ: AN INTERACTIVE EDUCATIONAL GAME

Davide Faranda

Laboratoire des Sciences du Climat et de l'Environnement, France

ClimarisQ is an innovative and captivating game specifically designed to cater to the needs of secondary school students, providing them with a comprehensive understanding of the complexities of climate systems. Developed for both Android and iOS platforms, this interactive game serves as a powerful educational tool, allowing teachers to engage their students in an immersive learning experience. Explore the effects of mitigation and adaptation choices to extreme climate events at the local, regional and global levels. Could you achieve a greener trajectory than the IPCC RCP 4.5 emission scenario? Explore the feedback mechanisms (notably physical, but also economic and social) that produce extreme effects on the climate system.

The Game Mechanism

Make decisions on a continental scale and see the impact of these decisions on the economy, politics and the environment. Deal with extreme events (heat waves, cold waves, heavy rainfall and drought) generated by a real climate model. Try to balance the "popularity", "ecology" and "finance" gauges as long as possible. Fulfill all the missions to explore different climates.

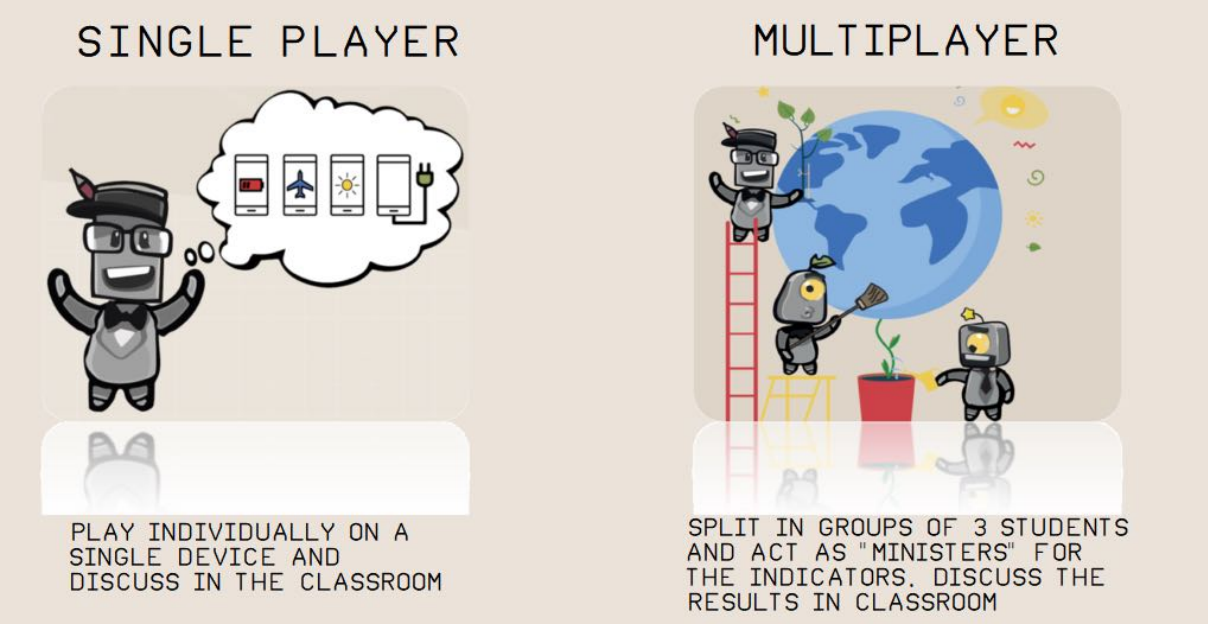
The game-over displays both the PPM (parts per million) of carbon dioxide deviation from the intermediate scenario of greenhouse gas emissions established by the IPCC (RCP4.5), as well as the number of survival

game turns. These elements stimulate thinking about climate change and motivate the player to do better next time. Thanks to the hazards introduced by the extreme events and cards, every game is different.

ClimarisQ is a game and an educational tool that helps to understand:

1. The urgency of collective action to limit the adverse effects of climate change (the importance of limiting greenhouse gas emissions),
2. the multiplicity of interacting climate components as well as the nonlinearities of the processes underlying climate dynamics (delayed effects, amplification, rebound effects),
3. the problems of predicting and projecting extreme weather events (unpredictable locations and timing but predictable frequencies).

The concept, questions asked and difficulty of ClimarisQ are tailored to the high school level and curriculum. The game, which has already been successfully tested by high school classes, stimulates debate about the choices to be made in the face of climate change. We propose two modalities for playing ClimarisQ in schools: “single-player” and “multi-player”.



The primary objective of ClimarisQ is to empower students to comprehend the intricate dynamics of climate science through hands-on exploration and interactive gameplay. By integrating this game into their teaching curriculum, teachers can supplement traditional classroom lessons with a dynamic and visually stimulating platform that enhances the students' understanding of climate systems.

The game's immersive gameplay and compelling visual storytelling enable students to embark on an exciting journey, where they encounter various climate scenarios and witness the consequences of their choices and actions. Through this experiential learning process, students gain invaluable insights into the interconnectedness of environmental factors and the far-reaching impact of human decisions on climate change.

ClimarisQ encourages students to think critically and strategically as they navigate through decision-making processes related to climate policies, energy choices, and environmental conservation. By actively participating in the game, students develop problem-solving skills and learn to consider the long-term implications of their choices, fostering a sense of responsibility towards the planet.

One of the key benefits of ClimarisQ is its ability to serve as a catalyst for classroom discussions on pressing climate-related topics. Teachers can leverage the game's user-friendly interface and intuitive gameplay to initiate meaningful conversations that encourage students to explore and analyze real-world climate challenges. This not only enriches their understanding of climate science but also nurtures their ability to think critically and engage in informed discussions.

ClimarisQ accommodates students with varying skill levels and learning styles, making it accessible to a wide range of secondary school students. Its engaging gameplay and captivating visuals captivate students' attention, making complex concepts more accessible and relatable. Moreover, the game provides teachers with a valuable opportunity to harness students' natural inclination towards technology and gamified learning to effectively convey scientific principles.

By incorporating ClimarisQ into their teaching repertoire, teachers can inspire their students to become environmentally conscious citizens equipped with a solid foundation in climate science. This game serves as a bridge between theoretical knowledge and practical application, empowering students to make informed decisions and take meaningful action to address the challenges of climate change.

In summary, ClimarisQ is a cutting-edge educational game that immerses secondary school students in the fascinating world of climate science. It not only facilitates their comprehension of complex climate systems but also fosters critical thinking, problem-solving, and responsible decision-making. By utilizing ClimarisQ as an integral part of their teaching approach, teachers can effectively engage and educate the next generation of climate-aware individuals, equipping them with the tools to shape a sustainable future.

Sabrina Speich

Full Professor of Physical Oceanography and Climate Sciences

Ecole Normale Supérieure – Department of Geosciences

Laboratoire de Météorologie Dynamique & IPSL

24 rue Lhomond, 75231 Paris Cedex 05 – France

sabrina.speich@ens.fr

www.lmd.ens.fr/speech

EDUCATION

2008: "Diplôme d'Habilitation à diriger des Recherches" (HDR, equivalent to the D. Sc. in the United Kingdom, to the "Libera docenza" in Italy, to the German "Habilitation") in Physical Oceanography and Climate Sciences, Université de Bretagne Occidentale, Brest, France;
1992: Ph.D. in Physical Oceanography, Université Pierre et Marie Curie, Paris;
1989: Laurea in Physics, Università degli Studi, Trieste, Italy.

CAREER

Since 2017: Associated Professor, SciencesPo, Paris, France;
Since 2013: Full Professor (PR EX2), Department of Geosciences at the ENS & LMD-IPSL UMR 8539, Paris, France;
2009-2013: Full Professor, Department of Physics at the "Université de Bretagne Occidentale", & LPO, Brest, France;
1995-2009: Assistant Professor, Department of Physics at the "Université de Bretagne Occidentale", Brest, France;
1994-1995: Research associate, LOCEAN, CNRS, Paris, France;
1992-1994: Postdoctoral researcher, Department of Atmospheric Sciences, UCLA, CA, USA.

RESEARCH INTERESTS

I am a physical oceanographer with three decades of experience in modelling and conceiving large international observing projects to better assess ocean and climate processes and monitor changes. The approach I favoured during the last 15 years is to promote interdisciplinary studies to understand the ocean nonlinear dynamics and its impact on biogeochemistry, marine biome and ecosystems and the atmosphere. I am also working together with the international community (within projects and organisations) to improve the ocean observing strategy and capacity. Indeed, the ocean is the key to the future of humanity challenged by a rapidly changing climate.

AWARDS AND HONORS (SELECT)

2023: Elected Member of the European Academy of Science
2019: Awarded the Albert Defant Medal by the German Meteorological Society (DMG: https://www.dmg-ev.de/aktivitaeten/auszeichnungen/albert-defant-medaille/)

Since 2002: Recipient of the National PhD Research Supervision bonus

PUBLICATIONS

I have published more than 100 publications on international journals, have been invited to over 40 conferences as a keynote speaker, and I have led several national and international research projects.
Among them there are multidisciplinary contributions to Nature and Science. My publication record showcases my scientific interdisciplinary approach. My current h-index is: 42 (Web of Science), 44 (Scopus), 45 (Semantic Scholar), 52 (Google Scholar).

INVESTIGATING TWO MAJOR UNKNOWNS IN THE CLIMATE EQUATION

Sabrina Speich
Laboratoire de Météorogie Dynamique
École Normale Supérieure, Paris

For the last forty-five years (since the Charney Report of the US National Academy of Sciences in 1979), climatologists have been grappling with a key parameter on which the extent of future global warming depends: the sensitivity of the climate system to CO_2 increase in the atmosphere. However, they now know that the way in which the ocean and the clouds react to global warming lies at the heart of the problem.

In an attempt to get a clearer picture, international groups of scientists are now focusing on accurately measuring and understanding the ocean heat and carbon uptake as well as the physical processes governing clouds formation and evolution. For example, tropical cumulus clouds, despite their limited size, are widespread in the tropics, a slight change in their properties might affect climate significantly. Will the coverage of these clouds, which have cooling properties, increase or decrease with global warming? Depending on the answer, warming would be either diminished or enhanced. In addition, the spatial organisation of these clouds can take on various patterns (see images). What controls these different arrangements? Do they play a role in the cooling properties of the clouds? Are they affected by global warming?

Recent warming caused by greenhouse gas emissions from human activities is affecting more than just the lower layers of the atmosphere and continental surfaces. In particular, the ocean is absorbing, storing and transporting absorbed heat, raising ocean temperatures into the depths and impacting ocean currents. Oceanographers have been collecting observations of the ocean for decades, and have shown that the ocean's capacity to store the excess heat generated by human activities (90% of the heat surplus) is far more efficient than the continents (6%), ice (3%) or the atmosphere (1%). Thus, it has a moderating effect on climate and climate change.

However, the ocean's absorption of almost all the excess heat generated by human activities does not stop at passive ocean warming, but plays a multifaceted role in the Earth system. This includes the intensification of the hydrological cycle. Changes in temperature and the hydrological cycle also modify ocean density and currents. It also affects the melting of sea ice and ice caps. It is also leading to an intensification of extreme events in the ocean and atmosphere that were previously rare. These include marine heatwaves, which are increasingly affecting ocean regions and marine ecosystems. The effects of heat stress include massive mortality of benthic communities, including coral bleaching, changes in phytoplankton blooms, adverse effects on algal and seagrass forests, toxic algal blooms, changes in species composition and geographic distribution, and declines in fish and seabird populations.

Finally, the combined effect of each of these impacts, particularly following extreme events, places greater stress on the environment than their individual effects, leading to additional stresses on marine ecosystems. For example, it is predicted that the maximum catch potential of tropical fish stocks in certain tropical exclusive economic zones will decline by up to 40% by the 2050s unless we reduce our greenhouse gas emissions. Ocean warming also intensifies tropical cyclones and storms. Other processes at the air-sea interface affected by ocean warming cause the precipitation associated with these events. The increase in ocean heat also has an impact on the thickness of pack ice, which is thinning, as well as that of the part of the ice caps immersed in the ocean.

The ocean, through its chemical interaction with the atmosphere and the action of its currents, also absorbs around 1/3 of the excess carbon dioxide generated by human activities, acting, once again, as an important element in mitigating climate change. However, the warming of ocean waters reduces the effectiveness of the mechanism for absorbing and storing surplus carbon dioxide.

In order to better understand the physics of the cumulus clouds, the ways in which they form and the factors that affect their properties, as well as ocean heat and carbon dioxide uptake, a vast ocean-atmosphere field campaign (EUREC^{4}A/ATOMIC) has been organised in the tropical Atlantic Ocean in Jan.-Feb. 2020. More than 40 partner institutions were involved, and four aircraft and four research vessels were deployed, combined with multiple ground, drone and space-based remote sensing observation systems.

The measurements allowed intensive observations of clouds, aerosols and the physical and biogeochemical properties of the ocean. They have been achieved through the continuous use of four richly instrumented research aircraft and four research vessels, a permanent observatory installed on the island of Barbados, and a large number of autonomous or semi-autonomous observing platforms in the atmosphere, in the ocean and at the surface, often used for the first time. In addition to collecting new observations as part of a unified, coordinated campaign, EUREC4A/ATOMIC has set up awareness-raising, training and knowledge-exchange activities.

Caribbean scientists and their counterparts in Europe and North America will, thus, be able to better understand the processes modulating global warming and the resulting climate changes on a regional scale. EUREC4A/ATOMIC has been the largest international measurement campaign to study the coupled role of clouds and the ocean in the climate system.

Ana Sofia P. S. Reboleira

Departamento de Biologia Animal

Faculdade de Ciências da Universidade de Lisboa

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Email: asreboleira@fc.ul.pt

EDUCATION

PhD in Biology, University of Aveiro (UA), Portugal (2012)

MSc in Ecology, Biodiversity and Ecosystem Management. UA, Portugal (2007)

Biology Degree, UA, Portugal (2006)

CAREER

Assistant Professor, Faculty of Sciences, University of Lisbon (2020-present)

Associate Professor, Faculty of Sciences, University of Copenhagen, Denmark (2017-2020)

Visiting Associate Professor at the Macquarie University, Sydney, Australia (2018)

Invited Visitor at Harvard University (2016)

RESEARCH INTERESTS

Biology

Subterranean Ecology

Biological Conservation

Entomology

PUBLICATIONS AND SERVICES

> 80 international peer-reviewed indexed publications; 4 books (2 edited). > 3500 citations on Google Scholar.

AWARDS AND HONORS

2023 Belmiro de Azevedo-FCT Prize, Portugal

2017 Young Investigator 2017. Villum Fonden, Denmark

2016 Research profile highlight at Science, doi: 10.1126/science.aaf5806

2011 Merit medal of the town Caldas da Rainha (hometown), Portugal

2008 Scientific-speleological Merit Award, Portuguese Federation of Speleology

SUBTERRANEAN ECOSYSTEMS

MACROECOLOGICAL AND CONSERVATION PERSPECTIVE

Ana Sofia P. S. Reboleira

Universidade de Lisboa, Portugal

Due to difficult accessibility, subterranean ecosystems – where light does not penetrate – are rich in endemic biodiversity with different morpho-physiological adaptations and constitute one of the most poorly known and unprotected natural resources of our planet.

The infiltration of contaminants to the subterranean ecosystems is fast, making them excessively vulnerable to impacts of pollution. Despite worldwide recognition of the importance of subterranean ecosystems as the most important sources of freshwater for human consumption and recognized as critically endangered, initiatives like the EU Water Framework Directive or the Groundwater Directive stress the need to achieve a good physicochemical status of groundwater, neglecting its endemic biodiversity.

Animal species richness below the ground plays a key role in regulating the whole suite of ecosystem functions directly related to groundwater dependent ecosystems, as springs and rivers. A complete evaluation of the condition of subterranean ecosystems should consider not only abiotic parameters but also their biological components. Furthermore, the fact that terrestrial subterranean ecosystems are intimately linked with the groundwater cycle is also neglected and scientific information concerning the effect of pollution in these ecosystems is needed for their protection.

We have generated a framework for future ecological assessment of subterranean ecosystems, ensuring its sustainability. As far as the subterranean species may be more sensitive to chemical pollutants and climate change than surface species, ecological quality criteria based on responses of surface organisms are clearly insufficient to protect subterranean ecosystems. The inclusion of the subterranean compartment in holistic biodiversity assessments is also a requirement for future nature conservation.

Key-words: biodiversity, karst, groundwater, conservation, risk assessment

JULIA PONGRATZ

Professor of Physical Geography and Land Use Systems, Department of Geography, Ludwig-Maximilians-Universität in Munich

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webpage: http://www.geographie.uni-muenchen.de/department/personen/pongratz-julia.php

EDUCATION

- Dr. rer.nat. in Geosciences, 2009, University of Hamburg
- Diplom Physical Geography, 2005, LMU München

CAREER

- Director of the Department of Geography, LMU Munich (since 2020)
- Professor of Physical Geography and Land Use Systems (W3), LMU Munich (since 2018)
- Lead of the Emmy Noether independent junior research group "Forest management in the Earth system", funded by the German Research Foundation, MPI-Meteorology (2013-2020)
- Klaus-Hasselmann-Fellow, MPI-Meteorology, Hamburg (2012-2013)
- PostDoc, Carnegie Institution, Department of Global Ecology, Stanford, CA, USA (2009-2012)
- PhD researcher, MPI-Meteorology (2006-2009)

RESEARCH INTERESTS

My work integrates Earth system and vegetation modelling with observations to assess the interactions between land-use change and climate as well as natural vegetation dynamics. Aims are both fundamental understanding of land-atmosphere exchange as well as finding sustainable paths to climate neutrality.

PUBLICATIONS AND SERVICES

- More than 100 articles published in peer-reviewed journals/reports with more than 25,000 citations
- Editor: Board of Reviewing Editors of *Science* (ongoing); previously editorial jobs with *Biogeosciences, Climatic Change, Anthropocene Review*
- Member of scientific steering groups: Global Carbon Project, AIMES, CMIP6's LUMIP & C4MIP, German
- Alliance for Global Health Research

AWARDS AND HONORS

- 2020, 2022 & 2023 Award for Teaching Innovations of the LMU Munich
- 2019 Elected as member of the Ecology Forum of the Bavarian Academy of Sciences
- 2014-2018 Elected member of the Junge Akademie (Young Academy) of the Berlin-Brandenburgische Akademie der Wissenschaften / Leopoldina - National Academy of Sciences
- 2011 AGU Editor's Citation for Excellence in Refereeing
- 2010 Wladimir Peter Köppen Award of the KlimaCampus, University of Hamburg
- 2009 Otto Hahn Medal of the Max Planck Society
- 2008 Young Scientists' Outstanding Poster Paper Award of the EGU
- 2003-2004 Grant from the German-American Fulbright Program
- 2001-2004 Scholarship "Studienstiftung des deutschen Volkes"

MANAGING CLIMATE BY MANAGING LAND

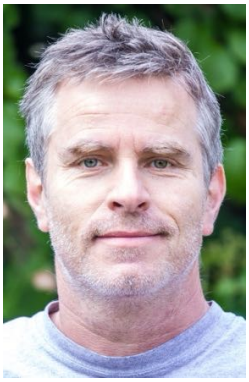
Julia Pongratz

Ludwig-Maximilian-University Munich, Germany

Three quarters of ice-free land surface is managed for human use — cleared for agriculture, grazed on, or used for forestry. While history saw the services of land management foremost in providing living space, food and fibre, we have come to understand that our land use activities have an enormous effect on the evolution of climate. After 10,000 years of unintended influence on climate, we now turn towards relying on land management to provide substantial contributions to emissions reductions and carbon dioxide removal to reach our goals of climate neutrality.

This talk will review how land management influences climate not just via carbon dioxide emissions and uptake, but also via changes in energy exchange, water fluxes and other so-called biogeophysical effects. Depending on the type of land use change and where it takes place, the effect may be a warming or a cooling contribution to overall global climate. But local climate and climate of near-by regions may be altered by land management, influencing local living conditions and constituting thus a potential tool to counteract and adapt to future global warming. While annual average temperature, for example, may be decreased by several degrees through a change from agriculture to forest in some regions, heat extremes may be dampened even more. Although forests are often darker than cropland or grassland and thus absorb more sunlight, their generally deep roots and high leaf area transpire water and cool the surface, and their higher surface roughness leads to vertical exchange of air masses in the atmosphere, dampening weather extremes.

Whether land use change has a warming or cooling contribution to global climate change is crucially important, in particular as land use choices such as afforestation, carbon-negative forest management, bioenergy with carbon capture and storage, agroforestry and other options will likely play a prominent role in preventing the global climate from surpassing the 2-degree target of warming. Currently, carbon dioxide removal happens almost exclusively in the land-use sector and plays an important role in future scenarios limiting warming in line with the Paris Agreement's goals, as residual emissions will have to be compensated for by carbon dioxide removal to reach greenhouse gas neutrality. This talk will highlight risks and opportunities beyond the climate perspective, including competition for land and other resources, and ways how to design a socially acceptable and ecologically as well as economically sensible mix of carbon dioxide removal methods.



Koen De Ridder

PhD

Senior Researcher

Environmental Modelling / Climate Impacts (CLIM)

VITO – Flemish Institute for Technological Research

Mol, Flanders, Belgium

EDUCATION

Koen De Ridder obtained an MSc in Physics at the University of Antwerp (1988), after which he briefly (1988-1989) became a secondary school teacher of physics and mathematics. Subsequently, he worked as a logistician in Africa and Asia with a humanitarian organisation (1989-1992), where he developed an interest in working with developing countries.

After this intermezzo, he embarked on a PhD research project at the University of Louvain-la-Neuve on the topic of 'Impact of the land surface on regional drought in semi-arid zones', mainly based on theoretical and numerical modelling approaches concerning the land surface-atmosphere exchange of energy and water. After obtaining the PhD degree in 1997, he briefly worked at the Royal Meteorological Institute of Belgium, in late 1997 getting a position as a research associate at the Flemish Institute for Technological Research (VITO), where he is still active today.

RESEARCH INTERESTS

While initially conducting research and policy studies on air quality modelling, his research interests gradually turned towards the numerical modelling of urban climate and the urban heat island phenomenon, culminating in the development of a new urban climate model (UrbClim, see De Ridder et al., 2015). In the past years, this model has been applied to hundreds of cities worldwide, among other within the Copernicus Climate Change Service, where it has been used to generate urban climate fields for 100 European cities.

At the same time, together with colleagues, Koen developed an interest in urban climate monitoring, largely motivated by the lack of climate stations in cities. Initially focusing on pro-grade climate stations, his attention shifted towards the deployment of cheaper measurement devices for use in community-based monitoring campaigns in recent years.

In the past years, Koen's focus has turned towards applying urban climate modelling and monitoring expertise to Africa, conducting projects together with African researchers, local authorities, and citizen organisations. Recent studies and projects were conducted in Johannesburg (South Africa, see Souverijns et al., 2022) and Niamey (Niger).

PUBLICATIONS

Koen De Ridder has (co-)authored more than 70 research articles in scientific journals and a number of policy reports, including 'Evaluation of the socio-economic impact of climate change in Belgium' (2020). He has initiated and coordinated tens of international climate projects and is a former lecturer in Atmospheric and Climate Science at the universities of Leuven and Ghent in Belgium.

De Ridder, K., D. Lauwaet, B. Maiheu, 2015. UrbClim – a fast urban boundary layer climate model. Urban Climate, 12, 21-48. https://doi.org/10.1016/j.uclim.2015.01.001

Souverijns, N., K. De Ridder, N. Veldeman, F. Lefebre, F. Kusambiza-Kiingi, W. Memela, N. Jones, 2022. Urban heat in Johannesburg & Ekurhuleni, S. Africa: A m-scale assessment and vulnerability analysis. Urban Climate, 46, 101331. https://doi.org/10.1016/j.uclim.2022.101331.

URBAN CLIMATE RESEARCH AS A SUPPORT TO RESILIENT CITY PLANNING

Koen De Ridder

VITO – Flemish Institute for Technological Research, Belgium

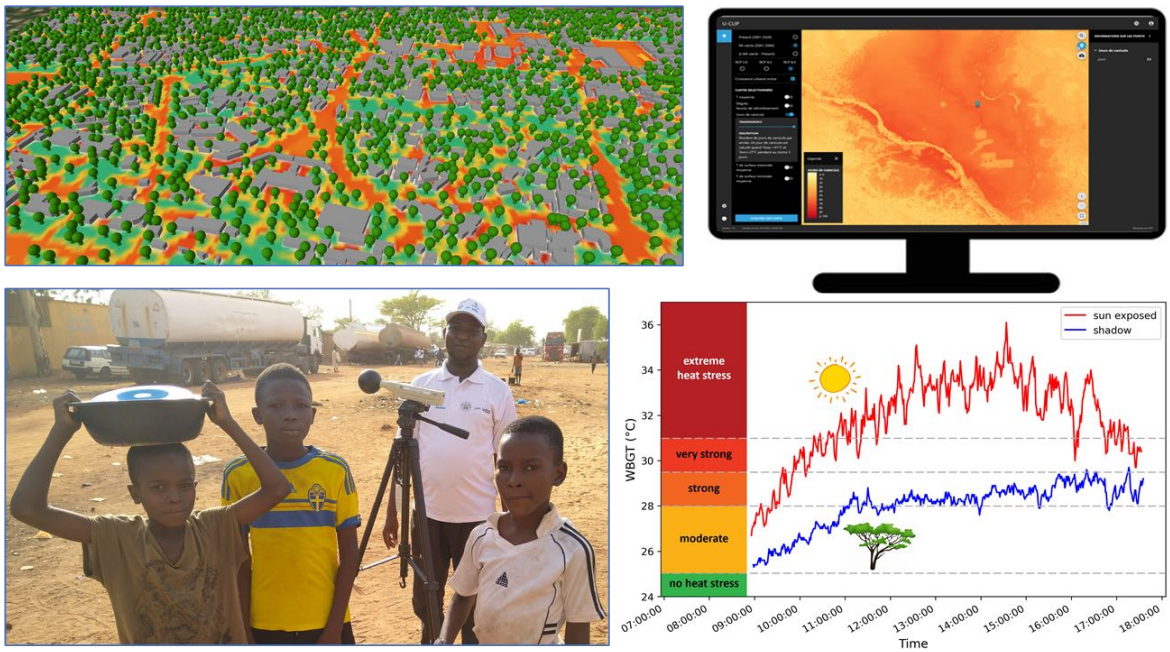
The combined effects of global climate change and the urban heat island (UHI) phenomenon are expected to lead to an increased occurrence of excessive heat in cities, with adverse impacts on human health, labour productivity, infrastructure, and energy consumption, among others.

This presentation focuses on urban heat risk assessment under present and future climate conditions, the way this affects human thermal comfort, and potential measures to combat excessive urban heat. It will delve into experience gathered by VITO's Climate Impacts (CLIM) team over the past twenty years in the domains of urban climate modelling & monitoring, demonstrating how research results feed into urban resilience policy and planning.

First, a quick overview is given of the UHI effect and its causes, among other using measurements conducted by VITO in and near cities. Subsequently, we describe the numerical models developed and applied at VITO to simulate urban climate at scales ranging from an entire urban agglomeration to the level of an individual tree.

Most of the presentation will focus on presenting research results, including

- simulation and analysis of urban climate for 100 European cities within the EU Copernicus Climate Change Service;
- urban heat assessment in Johannesburg (South Africa) to support heat mitigation strategies, see an article by Souverijns et al. (2002) and a project video;
- development of an urban climate information platform and assessment of the microclimatic impact of an urban climate forest in Niamey (Niger) (see figure below).



Illustrations from an urban climate project in Niamey (Niger). Top left: microclimate simulation for a city quarter in Niamey, the colours indicating levels of heat stress (legend in bottom right figure), revealing the local cooling effect of urban trees. Top right: still from an urban climate dashboard for Niamey, showing the number of heatwave days in 2050 under a high climate scenario. Bottom left: community-based monitoring campaign involving heat stress data loggers and young volunteers. Bottom right: measured heat stress under a tree as compared to a nearby exposed location.

POSTER SESSION EOS 5.2 “Teaching Climate Change at School”
Chairpersons: Annegret Schwarz, Stephen Macko, Gina P. Correia, Jean Luc Berenguer
The hyperlink gives detailed information about each abstract and the email address of its author(s)
X1.87
EGU24-2186
Erasmus+ and eTwinning projects in developing school students' specific skills related to climate change
Stefana Opria
X1.88
EGU24-2253
Aware of Climate Change
Ruzhica Jagurinoska
X1.89
EGU24-2803
My plan - responsibility and action for a green future!
Marcu Hajnal and Branzei Daniela
X1.90
EGU24-2935
Eco-STEAM Challenge Green Hotel
Danilo Borovnica and Miroslav Grujic
X1.91
EGU24-2936
Gaming the Water Cycle: a student-led activity to explore climate change.
Kendall Blue
X1.92
EGU24-3094
Green School Project
Lara García
X1.93
EGU24-3179
First edition of an “Ocean Readings Prize, a better knowledge for a better preservation”.
Helene Spilmont, Sophie Van Ommeslaeghe, Nathalie Jarnier, Katy Masset, and Aline Klawinski
X1.94
EGU24-3220

Teacher on board the deep sea vessel Pourquoi pas ? for SUPER MOUV campaign off the coast of Ecuador
Faustine Gendron
X1.95
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Hands-On Climate: Engaging the Public with 3D Geo-Data
Annamaria Lisotti
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EGU24-3256
Using digital technology to teach climate science
Lydia Ait Ouferoukh
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ECOding: Putting climate solutions at the heart of tech education
Selcuk Yusuf Arslan
X1.98
EGU24-3374
Hot spot in the schoolyard
Isabelle Veltz and Virginie Bour
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EGU24-3396
Struggling with climate changes
Karolina Damjanoska
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Climate change and Cosmography
Athanasios Vagenas
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EGU24-3871
Exploring the Complexity of Climate Change with an Interactive and Collaborative Learning Tool: The "Climate Fresk"
Michel Widmann
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Miedwie Lake as a source of life. Implementing SDGs in STEM lessons.

Ryszard Markowicz
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EGU24-4043
Solar energy, the types of energy that arise from it, and how we can use this energy while preserving the environment from pollution and preserving the natural ecosystem.
Lorena Kaçi
X1.104
EGU24-4148
From plots to theory: young students build their good practice on climate changes
Mauro Martelli
X1.105
EGU24-4396
The Role of Interdisciplinary PBL Activities: Climate of the Past
Nuno Correia, Vanessa Neves, and Alexandre Gandra
X1.106
EGU24-4421
The Greenhouses Affect
Gülperi Selcan Öncü
X1.107
EGU24-4432
Teaching Climate Change: using Earth Learning Ideas
Pete Loader, Giulia Realdon, Guillaume Coupechoux, Xavier Juan, and Gina P. Correia
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EGU24-4440
HIPER motivated students follow the SUPER-MOUV sea campaign
Jean Luc Berenguer, Faustine Gendron, Christelle Saliby, and Julien Balestra
X1.109
EGU24-4443
Insight Education : When highs chool students and teachers are involved in the science team.
Jean Luc Berenguer, Christelle Saliby, and Julien Balestra
X1.110
EGU24-4448
Take a photo, post it, alert it!
Mite Ristov

X1.111
EGU24-4452
GIS for Gist of Europe
Crina Aurelia Elefteriu
X1.112
EGU24-4568
Augmented Reality Supported Renewable Energy Game
Gülsüm Yasemin Uz
X1.113
EGU24-4603
"The changing climate of Our Planet"
Fatbardha Sulaj
X1.114
EGU24-4698
Microplastic Pollution Projects and Participatory Science
Agnès Pointu
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EGU24-4721
Teaching evolution for sustainability in the era of climate change: the Socio-Scientific Issues (SSI) approach
Giulia Realdon, Patricia Pessoa, and Xana Sá-Pinto
X1.116
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Climate change and sustainability resources: making materials from biomass
Maria Zambrotta
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Reducing our school's carbon footprint through composting the canteen food waste
Marta Molinos Solsona
X1.118
EGU24-4750
“Climate crisis and its impact: New ways to awaken curiosity and hope in the classroom environment”
Camilla Bredberg

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EGU24-4753
Critical thinking in high school science education: a focus on Fake News and Climate Change.
Etienne Dubreu
X1.120
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Simulating and Studying Greenhouse Effect in your classroom with Arduino UNO
Konstantinos Louvaris and Antonia - Zoi Mammi
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EGU24-6095
"Mathematics, Seismology and STEAM Education: The Strategic Alliance in Combating Climate Change"
Simona Gavrila
X1.122
EGU24-6146
CLIMAte change teachers' acaDEMY (CLIMADEMY)
Emmanouil Kartsonakis
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EGU24-6609
NASA GPM Mentorship Program - Educator Track
Lisa Milani, Raffaella Barozzi, Michele Bononi, Ennio Cantoresi, Giulia Ciantra, Pancrazio di Angelo, Andrea Davì, Laura Insogna, Sara Milan, Anita Paganelli, Tania Patrizio, Ilaria Piccioni, Elisabetta Ricci, Luca Samiolo, Carla Ventura, Michela Zanella, Andrea Portier, Vasco Mantas, and Dorian Janney
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World climate simulation
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Eco-Enigma Expedition Escape Room - The soils and climate change.
Elsa Salzedas and Kelly O'Hara
X1.126
EGU24-6739
Erasmus+ project and Geoparks for dissemination of Geology
Ana Rosa Aragón

X1.127
EGU24-7367
Teaching Climate change at school: increasing sustainable minded students and communities.
Elena Porazzi, Antonio Maiolino, Maria Martorana, and Paola Marra
X1.128
EGU24-7797
Revitalizing Earth Science Education in Italian Upper Secondary Schools: Crafting New Educational Materials Aligned with National Guidelines
Teresita Gravina and Alessandro Iannace
X1.129
EGU24-9077
Integrating Scientific Insight and Practical Expertise: A High School Initiative on Climate Change
Andrea De Pace, Giuliana Da Pra, Rosa Rusci, Morena Perron, Raffaella Navarretta, and Melinda Siciliano
X1.130
EGU24-9584
Unveiling the Biosphere: A Comprehensive Overview of GLOBE Program Protocols
Natalija Aceska
X1.131
EGU24-9953
Lesson Proposal for Climate Change in geography: Utilization of "Mystery" as a Learning Method
Hiromi Yamauchi
X1.132
EGU24-10910
School life as an ecological background for principled citizenship
Edgar Fernandes and Maria João Rebola
X1.133
EGU24-11644
The Importance of “Hands-On” Training for Basic and Secondary Level Science Teachers.
Francisco Fatela, Teresa Drago, Tanya Silveira, M. Conceição Freitas, Rui Taborda, João Cascalho, Jacqueline Santos, and Marcos Rosa
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EGU24-11736
If there is a problem, we are the solution
Seyran Esen

X1.135
EGU24-11909
An educational strategy to Climate Change integrating three interconnected Perspectives
Carole Larose, Gérard Vidal, Eric Le Jan, and Charles-Henri Eyraud
X1.136
EGU24-11943
InsegnaciETNA 2023
Carole Larose and Jean-Luc Berenguer
X1.137
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Understanding Climate change within a sustainable school in Community of Madrid (Spain)
Isabel Lopez Perez, Laura Garcia Sevilla, Ana Martinez García, David Martinez Serrano, and Mariano Leon Colmenarejo
X1.138
EGU24-12559
A geoday in our town
Mª Inmaculada Benito
X1.139
EGU24-12636
Sustainable development training and outcomes (poster only session)
Burcu Özdemir
X1.140
EGU24-13038
ClimActiC Project
Carla Freitas, Marco Silva, Eugénia Martins, and Ana Carvalho
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EGU24-13071
Lithium: a problem or a contribution to reducing climate change?
Sofia Marques and José Belo
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EGU24-13105
Raising awareness of global climate change through a school eco-team
Roman Veselsky
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The challenges of teaching climate change within the school science curriculum
Sally Parry
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Exploring climate change: A graphical journey through time
Olaia Iglesias
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EGU24-13203
Fostering Sustainable Habits: A Classroom Initiative on Reducing Carbon Footprint by Decreasing Plastic and Increasing Seeds
Aysel Gökce
X1.146
EGU24-13234
What future for our beaches?
Carla Crisostomo and Ana Nunes
X1.147
EGU24-13443
Do you hear the noise pollution?
Natalija Budinski
X1.148
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The Green Curriculum To Fight Against Climate Change
Hayriye Olğun
X1.149
EGU24-14665
Creating School Seismology Labs For the Development of Students'
Cristina Simionescu
X1.150
EGU24-15679
Collect and analyze data to make informed choices
Elena Rizzi
X1.151
EGU24-17091

GEO-Academy: GEO-Hub for Teachers in Europe

Henry Boeree, Annalisa Donati, Alkyoni Baglatzi, Afroditi Riga, Gustavo A. Rojas, Nikolaus Albrecht, Seda Özdemir-Fritz, Gina P. Correia, Loukas Katikas, Angelos Lazoudis, Alexandra Moshou, Marinos Kavouras, and Maria Bezerianou

X1.152

EGU24-17945

Education for sustainable development within the geography curriculum

Laura Cristea

X1.153

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Climademy: The Erasmus+ Climate Change Teachers' Academy

Maria Kanakidou, Nikos Kalivitis, Olivia Levrini, Giulia Tasquier, Laura Riuttanen, Mihalis Vrekoussis, Thalia Tsaknia, Athina Ginoudi, Giorgia Bellentani, Dimitris Stavrou, Emily Michailidi, Marius Dan, Jari Lavonen, Katja Lauri, Taina Ruuskanen, Annette Ladstätter-Weißenmayer, Emmanouil Zouraris, Simon Bittner, and Ioannis Pavlidis

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SpaceEDUnity: Introducing natural hazards to younger generations utilizing advanced technologies

Eleftherios Theodoropoulos, Stavroula Sigourou, Foteini Salta, Eleni Loulli, Marianna Hadjichristodoulou, Christiana Papoutsa, and Charalampos (Haris) Kontoes

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Aeolus Satellite: A Breath of Fresh Air for Climate Change Education

Panagiota Asimakopoulou, Ioanna Tsikoudi, Maria Tsichla, Panagiotis Nastos, Clara Cruz Niggebrugge, Maurane Gisiger, Thorsten Fehr, and Tommaso Parrinello

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Claretta Christille, Marie Claire Courthod, and Susanna Occhipinti