NAVARINO
ENVIRONMENTAL
OBSERVATORY

ANNUAL REPORT

2013

Stockholm University
www.su.se

ACADEMY OF ATHENS
BRFAA
www.bioacademy.gr

TEMES
DEVELOPERS OF COSTA NAVARINO
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Foreword

1. Introduction

Navarino Environmental Observatory (NEO), a cooperation between Stockholm University, the Academy of Athens and TEMES S.A., is dedicated to research and education on the climate and environment of the Mediterranean region. Located at Costa Navarino, Messinia, Greece, NEO is a dynamic hub where scientists from all over the world conduct frontline research, develop new tools and methods, as well as meet to exchange knowledge and ideas.

The Mediterranean area faces considerable environmental and climate challenges in coming decades. In addition to the long-standing problems of marine, atmospheric and terrestrial pollution, the ongoing climate change is predicted to lead to significant changes in this part of the world. Particularly the Ionian and Aegean Seas have been described as the crossroads of transboundary transport of air pollutants and atmospheric aerosols, which play an important role on the radiation balance of the region and therefore influence climate change. The ongoing climate change is predicted to lead to higher summer temperatures and an increase in drought events as well as in the frequency of forest wild fires. All this will significantly affect the environment and human societies.

The research taking place at NEO is orientated towards these future challenges. Multi-disciplinary research is conducted within relevant research fields, such as: i) atmospheric composition and climate changes, ii) geology, geomorphology and landscape changes, and iii) climate, water and environmental changes. The atmospheric composition and meteorological parameters are continuously monitored in order to track the origin of pollutants and detect climate change signals. Global and regional scale modelling is applied for climate projections and future pollution level simulations. Hydrological research, monitoring and evaluation are undertaken in order to understand past, present and future processes and to develop suitable water resource management strategies for the region. Tectonic, climate, environment and landscape studies are carried out in a long-term perspective, to understand the physical science basis of our earth. Specific further goals are to understand the role of natural versus human induced climate/environmental changes and to analyse the role of physical factors in the context of tourism and urbanism. All monitoring activities are linked to international networks.

In addition to the research taking place at NEO, emphasis is given to the education and training of students and y researchers. For this reason special courses and excursions are made in the field, training workshops are organized, and postgraduate and PhD students are involved in NEO research activities.

2. Partners

TEMES SA

TEMES S.A. (Tourist Enterprise of Messinia) is a premier developer of luxury mixed-use resorts in the Mediterranean region. Costa Navarino in Messinia is its flagship development. At the heart of the company's business philosophy is its strong commitment to environmental and social responsibility with the aim of achieving sustainable tourism development in complete harmony with the natural environment and traditions of the destination.

More information: www.costanavarino.com

Academy of Athens

The Centre of Environmental Health and Biophysics of the Biomedical Research Foundation of the Academy of Athens has been involved in pioneering research on ozone, chemistry-radiation interactions and global change during the past decades. The Biomedical Research Foundation is a non-profit institution, established by the Academy of Athens, which traces its name to the 3rd century BC Plato's Academy; it therefore brings the heritage of the first Academy on Earth. The Centre has participated in all WMO/UNEP Ozone Assessments and in numerous competitive international research projects and campaigns.

More information: www.academyofathens.gr

Stockholm University with the Bolin Centre for Climate research

Stockholm University, located in the capital of Sweden, is a major northern European university and carries out research and education within the natural and social sciences, the humanities and law. Stockholm University is one of the largest universities in Sweden and one of the largest employers in the capital.

The Bolin Centre for Climate research at Stockholm University is a pioneering institute within the field of climate and environmental research. The late Bert Bolin, professor at Stockholm University, was the leading force behind the establishment of the UN Intergovernmental Panel on Climate Change (IPCC), which was awarded the Nobel Peace Prize in 2007. The centre carries on Bolin's heritage by conducting fundamental research on critical processes in the climate system.

More information: www.su.se , www.bbcc.su.se

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3. Research

3.1 Atmospheric composition and climate changes

Research description

The main objective of the atmospheric and climate research programme of NEO is to study atmospheric composition in the area of western Peloponnese with focus on air quality, atmospheric radiation perturbations and links to the origin of air masses and meteorology. Using the observations at Methoni station the aim is to identify important sources of atmospheric aerosol and trace gases influencing regional air quality and climate in the Eastern Mediterranean. The results provide important data set to be used in regional and global climate models and in validation of satellite-based remote sensing observations.

Research activities 2013

The activities during 2013 have focused on running the continuous observations and evaluating the results obtained so far. The atmospheric observations were moved from the Library Tower at Navarino Dunes to the station of the Hellenic National Meteorological Service (HNMS) at Methoni, ca 30 km south of Navarino Dunes. The main reason was to link closer the NEO atmospheric research with broad network of the HNMS and use the unique facility available at Methoni. The preparatory works, the placement of a new container and the transport of instrumentation took place in late September. All equipment was dismantled from Costa Navarino and was set up in the new station where observations started in October 2013.

Figure 1: NEO Atmospheric Lab at Methoni HNMS premises.

A study on visibility records at Methoni, covering last 6 decades, was initiated to examine how visibility trends and variability can be used as a proxy for changes related to the local/regional air pollution influence and to varying climatic parameters.

A number of meteorological parameters as well as aerosol data from different satellite and modeling platforms were analyzed. Preliminary analysis show high reduction visibility rates from mid 50s to late 70s caused by an abrupt increase in atmospheric humidity, followed by a stabilization since around 2000, and an increase in visibility after 2008 attributed to the economic crisis and the subsequent reduction in anthropogenic activities/emissions.

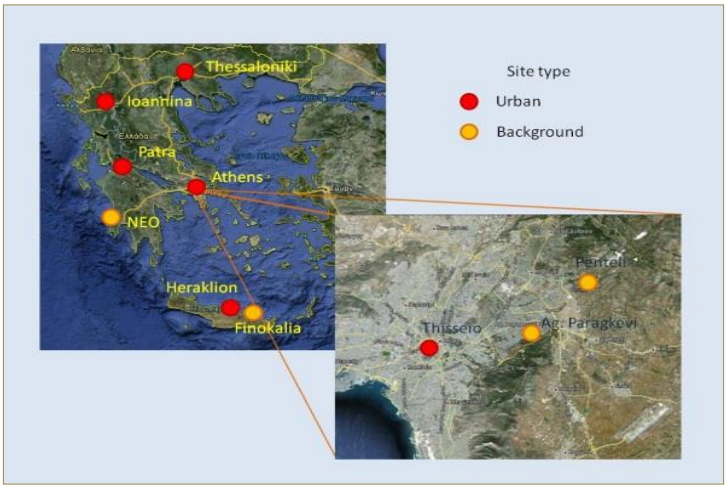

Figure 2: Urban and background sites participating in project for the monitoring of aerosol emissions and transport processes.

The NEO atmospheric group took part in a campaign of pan-Hellenic coverage, devoted to the determination of sources and physic-chemical properties of fine and ultrafine aerosols over Greece. During this campaign special emphasis was also placed on the increasing wood burning for domestic heating and the subsequent problems in air quality and photochemical smog formation. Measurements were carried out in Athens, Patras, Thessaloniki, Heraklion and Ioannina while NEO and Finokalia (Crete) were chosen as background sites.
(http://excellence.minedu.gov.gr/thales/en/thalesprojects/376735).

Planned activities for 2014

During 2014 the plan is to:

1. Finalization of the study on long term trends of humidity and preparation of a scientific article
2. Finalization of chemical analyses during the winter campaign and contribution to scientific publication within the consortium participating in the campaign
3. Finalization of analyses and preparation of a scientific article concerning the ARGON summer 2012 experiment

3.2 Geology

Research description

The aim of research in Geology is to further our quantitative understanding of the role of mountain building as a controlling factor of Earth climate. Our contribution is to constrain carbon fluxes during mountain building using rocks on Syros and Naxos as a natural laboratory and to constrain uplift rates along Sparti Fault.

Research activities in 2013

Sparti

We are currently writing up a study conducted on an exposed fault scarp at Anogia near the city of Sparti. This study focuses on the exhumed surface of the Sparti Fault. This is the probable site of the 464 BC earthquakes that ruined the city of Sparti. Previous workers have used chlorine-36 dating to show that the fault scarp was exhumed by 3-4 earthquakes during the past ca. 10,000 years. This corresponds to an earthquake periodicity of 2,000 – 3,000 years. In our study, we are using a portable X-ray fluorescence (XRF) analyzer to detect exhumed soil-rock interaction profiles on the fault surface. This field-based method with an analysis time of 60 seconds allow for analyses to be made at 5 cm intervals in a profile constructed along the fault surface. Yttrium has proven to be the most useful tracer of soil-rock interaction.

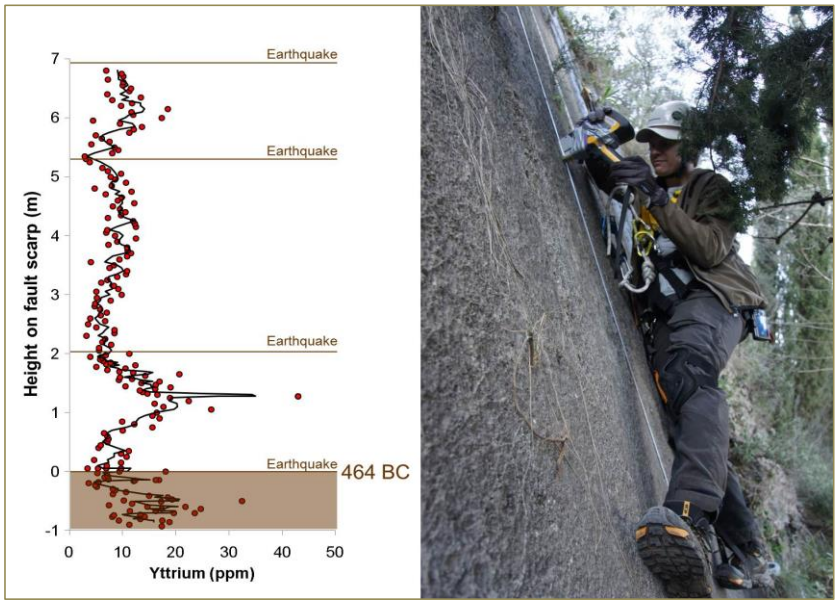

Figure 3: Sparti fault. Yttrium concentrations preserve a succession uplifted soil-rock interaction profiles (left side). Each profile was uplifted by an earthquake. Cosmogenic dating reveals that uplift of the exposed fault scarp has occurred over ca. 10 thousand years. The most recent earthquake recorded on this fault scarp could be the magnitude 7 earthquake in 464 BC that led to the demise of Spartan society. Measurement of Yttrium concentration was made using a portable XRF analyzer (right side).

This study confirms an earthquake periodicity of 2000-3000 years, an uplift rate of 1 mm/year and provides a novel approach to quantifying weathering rates.
The study is conducted by a licentiate student (Ruben Fritzon) as part of a Research School for Teachers focusing on Natural Hazards, which is financed by the Swedish Research Council and the Swedish Government and for which Prof. Alasdair Skelton is the principle investigator. Collaborators include Prof. Arjen Stroeven and Dr. Bradley Goodfellow at Stockholm University and Prof. Mark Caffey at Purdue University.

Syros

On Syros, we have calculated a flux for carbon along a fault during mountain building of 110-450 mol-CO_2.m^{-2}.yr^{-}1. This carbon flux can be compared with the carbon flux we calculated for the surrounding rocks: 0.4 mol-CO_2.m^{-2}.yr^{-1}. The carbon flux along the fault far exceeds the drawdown flux for CO_2 due to silicate weathering in mountains, but this carbon flow is highly localized. This study is part of a PhD study conducted by Barbara Kleine and the work has been accepted for publication in **Journal of Petrology** pending moderate revisions. The study was presented at the Nordic Geological Winter Meeting in Lund (January 2014) by Barbara Kleine.

Planned activities for 2014

During 2014, we will complete the revisions on our Syros study (deadline in April), we will undertake an ion microprobe study of grain-scale diffusion as part of our study on Naxos (scheduled for May), and we will write up our Sparti study. Our aim is for our studies on Naxos and near Sparti to be published in 2014.

3.3 Geomorphology and landscape changes

Research description

Geomorphological evolution in Greece during the Late Quaternary is affected by large-amplitude climatic swings and uplift/subsidence related to large-scale tectonism resulting in forcing of the geomorphological evolution that is both area-specific and highly variable over time. A deeper understanding of the current geomorphology and its evolution therefore requires a framework regarding the spatial patterns and more detailed nature of first-order drivers and the second-order controls on geomorphic evolution.

Research activities in 2013

Fieldwork was carried out in the Taygetos and Mt. Parnon to inspect glacial landforms, including the end moraine seen in the figure to the left, and high elevation valleys which appear to be relicts from previous relief generations. We have, from published data and a geomorphological analysis, erected a climatic-tectonic framework for the

Figure 4: End moraine, Taygetos mountain.

primary drivers of geomorphological evolution of the recent 4 million years. Our framework predicts (hindcasts) specific changes in geomorphic regime and landform production to have occurred as a consequence of cyclic climate change and tectonic events and trends. We test these predictions against observations and show that the landscape can only be understood in the context of a Plio-Pleistocene time perspective and that local tectonics can be regarded as a more important driver of the geomorphological evolution than climate

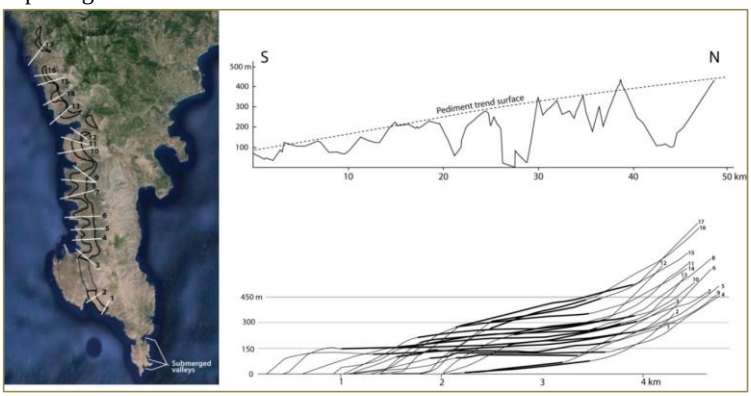

Figure 5: A southward-tilted pediment surface along the west side of the Mani peninsula.

A coherent relict surface comprising the highest summit of the Taygetos mountains and a disjunct high-elevation low-gradient valley is identified. We infer that this morphology formed at considerably lower elevation and has since been uplifted to its present position. It is indicative of very low non-glacial summit erosion rates throughout the Plio-Pleistocene uplift of the Taygetos horst. We further identify a semi-continuous and southward-tilted pediment surface along the west side of the Mani peninsula (Fig. 5).

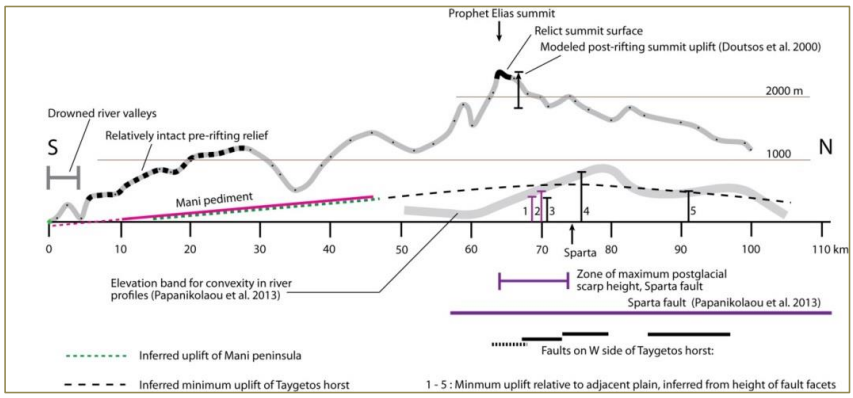

Figure 6: Available data relating to the uplift of the Taygetos

We conclude that the impact of climate changes is most obvious at the highest and lowest elevations (< 500m and > 2000m). The lowest elevations, eustatic sea-level changes influenced the spatial location of erosion and sedimentation, and ravine systems developed in tectonically uplifted marine sediments. At the highest elevations, glaciation has left a diagnostic imprint. At intermediate elevations, the landscape can be described as a continuously evolving fluvial landscape in which climatic changes have left few or no diagnostic landforms.

Analysing available data relating to the uplift of the Taygetos, (Fig. 6), we conclude that at the onset of rifting and the late-Pliocene-Pleistocene phase of uplift, there already existed a mature mountain morphology in the Taygetos – Mani block and that the central part of the massif was fluvially dissected to a lesser depth than today.

Planned activities for 2014

During 2014 the plan is to:

1. Participation in EGU conference in Vienna 27/4-2/5.
2. Submit a paper to the leading journal Geomorphology in april 2014.
3. Investigations regarding ravine formation, performed as minor thesis works by 2 students.
4. Fieldwork in the Taygetos mountains in August

3.4 Water research

Research description

We carry out research on hydrology and water resources in the Mediterranean region. A main aim is to understand and quantify the development and changes occurring from past through present to future hydro-climatic conditions in the region. A second main aim is to assess and evaluate management practices and strategies for regional water resources in view of past, ongoing and expected future regional and global changes.

Research activities in 2013

In 2013, Mazi et al. (2013a) described a new way to calculate the risk of seawater entering coastal aquifers under different environmental and climatic conditions. Calculations like these may be crucial for ensuring that people living in coastal regions have access to clean freshwater in the future. A follow-up popular insight article: Sea-level tipping points affect groundwater quality near coast was therefore also published in the Environmental Research Web for science, policy and engagement of the Institute of Physics (IOP) in order to further disseminate our results and their implications.

In the study by Mazi et al. (2013a), we showed that if sea-level rises even slightly above certain thresholds or "tipping points", the effects of seawater intrusion can be much more damaging than previously thought. The result implies that coastal aquifers that previously reacted only mildly to small changes in sea-level change may, if these tipping points are crossed, respond much more dramatically to similar changes in the future (Fig. 8).

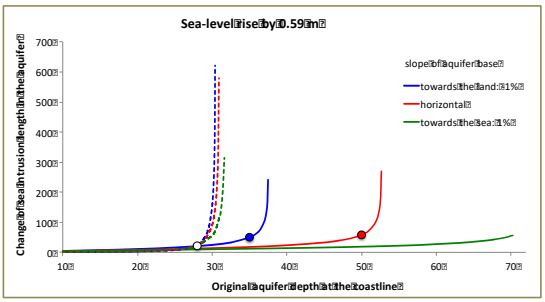

Figure 8. Example of results from Mazi et al. (2013a). The results show highly non-linear response (change) of seawater intrusion (length of intrusion toe) to sea-level rise (example of 0.59 m) and associated tipping points (circles) for different aquifer conditions (aquifer depth in x-axis, and various aquifer base slope for different curves).

With these considerations in mind, we further focused our work in 2013 on concretely assessing groundwater management practices in some important coastal regions around the Mediterranean Sea (Fig. 9), and particularly on assessing their proximity to critical groundwater tipping points (Mazi et al., 2013b). In this work, we reviewed the salinization history and current status of these aquifers, and quantified their resilience/vulnerability to current and future sea intrusion forcings, identifying two different critical limits of sea intrusion: a limit of well intrusion, at which intruded seawater reaches key locations of groundwater pumping, and a tipping point of complete sea intrusion upto the prevailing groundwater divide of a coastal aquifer.

Either limit can be reached, and ultimately crossed, under intensive aquifer exploitation and/or climate-driven change. Site-specifically, we found that the advance of seawater currently seriously threatens the Nile Delta Aquifer and the Israel Coastal Aquifer, while the Cyprus Akrotiri Aquifer is currently somewhat less threatened by increased seawater intrusion.

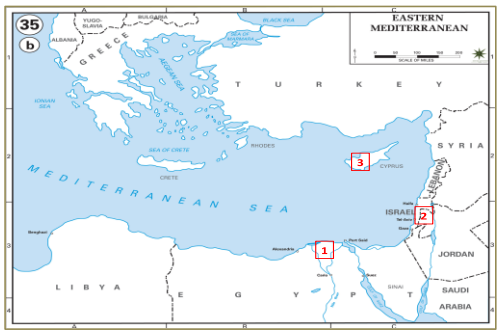

Figure 9. The locations of the aquifers under study in the Southeastern Mediterranean, 1) Nile Delta Aquifer, 2) Israel Coastal Mediterranean Aquifer, and 3) Cyrpus Akrotiri Aquifer. (adapted from http://www.emersonkent.com/map_archive/eastern_mediterranean.htm)

Possible site-specific studies of soil moisture dynamics and saltwater intrusion conditions at the NEO and Gialova Lagoon area have also been considered during 2013. Compilation of available site data and further theoretical development for appropriate hypothesis formulation and field measurement design were required as first steps toward fruitful such site studies. General theoretical development has been pursed for soil moisture dynamics during 2013, with a new study by Destouni and Verrot on the screening of long-term variability and change of soil moisture in a changing climate now being accepted for publication in Journal of Hydrology. After assessing available data for the NEO and Gialova Lagoon area, we have also included field measurement costs for necessary new soil moisture and other hydro-climatic and hydrogeological site conditions in a joint funding proposal with other NEO colleagues to the Peloponnese Prefecture.

Planned activities for 2014

Katerina Mazi will finalize her PhD thesis in 2014 (planned PhD defense in May). This will include the above-discussed papers by Mazi et al. (2013a,b), along with the underlying previous theoretical development by Koussis et al. in 2012, an additional new theoretical extension, and a new study on the quantification of a safe operating space for human use of groundwater under the typically multiple change pressures on coastal regions; the latter two studies will be finalized and submitted for publication/published in 2014. Research on long-term hydro-climatic change in Greece, started already in 2013, will also continue in 2014. Specifically, the multi-model ensemble of the Coupled Model Intercomparison Project Phase 5 (CMIP5), which synthesizes the latest research in global climate modeling, is being used to investigate climate projection implications for the land water system across different world regions, including Greece as a key regional node.

3.5 Tree-ringing

Research description

This research makes use of annual rings in trees to study past and current environmental processes. The overarching aim is to improve our understanding of possible future environmental issues.
Tree-ring series from Greece have potential to provide unique information on changes in the climate of the past. The NEO project in dendro-climatology has established new long tree-ring records from different parts of Greece (Fig. 1). The data is used to reconstruct the climate of the last millennium.

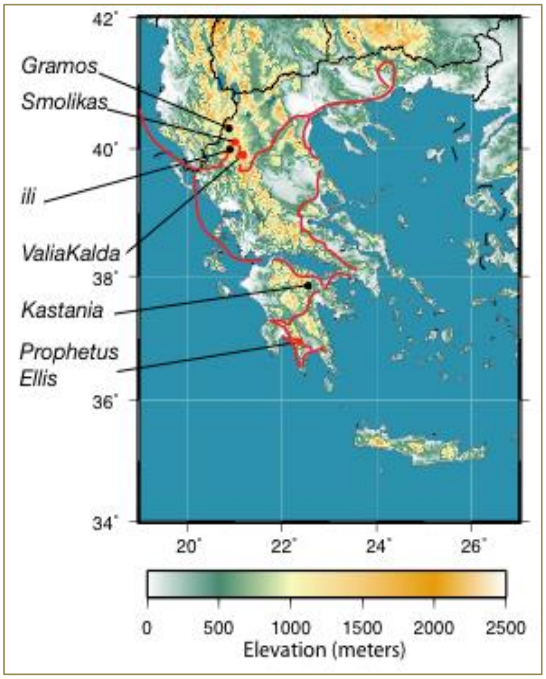

Figure 10. NEO sampling sites 2011 – 2013. The red line shows the route travelled during the 2013 field season in search for old wood. The red-marked sites were sampled in 2013.

Long records of precisely dated tree rings may also be used to study (and date) extreme environmental events, such as drought, flooding, and volcanic eruptions. The NEO-project in dendro-chemistry explores novel methods to trace such events in the physical and chemical properties of tree rings, and link these events to the human history in the area. The results will extend our knowledge of the timing, magnitude and spatial extent of extreme events in the past.

Major research activities 2013

The research activities in 2013 focussed on improving the collection of tree-ring data from around AD 1000 for the dendro-climatology project. This data comes from dead

wood that can be found only in remote, high-altitude areas. The map in Figure 1 shows the origin of the collected data. The field season of 2013 was very successful and resulted in a continuous record for the last c. 1500 years (Fig. 11). This now completes the fieldwork for the PhD project in dendro-climatology and the results will be published during 2014.

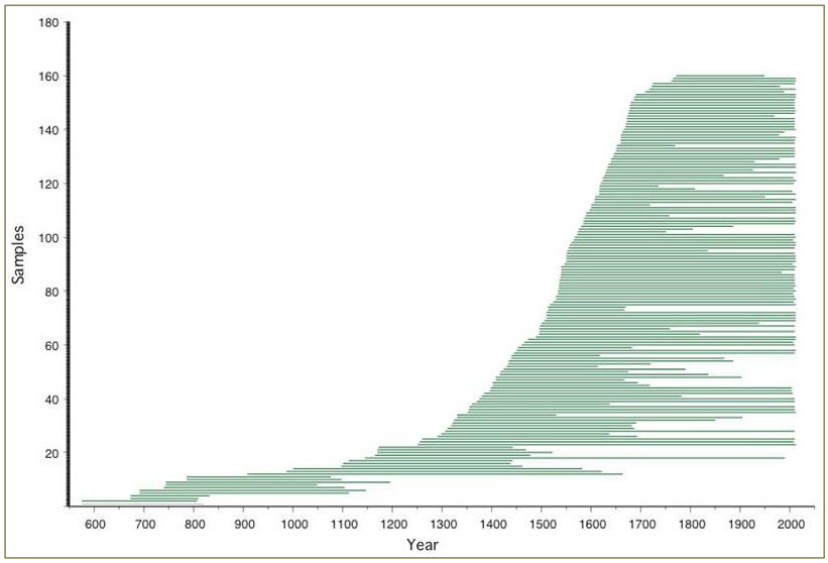

Figure 11. The NEO collection of *Pinus Heldreichii* tree-ring data. The current collection of 160 tree samples have provided a total of 63642 individual ring measurements, covering the time period 575 – 2012.

The dendro-chemistry project continued their sampling effort in the area of Chaironeia. This resulted in a small number of new samples of oak and cedar.

Planned activities for 2014

The PhD project in dendro-climatology will continue with analyses of the links between climatic factors and tree growth with the aim to formulate a model for climatic reconstruction for the past 1,500 years. Two research papers are to be submitted during 2014 describing the data, the dendro-climatological response factors and the climate reconstruction.

The dendro-chemistry project will have a meeting in Athens during 2014 to complete the first set of analyses and publish the results. An extended field campaign is desirable but dependent on the success of raising new funds.

The tree-ring research group have also initiated collaboration with the Center for Mediterranean Archeology and the Environment (CMATE) at University of Arizona, USA. The plan for 2014 is to formulate a joint research project on short-term extreme environmental events in the past.

3.6 Cave speleothems and wetland sediments

Research description

The focus of this research is to understand past climate and environmental variability, flooding events and sea-level history, using cave speleothems and sediments from wetlands, situated in Messinia, Lakonia and Arcadia. The caves of Peloponnese provide excellent opportunities to study the co-evolution of climatic, environmental and cultural changes in a historical perspective, going back to Bronze Age civilizations and beyond. Multi-proxy analyses of speleothems and lake sediments can reveal changes in regional precipitation, temperature and vegetation in the past. Combining speleothems and lake sediments will hopefully help us distinguishing between the human role versus climate factors behind observed changes in vegetation.

Major research activities 2013

The first results from studies of speleothems in Kapsia Cave have been summarised and are now in press for publication in the international scientific journal Quaternary Research (Finné et al. in press). The stalagmite shows that floods occurred in the cave in 500 BC, 70 BC and AD 450. The latest flood may have influenced the presence of human activity in the cave, as is observed from archaeological evidence from the 4th and 5th centuries AD. Local climate followed a semi-regular pattern of 500-year periods with rapid shifts toward wetter conditions followed by slowly developing aridity. Wetter conditions appear around 850, 700, 500 and 400-100 BC, and around AD 160-300 and AD 770. Driest conditions occurred around 450 BC, AD 100-150 and AD 650.

Figure 12: Stalagmite sampling in Alepotrypa

Analysis of spelothems from Glyfada Cave was completed and a manuscript is in progress. The spelothems grow discontinuously over the last glacial period. The stable isotope records indicate that the regional climate experienced increased precipitation and temperature in concert with the Greenland interstadials.

Field work in Alepotrypa Cave was conducted twice (Fig. 12) and speleothems sampled are currently being analysed. First dating results show that speleothem growth occurred over the last 18000 years.

Field work in two wetlands; Agios Floros near Kalamata and Gialova Lagoon took place in October and several sediment cores were collected (Fig. 13). The material is being analysed in labs at Stockholm University (diatoms, phytoliths) and at University of Peloponnese/ Kalamata (OSL-dating). First dating results indicate that the sediment covers mid-Holocene and late Holocene.

Figure 13: Coring with Russian corer in Ag. Floros.

Planned activities for 2014

During 2014 the plan is to:

1. Organise and run an international workshop, co-sponsored by, among others, PAGES, NEO and the Bolin Centre and entitled *Mediterranean Holocene Climate and Human Societies.* The workshop with 64 participants will take place at Costa Navarino on 23-25 April.
2. Submit a paper with the results from Glyfada Cave to the journal *Quaternary Science Reviews* (Finné et al.).
3. Submit a paper reporting from a methodological study of growth layers in a stalagmite from Kapsia Cave using ITRAX-technique (Finné, Boyd et al.).
4. Complete the analysis and submit a paper with the first results from Alepotrypa Cave (Boyd, Karkanas et al.).
5. Continue the analysis of the sediments from the wetlands and prepare the first manuscript (Norström, Zacharias et al.).
6. Martin Finné will defend his PhD thesis in November.

4. Education

4.1 Courses

Bachelor's level course in Physical Geography and Quaternary Geology, Stockholm University, 8-14 March, 2013

The 3rd Student Field Course in Physical Geography and Quaternary Geology, given by the Department of Physical Geography and Quaternary Geology, Stockholm University, was attended by 25 students (Fig. 14). Field course instructors were Ingmar Borgström, Sara Cousins and Martin Finné. During the excursion we visited a number of different sites mainly in Messinia among them, the Gialova/Navarino Bay area, Artemisia, Verga, Loussios River, Kapsia Cave, Mesochori, Methoni and Finikounda. The students studied different subjects e.g. tectonics, geomorphology, land use changes, erosion and deposition, forest fires, biodiversity and hydrological processes. The different localities represent different types of environments e.g. coasts, mountains and plains, placing the subjects in different context for the students. In the Gialova area and in Loussios River students worked in smaller groups with projects providing them with basic field work skills for example measuring distance, elevation and slope angles. In the Loussios River the projects involved the study of water discharge and water chemistry. In Gialova students worked with sand dune morphology, water chemistry, land use changes and bird diversity.

Figure 14: Stockholm University students during the 3rd Student Field Course at NEO at Prodromo river canyon.

Plant biodiversity and evolution – a global perspective,

Stockholm University, 20-27 April, 2013

The second Masters course "Plant Biodiversity and evolution - a global perspective", was attended by 20 participants from Stockholm University and with Catarina Rydin as the instructor. During their excursions within Messinia, more than 250 plant species were identified (Fig. 15).

Figure 15: Stockholm University student during the ‘’Plant biodiversity and evolution – a global perspective’’ masters course at NEO.

The 2nd International Masters Level Course on Ecohydrology,

Stockholm University and Cornell University, 9-15 June, 2013

For a second year, a joint effort between Stockholm University and Cornell University brought together students from the US, Sweden and Greece to explore NEO and its surroundings in an ecohydrologic framework via field experiments and observations. The main focus of the course 'Ecohydrology: a Mediterranean perspective' was to explore interactions between plants and the water cycle. To help develop students' understanding of this dynamic and sensitive region of the Mediterranean, they focused on evaporation and transpiration processes across different spatial scales.

Figure 16: Participants in the NEO Ecohydrology course

The main goal of the course was to explore some of the central theories in ecohydrology and their connection to plant–water interactions and the water cycle in a semiarid environment. Students designed and carried out several field experiments highlighting both the location's uniqueness and potential sensitivity to climatic changes (Fig. 16).

"Climate, Climate Change Impacts: Greece",

Justus-Liebig University of Giessen, 10-14 September, 2013

Students of the Justus-Liebig University of Giessen (a NEO Associated Member), Germany, visited NEO as part of their-course "Climate, Climate Change Impacts: Greece". Elena Xoplaki and Juerg Luterbacher were course instructors. The aim of the course was to provide interdisciplinary knowledge on the climate of Greece and the Eastern Mediterranean to BSc, MSc and PhD students. The course consisted of three interrelated parts, theoretical, methodological and a field excursion. The students prepared a scientific report combining knowledge acquired from the theory and methods and knowledge obtained during the excursion. The students visited Gialova lagoon, Paleokastro and Archaia Messini with the guidance of Giorgos Maneas and Karin Holmgren. Atmospheric monitoring, demonstration of the NEO atmospheric research station and latest research results were presented by Vangelis Gerasopoulos.

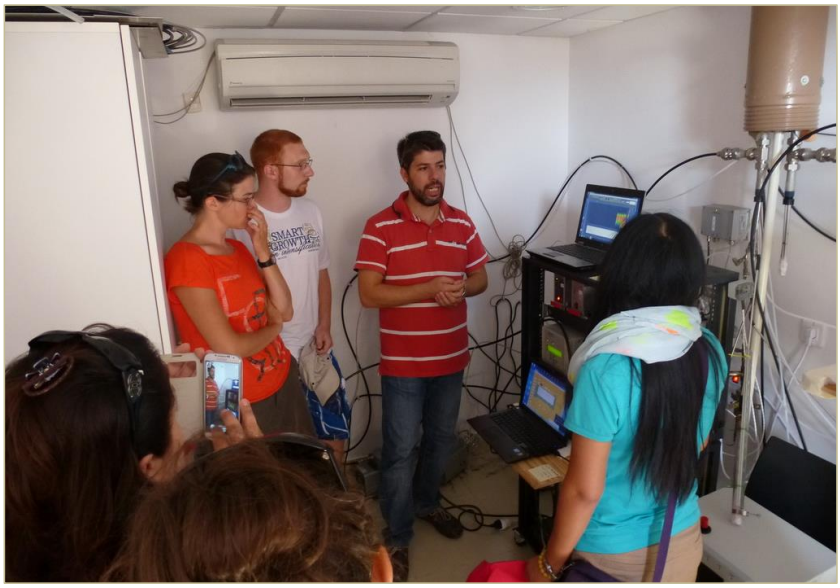

Figure 17: Demonstration of the NEO atmospheric station by Vangelis Gerasopoulos

Finally, the students attended a lecture on caves and speleothems by Karin Holmgren.

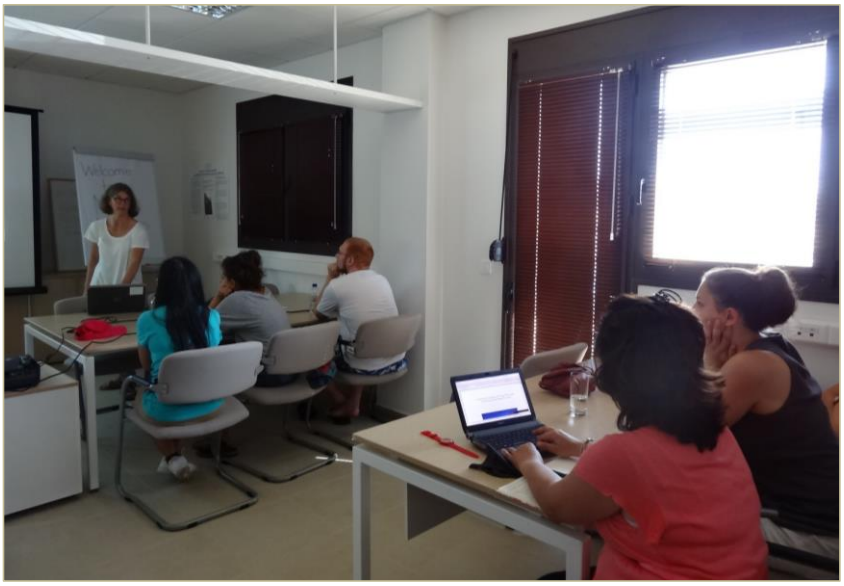

Figure 18: A lecture on caves by Karin Holmgren

"Natural disasters from natural and social science perspectives".

Students' course, Värmdö Gymnasium, 12-18 October, 2013

As part of a one semester Natural Science Specialization course, at Stockholm University, a group of students from the upper secondary school, Värmdö Gymnasium, visited NEO. The specialization course was aimed at third year students attending the natural science programme with a global perspective, and the course theme was "Natural disasters from natural and social science perspectives". During the stay at NEO Research Station they visited geological, biological and historical sights of interest. The purpose of the week was to give the students deeper understanding of how the landscape is shaped through geological processes and what effects these processes have on biological systems.

Figure 19: Student and teachers from Värmdö Gymnasium, Stockholm

"Water – resource management in time and space, focus Greece".

Swedish Institute at Athens, Stockholm University, Linköping University, University of Uppsala,

Interdisciplinary Masters course, November 25 - December 1, 2013

This master course is one of the courses within a broader university programme for internationalization, developed by Swedish universities and the Swedish Institutes around the Mediterranean. Following the "Water – resource management in time and space" course, the students were asked to focus on water quality and quantity in urban and rural areas, including examples of sustainable water usage and exploitation over time. During their visit at NEO, the students followed several lectures and also

organized and implemented a series of interviews with farmers, locals, representatives from the Water Management agency of Pylos, the Captain Vassilis Foundation and associates from Costa Navarino in order to deal with different aspects of water related issues for settlements and water management.

Figure 20: Students and instructors working at NEO, during the 'Water – resource management in time and space, focus Greece' interdisciplinary Masters course.

4.2 Summer School

Summer School on the subtropical frontier

Bolin Centre – NEO, June 23- July 3, 2013

From all over the world students and faculty attended an advanced studies, summer school on the subtropical frontier. The tropical regions of the world, which include the Mediterranean, are expanding. How fast and where this expansion will be greatest, and what will the implications to current climate conditions be, was the focus of this course. The course was delivered in a colloquium style where many invited scientists from as far away as Australia and Hawaii came to explain both the basics and current research in the field. The summer school was also well attended by students from all around the world, including many from Greece.

Figure 21: Participants at the Bolin Centre – NEO Summer School on the subtropical frontier, June 23rd to July 3rd, 2013.

The summer school was a joint collaboration between the Bolin Centre's Research Education division and NEO, with support from TEMES and the Westin Hotel. By all accounts it was a success.

Figure 22: The lecture hall at Costa Navarino

4.3 Internships

Closer links between research and education were implemented via an internship program that was launched for the first time at NEO, in August 2013. Two undergraduate students from the Department of the Environment, University of Aegean, conducted research and prepared a report on results regarding 'Development of an Algorithm Combining Aerodynamic and Electrical Mobility Size Distribution Data' and 'Instrumentation and Monitoring of atmospheric pollutants' (supervised by E. Gerasopoulos and G. Maneas).

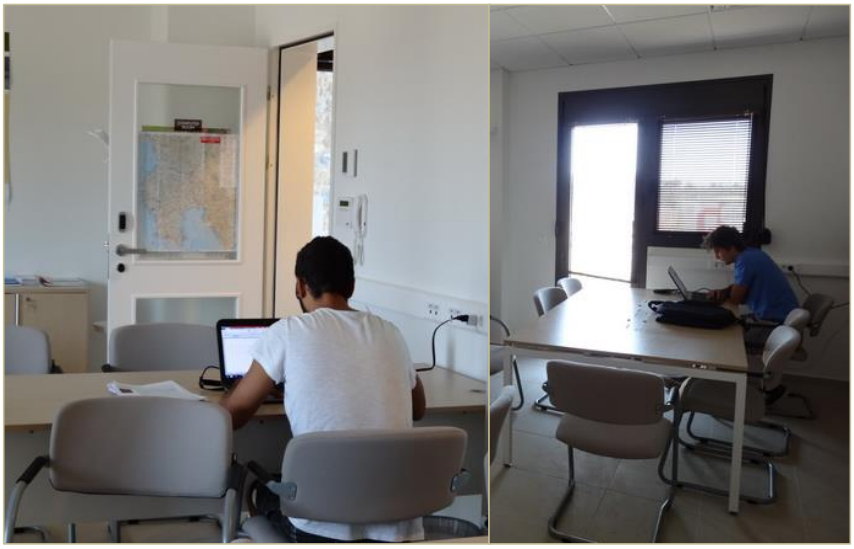

Figure 23: Interns from the University of Aegean working at NEO

4.4 Master Thesis

1. Josefine Klein has finished and presented her master thesis entitled: ***"Water resource sensitivity from a Mediterranean perspective"***. The thesis work exemplifies how hydrological modelling can be used to explore the combined impacts of climate and land-water management changes in the water-stressed Mediterranean region. The results highlight the importance of environmental monitoring and assessment to inform management and planning in this and other Mediterranean regions where water resources are vital to the economic-feasibility of development.

2. Karin Ekstedt has finished and presented her master thesis entitled: ***"Local water resource assessment in Messinia, Greece"***. The main objectives were to evaluate the balance between supply and demand, the sustainability of current water consumption, capacity of further land use intensification and to review local water management. The method was dual with both quantitative (water balance calculations and linear modeling) and qualitative (interviews and a questionnaire survey) approaches.

3. Marcus Hagman has finished and presented his master thesis entitled: **Karaktärisering av aerosolernas storleksfördelningar i centrala medelhavet.** The main objectives were to identify common size distribution types and 240 h back trajectories in order to define the origin of different aerosol types. Aerosols in the size range 10-924 nm were measured and counted during the period of April 2011 to October 2012 in Navarino by Navarino Environmental Observatory (NEO), Greece. Two different types of size distribution was found, which could be seen as background size distributions. One of them was present all year round and connected with the lowest dN/dlogDp/cm3 values (≈1700) and high precipitation during transport. The second one was associated with approximately the double dN/dlogDp/cm3 values (≈3400), which was present during summertime with no or little precipitation during transport en route to the receptor.

4. Isabella Hammarström has finished and presented her master thesis entitled: ***"Local and regional effects on aerosol size distribution in the Mediterranean region".*** The main objectives were to primarily qualify but also quantify the measured aerosols (DMPS measured and counted aerosols in the size range 10-924nm) at Navarino Environmental Observatory in Peloponnesos, Greece between April 2011 and September 2012. Local activities like biomass burning and tourism strongly influence the characteristics of the aerosol. During autumn and winter season burning of olive branches is a big source of pollutants while in summer the tourism contributes with a large fraction of aerosols. It is also shown that the presence of particles smaller than 100nm is greatest during winter season.

4.5 Navarino Natura Hall

Volunteers

For the 2013 season, Natura Hall opened its doors in March, hosting interactive exhibitions about Messinia environment and culture and about environmental issues of more general interest. For the period June – September, six volunteers were recruited to assist visitors in the Natura Hall. Vasiliki Tzimou, Isabella Hammarstr öm, Nick Lampiris and Fanny Tomband, were students from Stockholm University. Emily Honn, came from the US (University of California at Santa Cruz). The NEO Station Manager acted as the local supervisor. During their stay they also visited Archelon's camp in Kyparrisia for two nights and took part in conservation activities concerning the protection of Caretta-Caretta/ sea turtle. During their volunteer duties, all volunteers were actively involved in Natura Hall statistics and data collections, which contributed to the publication of the first scientific paper about Natura Hall (see also below).

Astronomy

A telescope was purchased after consultation by experts from the National Observatory of Athens (NOA) concerning requirements etc, and was brought to NEO for developing educational/observational activities in the field of astronomy, linked to Natura Hall.

The ‘Astronomy Nights’ event, held by Giorgos Maneas, once a week since June has been a great success. Most of the tours given were fully booked by Costa Navarino resort guests and in total more than 160 guests followed the event. The Moon, Saturn and the Great Globular Cluster of Hercules were the visitor’s most favorite objects!

5. Dissemination and outreach

5.1 Workshops

Urban Minds workshop
7-10 January 2013

The 'Urban Minds' Workshop, was held in the NEO Research Station, Costa Navarino, Messinia, Greece (Fig. 24). Urban Minds is a research program led by Prof. Paul Sinclair and Gullög Nordenskiöld Uppsala University and in which Karin Holmgren and Martin Finné participate.

The workshop was arranged for the Urban Minds steering-group in order to finalize a six-year program proposal for submission to Riksbankens Jubileumsfond (RJ) and the Knut and Alice Wallenberg Foundation. The focus of the proposed research program, is a comparative and in-depth research on urbanities and urbanism in three regions: Scandinavia and Western Europe, the Eastern Mediterranean and the Near East, and, southeastern Africa and Madagascar.

Figure 24: Participants at the 'Urban Minds' workshop

Central Asia workshop
8-12 May, 2013

The 'Central Asia' workshop gathered thirteen researchers working on the glacial history of the Central Asian region. The researchers came from the USA, Russia and Sweden to discuss results from last years' field season in the Tian Shan, to write a group review paper on the glacial history of the Tian Shan, and to prepare the

upcoming fieldwork to the Altai Mountains. The programme was led by Arjen Stroeven, Department of Physical Geography and Quaternary Geology, Stockholm University, and funded through the Swedish Research Council 2012-15.

Figure 24: Participants at the 'Central Asia' workshop

UOP@NEO workshop
27 September, 2013

A one-day-long workshop entitled UOP (University of Peloponnese) took place aiming at investigating research topics of mutual interest between the research groups of the University of Peloponnese and NEO.
Nine groups from the UOP, Department of History, Archaeology and Cultural Resources Management and the Department of Computing and Telecommunications, presented their research areas with focus on environmental issues. Classical Pylos geoarchaeology and marine archaeology of S. Peloponnese were presented by archaeologists of the local Ephorate of Classical and Prehistoric Antiquity and the Ephorate of Underwater Antiquities of Greece while an introduction about the NEO activities was given by K. Holmgren.
It was concluded that there are topics of common research interest and the participants were encouraged to contact relevant NEO researchers for further discussions on plausible collaboration.

Figure 25: Participants at the 'UOP@NEO' workshop

"Integrating calcareous plankton biostratigraphy"
Science Meeting at NEO, November 2013

Four specialists in the fossil record of calcareous plankton participated in a lively working meeting at NEO from 11 to 15 November 2013: Prof. Jan Backman (Stockholm University, Sweden) who hosted the meeting, Prof. Bridget Wade (University College, London, UK), Prof. Isabella Raffi (University of Chieti-Pescara, Italy) and Prof. Paul Pearson (Cardiff University, UK). The meeting was funded through the EU-EARTHTIME initiative, which is aimed at developing the next generation of geological timescale.

The four biostratigraphers worked together to develop a new common approach and terminology and to harmonize existing schemes based on the two fossil groups. Two manuscripts were developed: one on the philosophy and terminology of biostratigraphy and the second on an inter-correlation of the two groups. The meeting was outstandingly successful and will lead to a step-change in the way marine biostratigraphy is conducted in future.

5.2 Publications

Scientific Peer-review Publications (NEO researchers highlighted in bold)

Eleftheratos, K., I. Isaksen, **C. Zerefos**, P. Nastos, K. Tourpali, B. Rognerud, "Ozone Variations Derived by a Chemical Transport Model", Water Air Soil Pollut., 224: 1585, DOI 10.1007/sll270-013-1585-2, 2013.

Lyon, S.W., M.T. Walter, E.J. Jantze, and J.A. Archibald, 2013. Training hydrologists to be ecohydrologists: a "how-you-can-do-it" example leveraging an active learning environment for studying plant-water interaction, Hydrol. Earth Syst. Sci., 17, 269-279, doi:10.5194/hessd-17-269-2013, 2013.

Mazi K., Koussis A.D., Destouni G., Intensively exploited Mediterranean aquifers: resilience and proximity to critical points of seawater intrusion, Hydrology & Earth System Sciences Discussions, 10(11), 13817-13854, 2013b.

Mazi K., Koussis AD, Destouni G., Tipping points for seawater intrusion in coastal aquifers under rising sea level, Environ. Res. Lett., 8, 014001 (6pp), 2013a.

PAGES 2k Consortium (incl. NEO-researcher **Paul Krusic** and NEO associated member **Dr. Juerg Luterbacher**), 2013: Continental-scale temperature variability during the past two millennia. Nature Geoscience 6, 339-346

Weiberg Erika and **Finne Martin**, 2013. Mind or Matter? People-Environment Interactions and the Demise of Early Helladic II Society in the Northeastern Peloponnese. American Journal of Archaeology, 117, 1-31, 2013.

Annual Report

NEO Annual Report 2012 was published and up-loaded on the NEO web.

NEONEA

Four newsletters, called NEONEA, were published on the NEO web.

5.3 Presentations at conferences

Asokan M.S., Regional hydro-climatic change − historical assessment and projection, National Geosphere Laboratory (NGL) Annual Science Meeting, Oskarshamn, Sweden, 2013.

Athanasopoulou E., D. Rieger, C. Walter, H. Vogel, B. Vogel and **E. Gerasopoulos**: Modeling the chemical and radiative effects of aerosol during the wildfires of 2007 in Greece.

Destouni G., Water and Climate (Henry Darcy Medal Lecture), EGU2013-14177, EGU General Assembly, Vienna, Austria, 2013.

Fritzon, R., Stroeven, A., **Skelton, A**., Goodfellow, B., Caffee, M. (2013) Identifying paleoseismic information from limestone normal faults with a handheld XRF: European Geosciences Union

Fritzon, R., Stroeven, A., **Skelton, A**., Goodfellow, B., Caffee, M. (2013) Measuring earthquake periodicity of the Sparta fault with a handheld XRF: American Geophysical Union

Koussis A., Mazi K., Riou F., **Destouni G**., Prediction of sea-intrusion in unconfined coastal aquifers with 1-D sharp interface models corrected for 2-D submarine outflow dynamics, National Geosphere Laboratory (NGL) Annual Science Meeting, Oskarshamn, Sweden, 2013.

Liakakou E., **Gerasopoulos E**., Paraskevopoulou D., Zarbas P., Theodosi C., **Kalivitis N., Maneas G., Mihalopoulos N., Zerefos C**.: Aerosol chemical composition at NEO (Eastern Mediterranean) during the ARGON 2012 summer campaign.

Mazi K., Koussis A.D., Destouni G., Evaluating seawater intrusion at the regional-scale in intensely exploited coastal aquifers with an analytical generalised sharp-interface model, National Geosphere Laboratory (NGL) Annual Science Meeting, Oskarshamn, Sweden, 2013.

Mazi K., Koussis A.D., Destouni G., Regional-scale assessment of tipping points for Mediterranean Coastal Aquifers, EGU2013-818, Vienna, Austria, 2013.

Poster presentation:

Finné, Martin, Meighan Boyd, Karin Holmgren and Hanna S. Sundqvist: Late Quaternary Climate Variability in Southern Greece – ongoing speleothem research in the Peloponnese. Place: The Summer School on Speleothem Science, Heidelberg. Date: 28/-2/8.

Tzalas, H., C. Repapis, C. Synolakis, **C. Zerefos**, "Possible geophysical consequences of the 365 AD tsunami in Alexandria and the efforts and findings of the Greek mission", Workshop "Earthquakes, tsunamis and sea level change over the long term. Comparative data from Alexandria, Cyprus and Crete", Athens, 24-26 September 2013.

Voloudakis D., Karamanos A., Economou G., Vahamidis P., Kotoulas V., Kapsomenakis J., **Zerefos C**., "Prediction of climate change impacts on cotton yields in Greece under eigth climatic models using the AQUACROP crop simulation model." 1st CIGR Inter – Regional Conference on Land and Water Challenges, Bari, Italy, 10-14 September 2013.

Zerefos, C. (Chair), Round Table Discussion, Conference "Sharing data and information in the Eastern Mediterranean and the Middle East" Chania, Crete, 23-25 July 2013.

Zerefos, C., "Climate Change in the 21st century: Is it possible for the extreme to become normal?", Climate Change Conference, Brussels, 18 November 2013.

Zerefos, C., "Climate Change in the 21st century: Is it possible for the extreme to become normal?", Climate Change Conference, Luxembourg, 19 November 2013.

Zerefos, C., Future Earth Regional Workshop for Europe, Paris, 13-14 May 2013,

Zerefos, C., K. Eleftheratos, "Impact of different dynamical processes on total ozone and tropospheric OH", Workshop on CTM model development and climate-chemistry interaction studies, Norway, 11-12 September 2013.

5.4 Popular Science presentations

Open lectures, 23 June – 3 July, CostaNavarino

In parallel with the Summer School, which was held at NEO 23 June – 3 July and organised by the Bolin Center for Climate Research, 4 open lectures about Climate Change were offered for the visitors of Costa Navarino.

Figure 26: The program of the Open lectures at CostaNavarino

Swedish Institute in Athens, April 25, Athens

Karin Holmgren presented NEO for higher administrative staff from Swedish Institutes in the Mediterranean region. Place: Swedish Institute in Athens. Date: 25 April.

Swedish parliament,
May 22, Stockholm

On May 22, NEO Director was invited to present NEO at a meeting with Swedish-Greek Friendship Society at the Swedish parliament. Professor Gia Destouni, Karin Ulfsdotter-Crepin from Stockholm University and NEO Station Manager also participated in the meeting.

An insight article
April 16, on the web

Mazi K., Koussis A.D., Destouni G., Insight: sea-level tipping points affect groundwater quality near coast, IOP Environmental Research Web, April 16, 2013 - http://environmentalresearchweb.org/cws/article/news/53058.

Café-NEO
Kalamata, December 7

The Café-NEO meeting, organized by Navarino Environmental Observatory, is an attempt of NEO where, for the price of a cup of coffee or a glass of wine, anyone can come to explore the latest ideas in science and technology. The first Café-NEO for the dissemination of science to local communities was held at a café in Kalamata on December 7. At the first Café-NEO meeting, the attendees had the opportunity to discuss with Dr. Evaggelos Gerasopoulos, Research Director at the National Observatory of Athens, the impacts of the Financial Crisis to environment and health.

Figure 27: The first Café-NEO at Luna Lounge cafe in kalamata

American Geophysical Union 2013
December, San Francisco (USA)

The NEO film “A dream came true” was chosen to be shown at the film festival at the American Geophysical Union 2013 meeting in San Francisco in December.The AGU

Fall Meeting is the largest worldwide conference in the geophysical sciences, attracting nearly 20,000 Earth and space scientists, educators, students, and policy makers.

5.5 Meetings, Lectures and Visits

Meetings

During January 2013, Karin Holmgren and Giorgos Maneas had a series of meetings with researchers in Athens, including:

1. A meeting with marine science researchers from Hellenic Center of Marine Research (HCMR), Dr. V. Lykousis, Dr. A. Gogou, Gerasimos Korres and Dimitris Sakellariou to explore the possibilities for NEO to engage in marine bio- and geosciences. Apart from the scientists at HCMR, Dr. M. Triantophyllou from University of Athens, Dr. E. Xoplaki, Justus-Liebig-University Giessen and Martin Jakobsson, marine geoscientist, from Stockholm University participated in the meeting.
2. A meeting with the vice-Rector of the University of Peloponnese and Professor Nikos Zacharias to explore common science fields of potential collaboration. It was agreed that a new meeting with research groups from several departments of the University of Peloponnese will be held at NEO during 2013.
3. A meeting with researchers from National Observatory of Athens (NOA), introduced by Evangelos Gerasopoulos. Additionally, Giorgos Maneas met with Mr. Nikos Matsopoulos, an observational astronomer who will assist at the setup of the telescope at NEO.

On February 4, NEO researcher Steve Lyon gave a lunch seminar at Stockholm University about the ecohydrology course that was ran at NEO during the summer 2012. Also, Josefin Klein gave a short presentation of her research following up from the course.

On March 5, Karin Holmgren organized a NEO meeting in Stockholm, to brief and discuss with all colleagues at Stockholm University involved in NEO-related activities, about current activities (research, education, outreach), future possibilities, expectations and plans.

Within a frame of NEO's participation in the ACTRIS (Aerosols, Clouds, and Trace Gases Research Infrastructure) European Network, aiming at integrating European ground-based stations equipped with advanced atmospheric probing instrumentation for aerosols, clouds, and short-lived gas-phase species, the 3rd ACTRIS WP3 Workshop took place in Athens during the period 7-11 October 2013, organized by the National Observatory of Athens (NOA) and N.C.S.R. "Demokritos". E. Gerasopoulos as the main organizer of the event had the chance to introduce NEO activities and possibilities for hosting scientific/experimental research while together with R. Krejci presented details on instrumentation currently operating at NEO and results.

Lectures

On March 22, Karin Holmgren marketed NEO-related research and educational activities at a big event arranged for Swedish School pupils, during the World Water Day.

Visits

On January 18, Giorgos Maneas attended the International Archaeometry Award – Costa Navarino ceremony that took place at the Amphitheater of the Faculty of Humanities and Cultural Studies in Kalamata.

Three large groups of scouts visited NEO on July 31, August 1 and August 11. NEO Station manager gave them a presentation about NEO research and educational activities.

Figure 28: Scouts following a presentation about NEO.

5.6 Media

The Swedish Embassy in Athens is marketing NEO on:

- www.swedenabroad.com/en-GB/Embassies/Athens/Current-affairs/News/Navarino-Environmental-Observatory-NEO---upcoming-educational-events--sys/

- www.facebook.com/EmbassyOfSwedenInAthens

- https://twitter.com/SwedeninGR

Swedish Journalists

On April 15, NEO Management had a meeting with Susanne Ytterskog, journalist from the Swedish life-style magazine, Connoisseur. In the issue that came out 1 June 2013, there was then an article about Costa Navarino and NEO was highlighted as an important component of the sustainable development concept.

On May 15, NEO Station Manager was interviewed by Anna Benson a well-known Swedish journalist and author, writing for many print and online publications. Mrs Benson visited Costa Navarino and became interesting about Navarino Environmental Observatory. On the same day, a filming took place at NEO by Mr Ciro di Maio – journalist & presenter of "Diario di Viaggi" on Dove TV/Sky (Italy).

Meighan Boyd, PhD student at Stockholm University, was interviewed about her NEO related research in Alepotrypa Cave for the internal journal at Stockholm University.

National newspaper

A two pages article about NEO was released in April 28 at a Greek National Newspaper (Kathimerini). The article pointed out the research and the education at NEO as well as the pioneer cooperation between the Academic community and the private sector.

στη δημιουργία προβλέψεων για το μέλλον του πλανήτη. «Σε μια περιοχή με μεγάλο πληθυσμό, για την οποία όλα τα σενάρια για το μέλλον προβλέπουν ένα θερμότερο κλίμα με μεγαλύτερη συχνότητα πυρκαγιών, πρέπει να προετοιμαστούμε σε πρακτικό επίπεδο για την αντιμετώπιση της ενδεχόμενης ξηρασίας, της ατμοσφαιρικής ρύπανσης, της αύξησης της στάθμης της θάλασσας κ.ά.», μας λέει η δρ Holmgren.

Στην ομάδα της υδρολογίας, η δρ Γεωργία Δεστούνη από το Πανεπιστήμιο της Στοκχόλμης μάς μιλάει για την αύξηση της στάθμης της θάλασσας λόγω της υπερθέρμανσης του πλανήτη. «Η έρευνά μας δείχνει πότε και σε ποια σημεία της ακτογραμμής υπάρχει αυτός ο κίνδυνος. Καταλαβαίνετε πόσο σημαντικές είναι τόσο η μελέτη των αιτιών όσο και η λήψη μέτρων, όταν το 70% του πληθυσμού της Γης ζει σε απόσταση μιας ημέρας περπάτημα από την ακτή». Ενδιαφέροντα είναι και τα ευρήματα της ομάδας έρευνας της ατμόσφαιρας, η οποία αναλύει τα δεδομένα για την ατμόσφαιρα της Μεσογείου. Ο δρ Hans-Christen Hansson από το Πανεπιστήμιο της Στοκχόλμης, εξειδικευμένος στην ατμοσφαιρική ρύπανση, μας εξηγεί ότι η γενική εντύπωση που έχει δημιουργηθεί είναι πως η ατμόσφαιρα της Μεσογείου επηρεάζεται από την αέρια ρύπανση των μεγάλων αστικών περιοχών. Είναι εντυπωσιακό ότι η μόλυνση από τις μεγάλες πόλεις και τις βιομηχανικές περιοχές μεταφέρεται όχι μόνο χιλιάδες χιλιόμετρα μακριά, αλλά «ταξιδεύει» για ολόκληρες μέρες.

Το ΝΕΟ δεν είναι ο αποκλειστικός φορέας στη χώρα μας που ασχολείται με την κλιματική έρευνα. Έχει όμως τη μοναδικότητα μιας ερευνητικής πρωτοβουλίας που στηρίζεται στη διεπιστημονικότητα συνδυάζοντας γεωλογία, γεωμορφολογία, ατμοσφαιρική φυσική και χημεία, κλιματολογία, υδρολογία κ.ά. Η έρευνα μαζί με την εκπαίδευση θα διαμορφώσουν το μέλλον του πλανήτη μας και αυτός είναι ο δεύτερος και σημαντικότερος ίσως ρόλος που διαδραματίζει το ΝΕΟ καθώς διοργανώνει εκπαιδευτικές δραστηριότητες σχολείων, πανεπιστημιακών τμημάτων και ερευνητικών ινστιτούτων, αλλά και διεθνή επιστημονικά συνέδρια.

Πρώτα μετρήσεις, μετά διακοπές

Είναι Μάρτιος και όμως μοιάζει καλοκαίρι στη λιμνοθάλασσα της Γιάλοβας. Μια ομάδα φοιτητών από το Πανεπιστήμιο της Στοκχόλμης «χτενίζει» την περιοχή, εξοπλισμένη με εξειδικευμένα εκπαιδευτικά όργανα. Στόχος τους να εξοικειωθούν στο πεδίο με το αντικείμενο των σπουδών τους: τη φυσική γεωγραφία και τη γεωλογία. Μαθαίνουν να χρησιμοποιούν βασικά όργανα όπως το GPS και η πυξίδα, να χαρτογραφούν τη βλάστηση και τις χρήσεις γης, να κάνουν συγκρίσεις με παλαιότερες αεροφωτογραφίες και να εξάγουν συμπεράσματα για την αλλαγή του κλίματος σε διαφορετικές χρονικές περιόδους. Πάνω σε ειδικές πλαστικές βάρκες, χρησιμοποιούν όργανα μέτρησης της ταχύτητας των υδάτινων ρευμάτων και της αλατότητας του νερού στο ποτάμι. Η τελευταία μέτρηση δείχνει θερμοκρασία νερού 15 βαθμούς. Είναι ώρα για μπάνιο! «Οι μαθητές είναι ενθουσιασμένοι με την εμπειρία: καταπληκτικά τοπία, όμορφα χωριά, εξαιρετικό φαγητό! Το μόνο σίγουρο είναι ότι θα επιστρέψουμε, αυτήν τη φορά για διακοπές!» μας λέει ο υπεύθυνος καθηγητής του προγράμματος από το Πανεπιστήμιο της Στοκχόλμης Ingmar Borgstrom, ο οποίος επισκέπτεται κάθε χρόνο τη Μεσσηνία με τους φοιτητές του.

Figure 29: An article about NEO

Tourism for Tomorrow Awards

On October 10, NEO Station Manager had a meeting with Mr. Costas Chris, Editor and Columnist at National Geographic Traveler magazine and Columnist at Vistuoso Life magazine who was interested about Costa Navarino and NEO was highlighted as an important component of the sustainable development concept.

Videos

The Stockholm University has produced a third film about NEO, A dream came true". All the videos are available http://navarinoneo.geo.su.se/index.php/gr/videos .

The production of a new film/s presenting the activities at NEO is almost ready. The production is performed by Dionisis Dimitrakopoulos under the leadership of Giorgos Maneas

Press releases

A press release about NEO Educational activities was send to Greek media after the completion of the Summer School which was held at NEO in June.

6. NEO management

6.1 Administration

The NEO Steering Committee had two meetings in Athens during 2013.

The NEO Steering Committee (NEO SC) consists of Chairman and two delegates from Stockholm University, two delegates from Academy of Athens and two delegates from TEMES.

- Stefan Nordlund, Professor (Chairman)
  Department of Biochemistry and Biophysics
- Johan Kleman, Professor
  Department of Physical Geography and Quaternary Geology
- Georgia Destouni, Professor
  Department of Physical Geography and Quaternary Geology
- Christos Zerefos, Professor
  Atmospheric Environment Division Biomedical Research Foundation
  Academy of Athens
- Evangelos Gerasopoulos, Research Director
  Institute of Environmental Research and Sustainable Development
  National Observatory of Athens
- Marina Papatsoni, Marketing & Communications Director
  TEMES S.A
- Vasilis Karakousis, Environment & Sustainability Manager
  TEMES S.A

6.2 Infrastructures

The NEO building

In 2013, we have seen 6 courses, 1 summer school, 4 workshops, and 5 fieldwork periods taking place and we have had no less than 219 visitors staying for in total 1119 nights at NEO Research Station!!

The Methoni station

The main part of the atmospheric measurements of NEO is conducted at the "Methoni station". The station is on top of the hill surrounding Methoni from the west and it belongs to the Hellenic National Meteorological Service (HNMS). Under an MoU the station is now disposed to NEO for operating its atmospheric instrumentation. NEO station at Methoni premises include:

- a container that hosts aerosol state-of-the-art instrumentation

- the main building used as offices, material stocking and in the future for short term hosting of researchers/student

- a fully equipped, automated meteorological station operated by HNMS

6.3 Researchers involved (NEO-responsible researchers underlined)

Atmospheric research:

- Christos Zerefos, Professor, Academy of Athens (AA)
- Evangelos Gerasopoulos, Research Director, National Obs. of Athens (NOA)
- Stylianos Kazadzis, Associate Researcher, NOA
- Vassilis Amiridis, Associate Researcher, NOA
- Liakakou Eleni, Associate Researcher, NOA
- Paraskevopoulou Despoina, PhD student
- Andreas Kazantzidis, Assistant Professor, University of Patras
- Konstantinos Eleftheratos, Lecturer, UoAthens
- Konstantinos Douvis, Post doc, AA
- Hans-Christen Hansson, Professor, Stockholm University
- Tabea Hennig. Research engineer, Stockholm University
- Radek Krejci, Researcher, Stockholm University
- Peter Tunved, Researcher,
- Nikos Kalivitis, Researcher, University of Crete
- Giorgos Maneas, NEO Station Manager, Stockholm University

Geology:

- Alasdair Skelton, Professor, Stockholm University
- Barbara Kleine, PhD student, Stockholm University
- Ruben Fritzon, Licentiate student, Stockholm University
- Arjen Stroeven, Professor, Stockholm University
- Bradley Goodfellow, Post-doctoral fellow, Stockholm University
- Mark Caffey, Professor, Purdue University, USA
- Mike Bickle, Professor, Cambridge University, England.
- Marion Holness, Professor, Cambridge University, England.

Geomorphology:

- Johan Kleman, Professor, Stockholm University
- Ingmar Borgström, Lecturer, Stockholm University
- Alasdair Skelton, Professor, Stockholm University
- Peter Adler, Bachelor student, Stockholm University

Hydrology:

- Georgia Destouni, Professor, Stockholm University
- Jerker Jarsjö, Lecturer, Stockholm University
- Steve Lyon, Lecturer, Stockholm University
- Carmen Prieto, Scientific Programmer/Research Engineer, Stockholm University
- Shilpa M. Asokan, postdoc, Stockholm University
- Katerina Mazi, PhD student, Stockholm University

- Antonis Koussis, guest researcher at Stockholm University in 2013

Tree-ringing:

- Håkan Grudd, Senior researcher, Stockholm University
- Christos Zerefos, Professor, Academy of Athens
- Paul Krusic, PhD student, Stockholm University
- Konstantinos Eleftheratos, Dr, University of Athens

Caves and wetlands:

- Karin Holmgren, Professor, Stockholm University
- Mira Bar-Matthews, Professor, Geological Survey of Israel
- Meighan Boyd, PhD student, Stockholm University
- Martin Finné, PhD student, Stockholm University
- Dirk Hoffmann, researcher, National Research Centre for Human Evolution, Burgos, Spain
- Nikos Kalivitis, researcher, University of Crete
- Panagiotis Karkanas, Geologist, Ephoreia of Palaeonthropology-Speleology of Southern Greece
- Christos Katrantsiotis, research assistant, Stockholm University
- Giorgos Maneas, NEO Station Manager, Stockholm University
- Elin Norström, researcher, Stockholm University
- Hanna Sundqvist, researcher, Stockholm University
- Nikos Zacharias, Assistant Professor, University of the Peloponnese

6.4 Associated members

Two new associated members have joined NEO family:

- The Laboratory of Archaeometry, Department of History, Archaeology and Cultural Resources Management - University of Peloponnese.
- The Soil and Water Lab within the Department of Biological and Environmental Engineering at Cornell University.

NEO Annual Report 2013

Edited by NEO Management

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