

NAVARINO  
ENVIRONMENTAL  
OBSERVATORY

# ANNUAL REPORT

## 2016



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## **Foreword**

Stockholm May 2017

Karin Holmgren  
Chairwoman of NEO Steering Committee

## 1. Introduction

Navarino Environmental Observatory (NEO), 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 have an important effect 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 young 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**

### **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 the largest university 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](http://www.su.se) , <http://www.bolin.su.se/>

### **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](http://www.academyofathens.gr) <http://www.bioacademy.gr/?lang=gr>

### **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](http://www.costanavarino.com)

## Associated members

Nine associated members have joined NEO family:

- The National Observatory of Athens
- The Environmental Chemical Processes Laboratory (ECPL), Department of Chemistry - University of Crete
- The Laboratory of Atmospheric Physics, Department of Physics - University of Patras (LAPUP)
- The Laboratory of Climatology, Climate Dynamics and Climate Change, Department of Geography - Justus Liebig University Giessen
- 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.
- The Laboratory of Tree-Ring Research, University of Arizona
- The Department of Geography, Johannes Gutenberg University
- The Department of Archaeology and Ancient History, Uppsala University

### 3. Research

#### 3.1 Learning from the past...

In order to better understand Climate Change and its effects to the environment we need to learn more about past climate variability and loops in climatic conditions prior to human interference.

##### 3.1.1 Geology, Geomorphology and landscape changes

###### *Research description*

The geomorphology in southern Greece is a product of large-scale tectonic events related to the continental collision between Africa and Eurasia, and of climate changes on geological timescales. During the Quaternary the area was affected by many cold periods, with glaciers developing on the highest summits, and uplift/subsidence of individual tectonic blocks. The Taygetos mountains are a good example of such an uplifted block. A deeper understanding of the current landforms and landscape requires a “holistic” framework that identifies the main geological and climatic events that have driven the geomorphologic evolution in the area.

Coupled with geological research NEO researchers aim to further the quantitative understanding of the role of mountain building as a controlling factor of Earth’s climate, and to estimate how often earthquakes occur on active faults in Peloponnese.

###### *Research activities 2016*

2016 was a rap up year for the Geomorphology group at NEO. After 5 years of engagement with the area NEO researchers Johan Kleman and Ingmar Borgstrom have concluded their results on “*Landscape evolution and landform inheritance in tectonically active regions*” in a publication at *Zeitschrift für Geomorphologie*.



**Figure 1:** Johan Kleman and Ingmar Borgström during fieldwork on Taygetos mountain.

The Geology research was continued in active faults of Peloponnese. The fieldwork targeted sampling of the Sparta Fault for dating paleoseismicity on this potentially dangerous normal fault using the following in situ-produced isotopes,  $^{36}\text{Cl}$ ,  $^{26}\text{Al}$ , and  $^{14}\text{C}$ .

The work builds on published dating work using  $^{36}\text{Cl}$  and the licentiate work of Ruben Fritzon, who identified a surprisingly heterogeneous mineralogy of the exposed fault surface and resulting potential contamination of previous dating by meteoric  $^{36}\text{Cl}$ . The multi-isotope approach is designed to unravel this contamination issue, allowing for a more accurate reconstruction of paleoseismicity on this fault (and other limestone normal faults, which are common throughout the eastern Mediterranean).

This work forms part of a project on geohazards in Peloponnese in collaboration with Alasdair Skelton (IGV), Bradley Goodfellow (IGV and NG), and Uwe Ring (IGV).



**Figure 2:** Setting up a sampling transect adjacent to a transect sampled for  $^{36}\text{Cl}$  in 2002 by Lucilla Benedetti and colleagues

### *Planned activities for 2017*



### 3.1.2 Cave speleothems and wetland sediments

#### Research description

The caves and wetlands of Peloponnese provide opportunities to study the co-evolution of climatic, environmental and cultural changes in a historical perspective, going back to Bronze Age civilizations and beyond. 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. Multi-proxy analyses of speleothems and sediments reveal changes in regional sea levels, precipitation, temperature and vegetation in the past. Combining results from analysis of speleothems and lake sediments will help us distinguishing between the human role versus climate factors behind observed changes in vegetation.

#### Research activities 2016

With plenty material already retrieved from Ag. Floros fen (Messinian plain) and Gialova lagoon (both in Messinia, Greece) back in 2015, NEO researchers focused mainly on analyzing samples, aiming to understand changes in land use practices through time and possible effects of climate on vegetation.

A morphological study of the diatom species *Cyclotella distinguenda* and a description of a new species (*Cyclotella paradistinguenda* sp. nov.), based on a high resolution microscopic analysis from the **Agios Floros sediment core**, was published in a new paper, in the Diatom Research. This research contributes to the high taxonomic resolution, correct identification and ecological separation of closely related species, which are essential to improve paleo-limnological reconstructions in the Agios Floros wetland.

The **sediment cores from Gialova lagoon** were analysed by Christos Katrantsiotis and Pavlos Avramides in terms of micro- and macrofossils, carbon and deuterium isotopes on fossil *plant lipids* and stratigraphic changes in elemental composition, both at Stockholm University and the University of Patras. Parallel work from master students Erika Modig and Taariq Sheik, under supervision of Martina Hättestrand, on pollen analysis, aims to study human activity and vegetation changes since the Late Bronze Age in SW Peloponnese



Preliminary results of the pollen analysis from Gialova showed that from the Late Bronze age (3650-3025 BP to 1700-1075 BC) onwards, the pollen record include pollen from cultivated grass, vine, and the grazing indicator species. In the Early Iron age (3025-2650 BP to 1075-700 BC) olive pollen displays a marked peak, at the same time as accumulation rates and influx from terrestrial sources increase. Thereafter the olive pollen percentages decrease and remain relatively low until the end of the Frankish period (c. 500 years ago) when both accumulation rates and olive pollen percentages increase again. Pollen analysis was conducted by

the master students Erika Modig and Taariq Sheik, under supervision of Martina Hättestrand and was compared to the studies of Christos Katrantsiotis and Pavlos Avramides. Moreover, studies of volcanic tephra on cores from Gialova and Agios Floros, showed the presence of a tephra

layer at about 3200 BP. The studies were conducted by master student Helene Sunmark and bachelor student Axel Hultquist, under the supervision of Stefan Wastegård (??????).

The paleo-environmental record from Gialova is interpreted in collaboration with Elin Norström (Stockholm University), Shari Stocker (University of Cincinnati) and Calla McNamee (The American School of Classical Studies at Athens).

In close collaboration with DoLP (Domesticated Landscapes of the Peloponnese) group - Department of Archaeology and Ancient History, Uppsala University - more material for future paleo-environmental research was retrieved from a new site, ancient Lake Lerna which is located close to Argos in SE Peloponnese. The cores are expected to cover the ca last 8000 years and they will be analyzed in terms of microfossils and geochemistry for paleoclimate and vegetation reconstructions.



**Figure 3:** Martina Hättestrand, Elin Norström, Christos Katrantsiotis, Erika Modig and Helene Sunmark during fieldwork at ancient Lake Lerna.

A new core from the upper 3 m at Agios Floros was also sampled during the fieldwork. This material is expected to complement and improve the resolution of earlier paleo-environmental reconstructions covering the last ca 3000 years.

### *Planned activities for 2017*

- Submit the results from Gialova lagoon in peer reviewed journals
- Analyse new material from ancient Lake Lerna and additional material from Agios Floros.
- Martin Finne will start working on newly collected speleothems from a cave in Argolis, NE Peloponnese

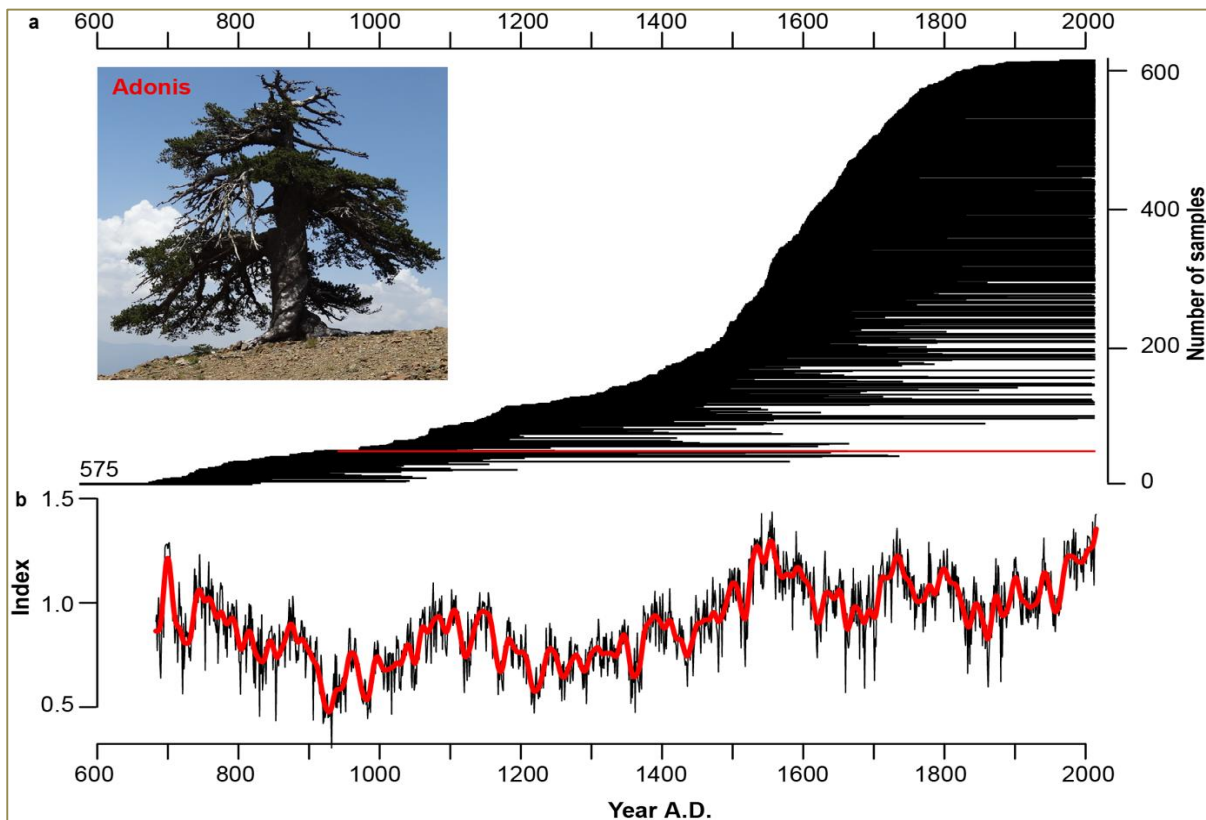
### 3.1.3 Tree-ring research

#### Research description

This research makes use of annual rings in trees to study past changes in the climate. The project is assembling new tree-ring records from different parts of Greece with the goal to cover the last c. 1 000 years and add to the international network of tree-ring data for the larger Mediterranean. The overarching aim is to improve our understanding of climate change in this region. Tree rings may also be used to study and precisely date extreme environmental disturbances in the past, such as the effects of explosive volcanism. A second aim is therefore to explore novel methods to trace and quantify such events in the physical and chemical properties of tree rings. The results will extend our knowledge of the timing and magnitude of these events in the past.

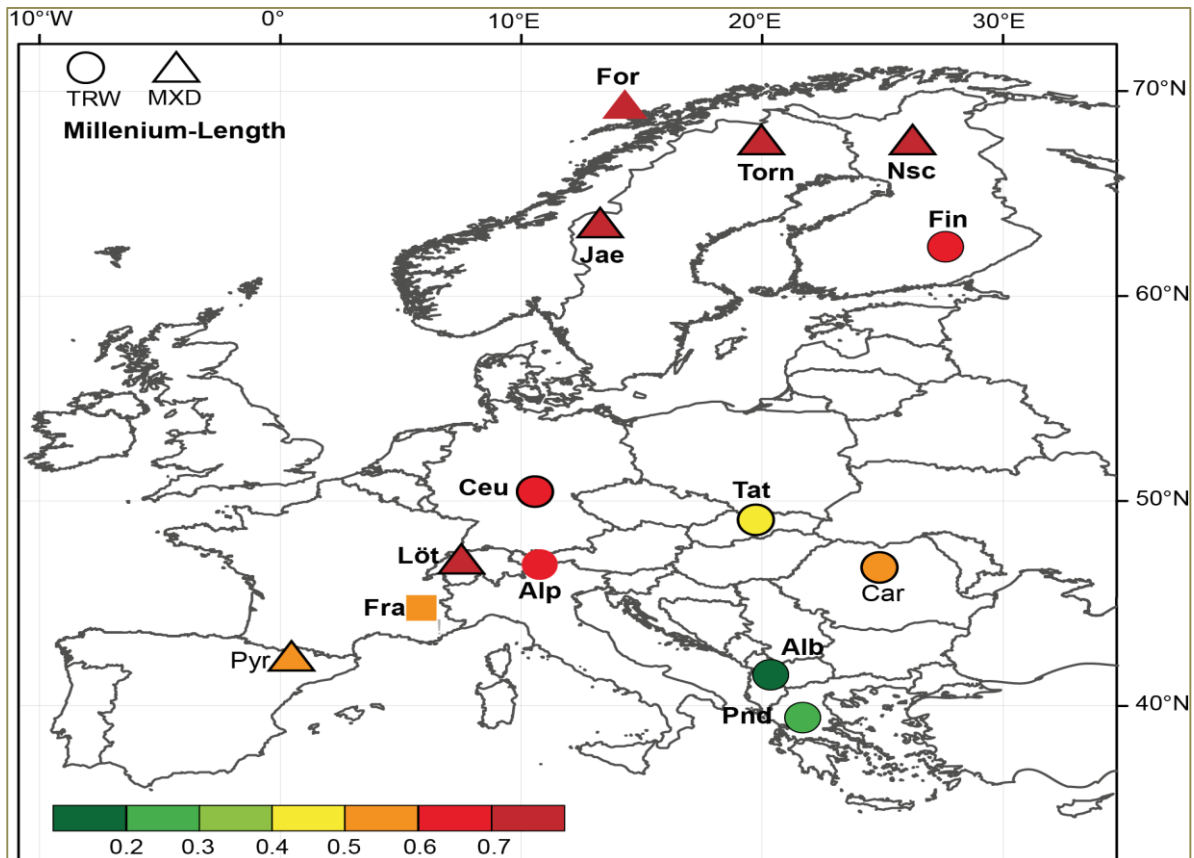
#### Research activities 2016

Europe's oldest known living inhabitant, a Bosnian pine, was discovered during a research expedition conducted by the Navarino Environmental Observatory (NEO) in Northern Greece, under the leadership of Paul J. Krusic.



**Figure 4:** Smolikas dataset: **a** temporal distribution of 615 samples from 9 sites. One bar represents an individual sample and the red bar indicates *Adonis* a Bosnian pine, dendrochronologically dated to be 1075yrs old. and therefore, currently the oldest living inhabitant in Europe.; **b** RCS detrended Smolikas *Pinus heldreichii* TRW chronology ( $n < 5$ ) and corresponding 50yr spline (red).

A Bosnian pine (*Pinus heldreichii*) growing in the highlands of northern Greece has been dendrochronologically dated to be more than 1075 years old, by scientists from Stockholm University (Sweden), the University of Mainz (Germany) and the University of Arizona (USA). This makes it currently the oldest known living tree in Europe. Considering where the tree was found, and its venerable age, the scientists have named this individual “Adonis” after the Greek god of beauty and desire.



**Figure 5:** Millennium-length proxy network based on MXD and TRW chronologies. Colors indicate the correlation with regional instrumental summer temperature data.

The compilation of samples from living and relict *Pinus heldreichii* trees at Mount Smolikas in the Pindus Mountains in Greece enabled the development of one of the longest high-elevation TRW datasets in the Mediterranean. Tree-ring maximum latewood density (MXD) chronologies, shown to be good climate predictors, are an important proxy for reconstructing annual climate variability over the past millennium. Compared to frequently used tree-ring width (TRW) data, MXD has been shown to contain a stronger climate signal as it is less biased by biological memory effects. The scientists hope the annual variations of the tree rings from trees like this and those fallen in centuries past, yet still preserved on the ground, will provide an informative history of climatic and environmental conditions, going back thousands of years.

### *Planned activities for 2017*

- Measure wood density using the DENDRO2003 X-ray instrumentation to develop a millennium-length density chronology. The climate signals inherent the new MXD chronology will be assigned by calibration of the chronology against regional instrumental climate data and the chronology will be transformed into a climate reconstruction.

## 3.2 Understanding the present...

Most scientists agree that humanity is constantly changing the environment and is affecting the climate of the planet. Many will agree that we have entered a new geological era, the Anthropocene. We need to further understand the drivers of environmental and climate change in order to be able to adapt to future conditions...

### 3.2.1 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 sets to be used in regional and global climate models and in validation of satellite-based remote sensing observations.

#### *Research activities 2016*

The activities during 2016, apart from maintaining and running the continuous existing observations at Methoni Atmospheric Station, have focused on the significant upgrade of the site with new infrastructure in compliance with the standards of ACTRIS (Aerosol, Clouds and Trace Gases Research Infrastructure network, <http://www.actris.eu/>) which is officially part of the European Research Infrastructure (ESFRI).



**Figure 6:** NEO Atmospheric Lab at Methoni HNMS premises.

NEO's aerosol sampler is up and running for continuous aerosol sampling and chemical analyses, in collaboration with the Atmospheric Chemistry Laboratory of the National Observatory of Athens and University of Crete. The monitoring of atmospheric composition has been complemented with two new trace gases analyzers, one for carbon monoxide (CO) and one for ozone (O<sub>3</sub>). The measurements will be provided in real time and online through a dedicated platform currently prepared by the Academy of Athens, that will be hosting similar measurements from several stations in the Eastern Mediterranean.

Along this line, a new pyranometer was installed on top of the roof, measuring both total and diffuse solar radiation and sunshine duration. A standard meteorological station covering air temperature, relative humidity, air pressure, precipitation, wind speed and direction (on separate 6m mast) was also installed (data are also available on line for NEO researchers at: [http://www.meteo.noa.gr/WeatherOnLine/s\\_Methoni/meteo\\_tableEN.html](http://www.meteo.noa.gr/WeatherOnLine/s_Methoni/meteo_tableEN.html)).



**Figure 7:** Aerosol sampler at Methoni

In terms of scientific results ....

*Planned activities for 2017*

### 3.2. 2 Ecosystem Services

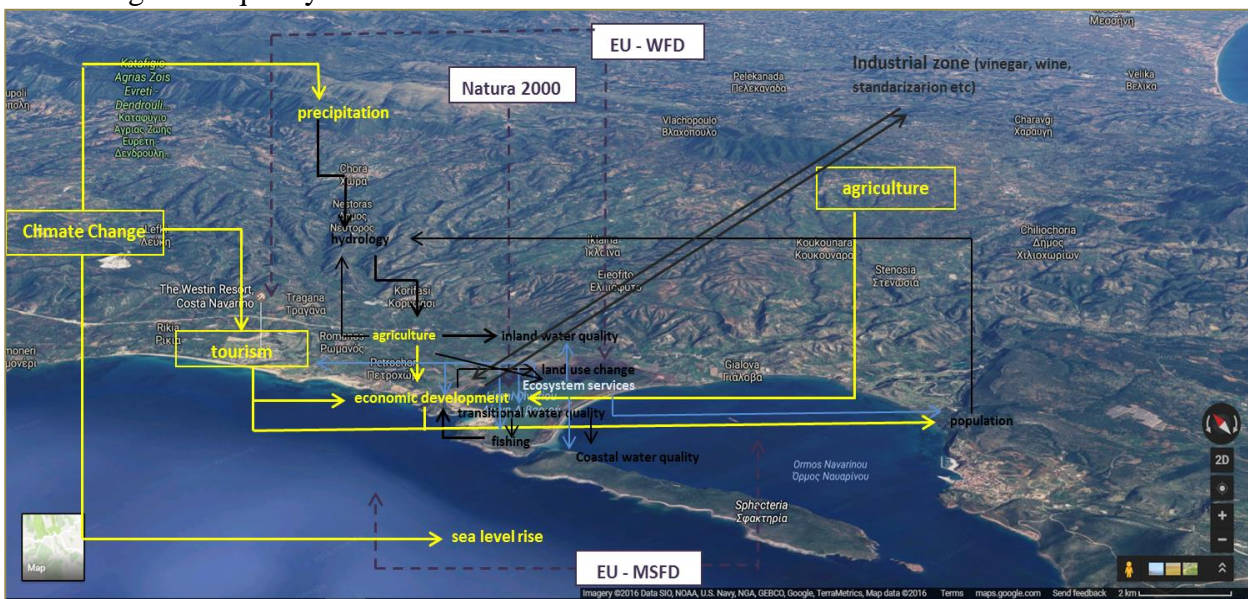
#### Research description

Conservation efforts are faced with common problems throughout the Mediterranean, including fire, overgrazing and tourism development, combined with inadequacy of legislation or ineffective enforcement as well as the lack of political commitment to protect the natural habitats. On the other hand, humankind benefits in a multitude of ways from all kinds of ecosystems, which collectively are called Ecosystem Services (ES).

In proximity to NEO Research Station, several Natura2000 sites are located. This project aims to assess and help different stakeholders in the Pylos municipality on how to incorporate Natura 2000 areas in the local economy and provide options for multifunctional landscapes.

#### Research activities in 2016

This research topic is mainly driven by Hakan Berg and Giorgos Maneas who has started his PhD studies at the Department of Physical Geography, Stockholm University in December 2015. Building on previous studies about the area, in 2016 we started to identify the variables that affect the generation of Ecosystem Services in Gialova Lagoon wetland and we have also started monitoring water quality and birds.



**Figure 8:** Different variables affecting the generation of Ecosystem Services at Gialova Lagoon wetland, located in SW Messinia (Peloponnese, Greece).

In collaboration with Stefano Manzoni (Stockholm University) and the valuable help of Agnes Classon (master student at SU) we have installed several sapling stations in the lagoon measuring on a daily basis the basic water physic-chemical parameters: 5 monitoring stations equipped with water temperature/conductivity/depth sensors (Decagon Devices CTD-10), with data logged at 5 minute resolution and 1 meteorological station equipped with Decagon sensors and logger (Rain gauge ECRN-100, Pyranometer, RH/temperature sensor VP-4, 2-D sonic anemometer). Preliminary results from a first year of monitoring will be presented at Agnes' master thesis in 2017. Since October 2016, we have also started a standardized bird counting, on a monthly basis, which will be supported with extra observations by master students during the migration period.



**Figure 9.** Gialova lagoon – Monitoring station. (photo: Agnes Classon)

In parallel, we have initiated discussions with local stakeholders (farmers, fishermen, municipality etc), as a first step to engage them in a joint discussion on the potential and importance to identify future development strategies that are sustainable and more resilient to climate change.

### *Planned activities for 2017*

- Continue water and bird monitorings
- Investigate the status and the potential of agriculture in the catchment areas around the lagoon
- Work on identifying land use changes and changes in ES
- Draft a first paper



### 3.2. 3 Water resources

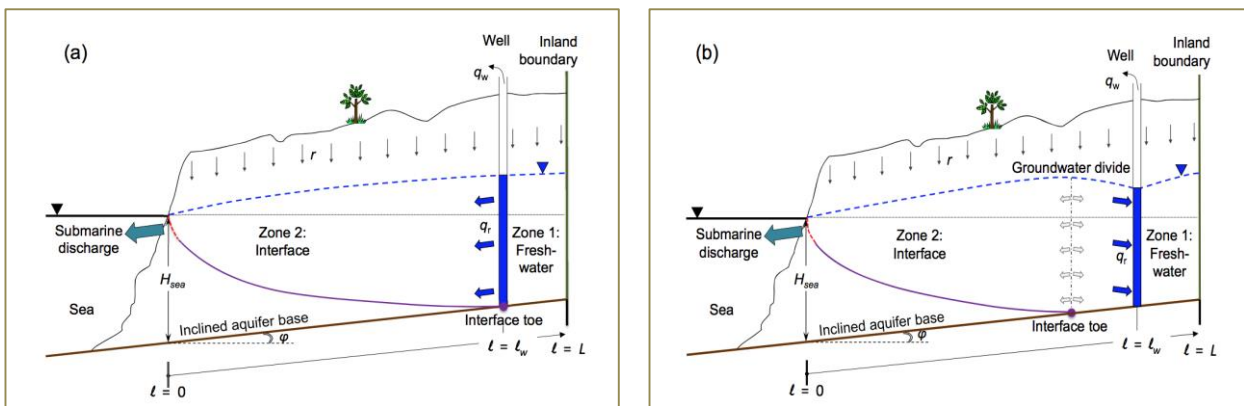
#### Research description

On a broader scale, we also investigate hydro-climate and water resource conditions and changes in the Mediterranean region. In this research, modeling approaches, management practices and mitigation-adaptation strategies for water environments and resources in the region are assessed and improvement opportunities are identified, developed and recommended.

#### Research activities in 2016

In the densely populated coastal regions of the world, loss of groundwater due to seawater intrusion, driven by changes of climate, sea level, land use and water use, may critically impact many people. Research activities in 2016 have focused on analytically investigating and quantifying the limits constraining a coastal aquifer's sustainable management space, in order to avoid critical loss of the coastal groundwater resource by seawater intrusion.

The research has clarified that limiting conditions occur when the seawater intrusion reaches (a) a key area with groundwater pumping wells in a region, referred to as the well intrusion condition (Figure 10.a), or (b) the coastal groundwater divide, referred to as complete intrusion (Figure 10.b). In both cases, the limiting conditions depend on the seaward groundwater flow remaining after human extractions of coastal groundwater. Our published study (Mazi et al., 2016) develops and presents a screening-level approach to the quantification of these conditions, their key natural and human-determined controls, and the sustainability limits they imply for the human use of coastal groundwater.



**Figure 10.** Schematic illustration of two main critical conditions for seawater intrusion in a coastal aquifer: (a) intrusion into water supply wells, with the toe of seawater-freshwater interface (purple line) reaching a key well location; (b) complete intrusion into the coastal aquifer, with the interface toe reaching the coastal groundwater divide (point of maximum resistance to intrusion), which may be located between key pumping well locations and the coast. *Source: Mazi et al. (2016).*

The physical and geometrical characteristics of a coastal aquifer (schematized in Figure x1), along with the natural conditions for groundwater recharge and replenishment, are the key natural controls of the sustainable management space implied by the identified critical conditions (panels a and b in Figure 10). The groundwater pumping rates and locations are the key human-determined controls of these conditions. In combination, these conditions determine sustainability limits for the human use of coastal groundwater, and an associated sustainable management space spanned by these limits. The approach developed and proposed by Mazi et al. (2016) for combining and accounting for both of these types of controls, and their implied

sustainability limits and sustainable management space, is simple, yet general. The approach is applicable across different scales and regions, and for historic, current and projected future conditions of changing hydro-climate, sea level, and human freshwater use. The study by Mazi et al. (2016) also concretely demonstrates the practical use of this approach by quantifying the natural and human-determined controls and limits of the sustainable management space for two specific Mediterranean aquifers: the Israel Coastal Aquifer and the Cyprus Akrotiri Aquifer.

### *Planned activities for 2017*

The plans for 2017 are to investigate hydro-climatic changes specifically within Greece and its various parts, including the Peloponnese. For the key change drivers of atmospheric climate change and irrigation developments over Greece, we will quantify past and future water resource changes in the country. As such, this work and associated data compilation and synthesis within the framework of NEO will pave the ground for introducing NEO-related Peloponnese and/or whole of Greece case studies in planned forthcoming research proposals in the EU Horizon 2020 calls during 2017.

Furthermore, we will during 2017 also finalize the follow-up work from the second workshop of the global wetland ecohydrology network (GWEN), held at NEO in 2015, and aim for publishing a GWEN community perspective paper based on that work. This work synthesizes the collective research experiences of GWEN researchers regarding water-related ecosystem functions and services, and their changes and change drivers, for the worldwide set of wetlandscapes studied within GWEN.

## 4. Education

### 4.1 Field courses

Many courses visit NEO station annually. Subjects studied here include atmospheric composition, water resources, climate change, earth sciences, geography and interdisciplinary environmental management among others. NEO facilities are open to teachers and students from Stockholm University and collaborating institutions as well as to other Universities from Greece and abroad. In 2016, more than xx students have visited NEO station, .

#### School level

##### *Course in “Natural disasters form a natural- and social science perspective”*

##### *Värmdö Gymnasium, Upper secondary school from Stockholm, 15-22 October*

Students from the Värmdö Gymnasium visited NEO for a fourth year in a row. The field trip was a highly appreciated learning experience, with a strong connection to the areas surrounding NEO. As every year, the focus was the Natura 2000 area, Gialova Lagoon. The area brings amazing potential for understanding nature preservation from a national and European perspective. Parallels are drawn to similar Natura 2000-protected areas in Sweden, so that the students better understand the rules and regulations surrounding nature conservation. The perspective of the local population was also considered.



**Figure 11.** Students from Värmdö Gymnasium walking on Paleokastro (photo: Paul Strehlenert)

A visit to ancient Olympia was a new and appreciated addition to the programme. The trip included a stop at a honey farm to create further understanding of ecosystem services.

The product of the students' efforts was a film about the Gialova Lagoon area. The objectives of the film were to spread knowledge about the Natura 2000 network to the general public and to describe the areas around the lagoon. The films described 4-6 habitats and some species that are mentioned in the Natura 2000 data form, available on the EU-commission website. Also the ecosystem services which benefit peoples' lives were mentioned.



**Figure 12:** Lecture at Pylos square (photo: Paul Strehlenert)

### Bachelor level

### *Course in “Physical Geography and Quaternary Geology”*

*Department of Physical Geography, Stockholm University, 24-28 February*

The sixth Physical Geography course took place at NEO. Sara Cousins, Ingmar Borgström and Martin Finné were the instructors of the field course and 25 bachelor students together with 4 PhD students from Stockholm University attended the course. Topics that were covered were how different processes like tectonics, erosion, humans, etc shape the landscape and how climate change and land use processes might shape the landscape in the future. During the excursion they visited a number of sites mainly in Messinia. Among them are 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.



**Figure 13:** Stockholm University students during the 6<sup>th</sup> course in Physical Geography and Quaternary Geology at NEO.

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.

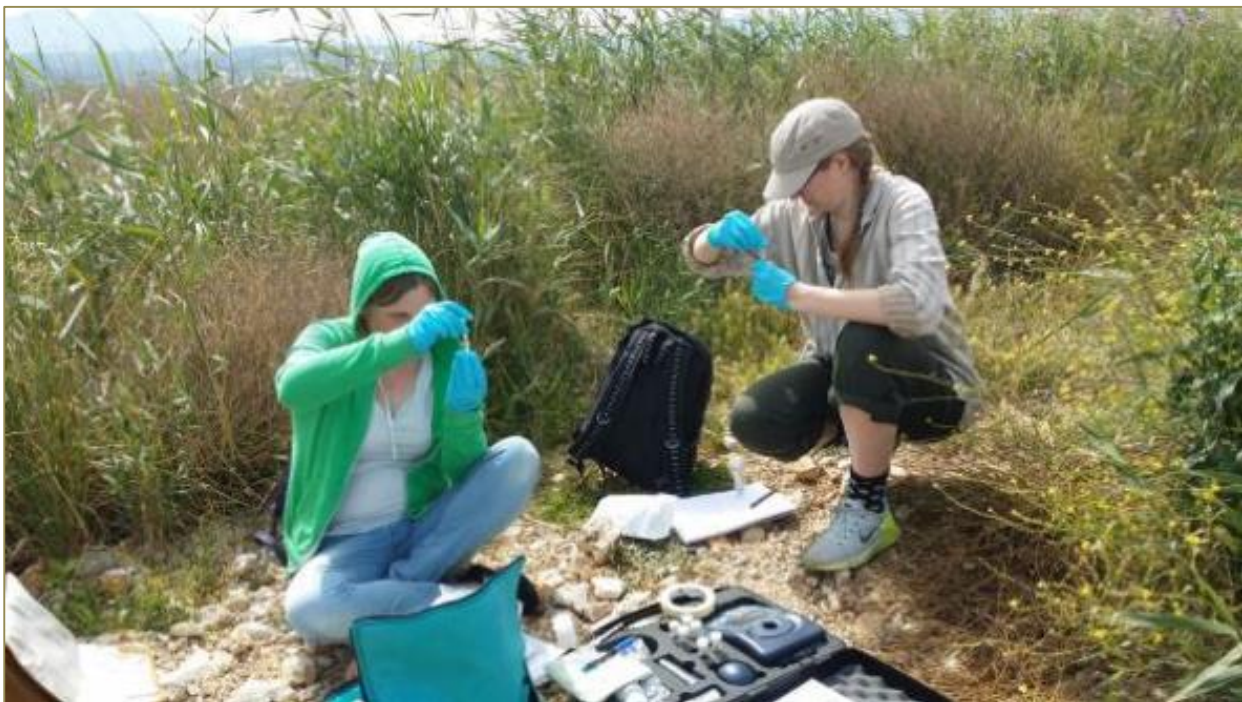
## Course in “General Geochemistry”

Department of Geology, Stockholm University, 3-9 May

The field course focused on redox and nutrient geochemistry and microbial biogeochemistry. The students engaged in two intense days of chemical field measurements in the Giavola Lagoon, focusing on two themes:

1. Water chemistry and nutrient state of the lagoon and its tributary and drainage canals;
2. Biogeochemistry of hypersaline microbial mats on mudflats surrounding the lagoon.

The students took samples at various locations around the lagoon to determine the concentration of total dissolved ions, and selected major cations and anions (calcium, magnesium, nitrate, phosphate), dissolved oxygen, pH, alkalinity, and temperature in order to assess the contribution of agriculturally derived nutrients, freshwater input, and saltwater inflow from Navarino Bay at various locations of the lagoon. Temperature, salinity, and dissolved oxygen concentrations were used to assess oxygen saturation state and biological oxygen demand. Nutrients were measured using spectrophotometric methods in the laboratory of NEO and alkalinity was measured by Gran titration.



**Figure 14:** Students conducting field measurements during the Geochemistry course at NEO.

In situ measurements of dissolved oxygen were also conducted, using oxygen microelectrodes in photosynthetic microbial mat ecosystems that can be found around the edges of the lagoon. High-resolution profiles at 500  $\mu\text{m}$  resolution were taken under various light, temperature, salinity, and water levels in order to demonstrate the physical and biological controls on photosynthetic oxygen production and microbial respiration and to introduce the concept of coupled biogeochemical cycles. The two days were intense and produced new interesting results worth pursuing for future student research projects.

### *Course in “Climate, Climate Change Impacts: Greece”*

*Department of Geography Justus-Liebig University of Giessen, 21-25 September*

It is the fourth year in a row that the visit is taking place and is now a milestone of the project-course "Climate, Climate Change Impacts: Greece" established in the JLU Geography studies curriculum. The group of geographers visited the many sites including Gialova lagoon, Paleokastro and Methoni under the guidance of Mr. Giorgos Maneas. The project course is aiming at providing interdisciplinary knowledge on the climate of Greece and the Eastern Mediterranean, volcanism and impacts on climate and societies, the Mediterranean Sea circulation, palaeoproxies, climate reconstruction and methodologies, impacts of climate variability and change on ecosystems, hydrology and water resources, atmospheric monitoring, archaeology, plant ecophysiology.



**Figure 15:** A view of Gialova lagoon in September (photo: Dr. Elena Xoplaki, Giessen University)

The project consists of three interrelated parts, theoretical, methodological and the field excursion. The students prepare a scientific report combining knowledge acquired from the theory and methods and knowledge obtained during the excursion.

### *Course in “Meteorology”*

*Department of Physics, University of Patras, Greece, 13-14 December*

Twenty-two undergraduates from the University of Patras, Greece studying at different Departments (Physics, Mathematics and Geology) of the Faculty of Science participated in the course. They had the chance to follow lectures and train on experimental and computational topics.

Among others, the students followed lectures on “*The characteristics of the atmosphere in the greater Pylos area (extreme weather, climatology, local and regional pollution sources)*” by Giorgos Maneas, on “*An exploration of the power consumption characteristics for residential and commercial use in Athens and their correlation with the meteorological conditions*” by Bill Psiloglou (National Observatory of Athens) and on “*Challenges in Numerical Weather Prediction*” by Ioannis Kioutsioukis (University of Patras).



**Figure 16:** Students from University of Patras

The students visited the NEO Atmospheric laboratory in Methoni, where they were trained on the calibration procedures. Moreover, they acquired hands-on experience on combining measurements and modeling techniques to interpret experimental data with emphasis on source apportionment of chemical compounds and aerosol measurements.



### Master level

#### *Course in “Cultural Heritage Materials and Technologies”*

*Department of History and Archaeology, University of Peloponnese, 5-9 March*

The MSc “Cultural Heritage Materials and Technologies, CultTech” from the Department of History and Archaeology, University of Peloponnese which numbered by 18 post graduates, the program secretary V. Valantou and the program director Assoc. Prof. N. Zacharias, visited the NEO Station for the first time in 2016.



**Figure 17:** Dr. E. Gerasopoulos giving a lecture at NEO.

The CultTech students had a total of 3 days field work and lecturing within the frames of semester B Environmental, Remote and Field Prospection Studies in the nearby advanced cultural and environmental landscape of Gialova and Koryfasio where they had valuable guidance by the NEO Station Manager. A visit to Methoni Station took place where they had a lab introduction and practice given by Dr. E. Gerasopoulos from NOA (National Observatory of Athens).

#### *Course in “Plant Systematics ”*

*Department of Ecology, Environment and Plant Science, Stockholm University, 23-30 April*

The fourth Masters course "Plant Biodiversity and evolution - a global perspective", took place at NEO in April. Per Ola Karis was the instructor of the field course. The young ecologists spent a

very fruitful week at the NEO station, from where they went on daily trips to face the vegetation in different kinds of habitats and environments.



**Figure 18:** Young ecologists on Paleokastro ruins.

Coming from Stockholm means that they are used to a quaternary landscape with its landforms, and this contrasts strikingly with the landforms in Greece, which has barely any remnant of the latest ice age.

*Course in “Water – resource management in time and space, focus Greece”*

*Stockholm University, Linköping University, University of Uppsala, Swedish Institute at Athens, 13-18 November*

In mid-November, a group of four lecturers and 10 master students visited NEO for a week. This was a part of the master course ***Water – resource management in time and space, focus Greece*** – a collaboration between Stockholm and Linköping Universities and the Swedish Institute in Athens. It is an interdisciplinary course with students from all over the world. The course includes different aspects of water related issues for settlements and water management, where the week in Greece is to from various scientific perspectives carry out a field study on water problems and the role of water in society. The students interviewed farmers, management at DEYA and Costa Navarino resort, as well as citizens and tourists. It was an interesting week discussing water use and management from different perspectives.



**Figure 19:** Lectures and students at the master course (photo: Åsa Danielsson)

## 4.2 Studies at NEO

*“A comparison on water demands of two different managed landscapes: An olive orchard and a golf course - Preliminary results from two eco-hydrological monitoring stations MSc thesis”*

*Master's Programme in Hydrology, Hydrogeology and Water Resources, Stockholm, December 9*

On December 9th Reyes Martin-Gonzales successfully defended her MSc thesis in the Master's Programme in Hydrology, Hydrogeology and Water Resources. Stefano Manzoni was her supervisor.

### Summary

Human activities affect the hydrologic system by changing the land-cover. This change becomes even more important in seasonally dry areas (like the Mediterranean) where water is a limiting resource needed to meet an increasing agriculture demand and a current growth in the tourism sector. Hence, this project seeks to compare the water demands of two typical managed (irrigated) vegetation covers of the Mediterranean region.

For this purpose, two eco-hydrological stations were installed, one in an Olive orchard and one in a Golf course managed by TEMES S.A. The monitoring stations have been running at high temporal frequency since March 10 to October 31, 2016, and will continue to do so for future research.



The analyses of the soil water balance at each site has allowed for water demand comparisons

Crop evapotranspiration rates of the grass at the golf course have usually varied between 1-5 mm/day for the period of low irrigation, and between 4-10 mm/day for the period of intense irrigation. Instead, the rates for the olive orchard have reached at most 5 mm/day, but our method neglected contributions from deep roots, which would have increase the estimated evapotranspiration during irrigation periods. Irrigation has therefore revealed to be a vital water resource for the growth of both traditional (olives) and new (turf grass) vegetation types.

## 5. Outreach and Dissemination

Conferences and workshops are organized to promote research and to bring together academics, corporates and policy-makers to discuss important issues of local, regional and global interest.

### 5.1 Workshops

#### *NEO workshop - Achievements and future perspectives Stockholm (24-25 November)*

A workshop on NEO research “Achievements and future perspectives” was held at the Department of Physical Geography Stockholm University on the 24-25 November, 2016.

The workshop was attended by 23 participants representing the different research themes and partners linked to NEO. The aim of the workshop was to highlight results from research conducted under the NEO collaboration, and to explore possible synergies and the potential for joint synthesis papers between the different research themes.



**Figure 20:** Participants at NEO workshop in Stockholm

Another important aim was to discuss opportunities and initiate plans for future research, funding and proposals, with a focus on applied research of high relevance to the society.

It was agreed at the workshop that 3-4 syntheses paper will be written and that the participants would start work on different proposal for future funding of research and education activities related to NEO.

#### *Hellenic Association for Aerosol Research (HAAR) workshop NEO station, May 15 - 16*

HAAR (<http://hellenic-aerosol.org/?l=en>) organized a two days event at NEO for its annual meeting. 22 professors, researchers, postdocs and PhD students met and presented their current research activities and results, and exchanged ideas for further collaboration opportunities.



**Figure 21:** Participants at the HAAR workshop at NEO.

The Greek candidacy and preparations for the 2022 International Aerosol Conference were thoroughly discussed, while an initiative for the organization of a collaborative HAAR-NEO Summer School at NEO for 2017 was launched. The scope of the summer school will be on aerosol science and technology and besides NEO and HAAR researchers involvement, there will be numerous internationally recognized scientists invited.

*Workshop - Biogeography and Geomatics  
NEO station, 27-29 November*

The research unit for Biogeography and Geomatics had a three day workshop discussing outreach, science within the group, future activities and master projects. The main theme was to present their research but also to look at the landscapes and discuss possible projects around the field station.



**Figure 22:** Relaxed discussions next to Voidokilia bay (photo: Sara Cousins)

## 5.2 Publications

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

- Büntgen U., et al.,(includes: **Krusic, P.J.**), (2016). Cooling and societal change during the Late Antique Little Ice Age from 536 to around 660 CE. *Nature Geoscience*.
- Diémoz, H., K. Eleftheratos, S. Kazadzis, V. Amiridis, and **C. S. Zerefos**, “Retrieval of aerosol optical depth in the visible range with a Brewer spectrophotometer in Athens”, *Atmospheric Measurement Techniques*, 9, 1871-1888, doi:10.5194/amt-9-1871-2016, 2016.
- Esper J, Büntgen U, Denzer S, **Krusic P.J.**, Luterbacher J, Schäfer R, Schreg R, Werner J (2016) Environmental drivers of historical grain price variations in Europe. *Climate Research*.
- Esper, J., **Krusic, P.J.**, Ljungqvist,F.C., Luterbacher, J., Carrer, M., Cook,E., Davi, N., Hartl-Meier,C., Kirilyanov, A., Konter, O., Myglan ,V., Timonen, M., Treydte, K., Trouet, V., Villalba, R., Yang, B.,and Büntgen, U, (2016). Review of tree-ring temperature reconstructions of the past millennium. *QSR*
- Holmgren, K.**, Gogou, A., Izdebski , A., Sicre, M.A., Xoplaki, E., Luterbacher, J., 2016. Mediterranean Holocene climate, environment and human societies, *Quaternary Science Reviews*, 136, 1-4. doi.org/10.1016/j.quascirev.2015.12.014
- Izdebski, A., **Holmgren, K.**, Weiberg, E., Stocker, S.R., Büntgen, U., Florenzano, A., Gogou, A., Leroy, S.A.G., Luterbacher, J., Martrat, B., Masi, A., Mercuri, A.M., Montagna, P., Sadori, L., Schneider, A., Sicre, M.A., Triantaphyllou, M., Xoplaki, E., 2016. Realising consilience: How better communication between archaeologists, historians and natural scientists can transform the study of past climate change in the Mediterranean, *Quaternary Science Reviews*, 136, 5-22. doi.org/10.1016/j.quascirev.2015.10.038.
- Katrantsiotis C.**, Risberg J., Norström E. & **Holmgren K.**, (2016): Morphological study of *Cyclotella distinguenda* with a description of a new fossil species *Cyclotella paradistinguenda* sp. nov. from the Agios Floros fen, SW Peloponnese, Greece in relation to other *Cyclotella* species. *Diatom Research*, 31(3) 243-267. DOI: 10.1080/0269249X.2016.1211178
- Kleman J.**, **Borgström I.**, **Skelton A.**, Hall A., (2016). Landscape evolution and landform inheritance in tectonically active regions: The case of the Southwestern Peloponnese, Greece. *Zeitschrift für Geomorphologie*, Vol. 60/2 (2016), 171–193, Stuttgart, June 2016
- Leland, C. Hom, J, Skowronski, N., Ledig, F.T., **Krusic, P.J.**, Cook, E., Martin-Benito, D., Martin-Fernandez, J., and Pederson, N., (2016). Missing rings and common variability in a New Jersey, Pitch pine (*Pinus rigida*) provenance plantation, *Plos One*
- Ljungqvist, F.C., **Krusic, P.J.**, Sundqvist, H., Zorita, E., Brattstrom, G., Frank, D., (2016). Northern Hemisphere hydroclimatic variability over the past 12 centuries.(in press *Nature*)
- Luterbacher J., Werner J.P., Smerdon J.E., Fernández-Donado L., González-Rouco F.J., Barriopedro D., Ljungqvist F.C., Büntgen U., Zorita E., Wagner S., Esper J., McCarroll D., Toreti A.,Frank D., Jungclaus J.H., Barriendos M., Bertolin C., Bothe O., Brázdil R., Camuffo D.,Dobrovolný P., Gagen M., García-Bustamante E., Ge Q., Gómez-Navarro J.J., Guiot J., Hao Z.,Hegerl G.C., **Holmgren K.**, Klimenko V.V, Martín-Chivelet J., Pfister C., Roberts N., Schindler A.,Schurer A., Solomina O., von Gunten L., Wahl E., Wanner H., Wetter O., Xoplaki

- E., Yuan N., Zanchettin D., Zhang H. and **Zerefos C.**, 2016. European summer temperatures since Roman times. *Environmental Research Letters*, 11, 024001, doi: 10.1088/1748-9326/11/1/024001 <http://iopscience.iop.org/article/10.1088/1748-9326/11/2/024001>
- Mazi K., Koussis AD, Destouni G.**, 2016. Quantifying a sustainable management space for human use of coastal groundwater under multiple change pressures, *Water Resources Management*, 30, 4063–4080, DOI 10.1007/s11269-016-1363-1, 2016 (Erratum, pp 4081–4081).
- Mazi K., Koussis A.D., Destouni G.**, Quantifying a sustainable management space for human use of coastal groundwater under multiple change pressures, *Water Resources Management*, 30, 4063–4080, 2016 (Erratum, correcting a typo, pp 4081–4081). Open access link: <http://link.springer.com/article/10.1007/s11269-016-1363-1>. (Erratum: <http://link.springer.com/article/10.1007/s11269-016-1427-2>).
- Weiberg, E., Unkel, I., Kouli, K., **Holmgren, K.**, Avramidis, P., Bonnier, A., Dibble, F., **Finné, M.**, Izdebski, A., **Katrantsiotis, C.**, Stocker, S.R., Andwinge, M., Baika, K., **Boyd, M.**, Heymann, C., 2016. The socio-environmental history of the Peloponnese during the Holocene: Towards an integrated understanding of the past, *Quaternary Science Reviews*, 136, 40-65. doi.org/10.1016/j.quascirev.2015.10.042.
- Wilson, R., et al., (includes: **Krusic, P.J.**), (2016) Last millennium northern hemisphere summer temperatures from tree rings: Part I: The long term context. *Quaternary Science Reviews*. doi:10.1016/j.QSR.2015.12.005
- Zerefos, C. S.**, K. Eleftheratos, J. Kapsomenakis, S. Solomos, A. Inness, D. Balis, A. Redondas, H. Eskes, V. Amiridis, C. Repapis, M. Allaart, R. Engelmann, A. Dahlback, V. De Bock, H. Diémoz, P. Eriksen, J. Gröbner, A. Heikkilä, J. Jarosławski, W. Josefsson, T. Karppinen, U. Köhler, C. Meleti, C. Repapis, J. Rimmer, V. Savinykh, V. Shiroto, A. M. Siani, A. R. D. Smedley, M. Stanek, and R. Stübi, “Detecting volcanic sulfur dioxide plumes in the Northern Hemisphere using the Brewer spectrophotometer, other networks, and satellite observations”, *Atmospheric Chemistry and Physics Discussions*, doi:10.5194/acp-2016-500, 2016.

### *Annual Report*

NEO Annual Report 2015 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

#### *Conference on Climate Change, Athens, July 13*

On behalf of Navarino Environmental Observatory, Giorgos Maneas participated in a day conference in Athens entitled “Climate Change and new policies: Global community, European Union and Greece” which was organized by the “Constantinos Karamanlis Institute for Democracy”. The day conference was held at the “Eugenides Foundation” and during his 15min presentation, Giorgos presented NEO activities, focusing mainly on the scenarios of future climate change in Messinia (previous NEO work).



#### *MedClivar conference “Learning from the past, perceiving the present, engaging for the future” Athens, 26-30 September*

Martin Finné and Erika Weiberg, both from the NEO associated department, Dept. of Archaeology and Ancient History at Uppsala University, participated in the 4th MedClivar conference “Learning from the past, perceiving the present, engaging for the future”, in Athens 26-30 September.



Peloponnese”, which will

Martin presented a new paleoclimate record based on stable isotopes from a speleothem from the cave Mavri Trypa in SW Peloponnese. Erika gave a presentation that focused on the archaeological impact of the climate especially during the Bronze Age with the new record from Mavri Trypa as a starting point. In combination, the two papers aimed to give a more nuanced picture of the whole Bronze Age rather than just focusing on specific events that is usually the case. In this way, focus were put on periods of social decline and prosperity as well as on times of deteriorating climate and improved climate. The work on the Mavri Trypa record is closely related to NEO. Both presentations are also part of the research project “Domesticated Landscapes of the run over 4 years and started in 2015.

**Zerefos, C.**, “The importance of synergistic events monitoring Earth and Space Observations for Disaster Risk Assessment in particularly vulnerable regions with examples”, IUGG-GEO Side Event “Panel on Earth & Space observations for Disaster Risk Assessment (ESO4DRA)”, St. Petersburg, 8 November 2016.

**Gerasopoulos E.**, Metaxatou A., **Maneas G.**, **Kalivitis N.**, Liakakou E., **Krejci R.**, **Tunved P.**, **Hansson H.C.**, Sciare J., Mihalopoulos N. and **Zerefos C.S.**, 2016. Aerosol monitoring activities at the Navarino Environmental Observatory, a new ACTRIS site in the Eastern Mediterranean. European Aerosol Conference EAC 2016, Tours (France), September 4-9, 2016.

## 5.4 Popular Science presentations and other outreach activities

### *Café-NEO, Science cafe at coffee places around the Peloponnese Vyzantino café, Patras, February 23*

The *café-NEO* meeting, organized by NEO, is an attempt 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.

A ‘cafe-NEO’ meeting for 2016, took place at Vyzantino café in Patra. The subject was: “*The hidden secrets of the underworld! Peloponnesian caves as story tellers of past climate*”. The attendees had the opportunity to learn from NEO Director, Professor Karin Holmgren, and discuss with her how we can gain information on past climate changes by analyzing natural archives such as the stalagmites which grow in caves.



**Figure 23:** Café-NEO at Vyzantino café in Patra.

The well attended event was co-organized together with the Laboratory of Atmospheric Physics (Physics Department, University of Patras).

*Astronomy nights,  
Costa Navarino, summer 2016*

"Astronomy nights" is an interactive experience at Costa Navarino organized by the Navarino Environmental Observatory where visitors are introduced to the stars and the constellations of the night sky and they become the astronomers deciding how the night unfolds.

Under the guidance of the National Observatory of Athens and with the excellent support from the Navarino Collections team, we have managed to organize this event on a weekly basis and we are happy to see that it was fully booked!

During the summer period 2016 we gave a tour to more than 270 visitors!

*Mission Earth*

*Comic strip from the Costa Navarino magazine ☺*

A chameleon, a turtle and a flamingo are supporting NEO scientists to conduct fieldwork and save the earth!



## NEO t-shirt

Using a picture from an old tree and one from a stalagmite, NEO management together with Malin Nordlund and Malin Stenberg de Serves have produced two different NEO t-shirts aiming to make NEO and NEO's research more visible to a broader audience.



Figure 24: NEO t-shirts.

## 5.5 Media

### International media

- WashingtonPost:<https://www.washingtonpost.com/news/speaking-of-science/wp/2016/08/19/this-tree-might-be-the-oldest-living-thing-in-europe/>).

### National media

- Following the discovery of the oldest living tree in Europe, NEO has sent a press release to the Greek national media. In particular, Kathimerini made an article special for this discovery in one of its enclosed magazines in which both Giorgos Maneas and Paul Krusic were interviewed. In addition Giorgos has also spoken to the radio (Athens 984).
- NEO was advertised in a TV reportage on ERT TV (Greek National channel). The reportage was highlighting Messinia and Costa Navarino.

## 6. NEO management

### 6.1 Administration

The NEO Steering Committee had one meeting in Athens and one in Stockholm during 2016.

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

- Karin Holmgren, Prorektor, Professor (Chairwoman)  
Swedish University of Agricultural Sciences
- Georgia Destouni, Professor  
Department of Physical Geography and Quaternary Geology
- Alasdair Skelton, 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 2016, we have seen 8 courses, 2 workshops and several fieldwork visits taking place and we have had no less than 196 visitors staying for in total 8 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

## 6.3 Researchers involved (NEO-responsible researchers underlined)

### Geology, Geomorphology and Landscape changes:

- Alasdair Skelton, Professor, Stockholm University
- Johan Kleman, Professor, Stockholm University
- Ingmar Borgström, Lecturer, Stockholm University
- Bickle Mike, Cambridge University, England.
- Caffey Mark, Purdue University, USA
- Goodfellow Bradley, Stockholm University
- Holness Marion, Cambridge University, England.
- Kleine Barbara, Stockholm University
- Ruben Fritzon, Stockholm University
- Stroeven Arjen, Stockholm University

### Cave speleothems and s and lake sediments:

- Karin Holmgren, Professor, Stockholm University
- Avramides Pavlos, University of Patras
- Bar-Matthews Mira, Geological Survey of Israel
- Boyd Meighan, Stockholm University
- Finné Martin, Stockholm University
- Hoffmann Dirk, National Research Centre for Human Evolution, Burgos, Spain
- Kalivitis Nikos, University of Crete
- Karkanias Panagiotis, Ephoreia of Palaeontology-Speleology of Southern Greece
- Katrantsiotis Christos, Stockholm University
- Kouli Katarina University of Athens
- Maneas Giorgos, Stockholm University
- Norström Elin, Stockholm University
- Risberg, Jan, Stockholm University
- Zacharias Nikos, University of the Peloponnese

### Tree-ring research:

- Paul J. Krusic , Stockholm University
- Christos Zerefos, Academy of Athens
- Eleftheratos Konstantinos, University of Athens
- Esper Jan, Johannes Gutenberg University
- Klippel Lara, Johannes Gutenberg University
- Meko Matthew, University of Arizona
- Trouet Valerie, University of Arizona

### Atmospheric research:

- Christos Zerefos, Professor, Academy of Athens (AA)
- Evangelos Gerasopoulos, Research Director, National Obs. of Athens (NOA)
- Hans-Christen Hansson, Professor, Stockholm University
- Amiridis Vassilis, NOA

- Douvis Konstantinos, AA
- Eleftheratos Konstantinos, UoAthens
- Kazadzis Stylianos, NOA
- Kazantzidis Andreas, University of Patras
- Kalivitis Nikos, University of Crete
- Liakakou Eleni, NOA
- Paraskevopoulou Despoina, PhD student
- Hennig Tabea, Stockholm University
- Krejci Radek, Stockholm University
- Tunved Peter, Stockholm University
- Maneas Giorgos, Stockholm University

Ecosystem Services:

- Hakan Berg, Ass. Professor, Stockholm University
- Maneas Giorgos, Stockholm University

Water resources:

- Georgia Destouni, Professor, Stockholm University
- Asokan Shilpa M., Stockholm University
- Jarsjö Jerker, Stockholm University
- Koussis Antonis, Stockholm University
- Lyon Steve, Stockholm University
- Mazi Katerina, Stockholm University
- Prieto Carmen, Stockholm University

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