



2021

ANNUAL REPORT



**AN INTERNATIONAL PARTNERSHIP BETWEEN THE
ACADEMIC COMMUNITY AND THE PRIVATE SECTOR**



TEMES

DEVELOPERS OF
COSTA NAVARINO

ABOUT NAVARINO ENVIRONMENTAL OBSERVATORY (NEO)



NEO field station



NEO is a Mediterranean hub for research and education where science, business, society and policy makers join in a pioneer cooperation to create a more sustainable future under a changing climate.

NEO started its operation in 2009 with support from Stockholm University (SU), the Atmospheric Environment Division of the Biomedical Research Foundation of the Academy of Athens (BRFAA) and Tourism Enterprises in Messina (TEMES SA). The field station in Messinia, Greece, is open to students and scientists, with an interest for the Mediterranean region, and is increasingly used as a meeting place for scientists, business companies and policy makers to discuss the complex issues of environmental management and sustainable development.

NETWORKS & ALLIANCES



NEO counts 9 associated members (research institutions from Greece, Sweden, Germany and the USA), it is a member of **ACTRIS**, the European Research Infrastructure for the observation of Aerosol, Clouds and Trace Gases, **PANACEA**, the PANhellenic infrastructure for Atmospheric Composition and climate change), **GWEN**, a Global Wetland Ecohydrology Network, and **LTER-Greece**, the Greek Long-term Ecosystem Research Network which is a collaborative network of scientists and their stakeholders engaged in long-term, site-based ecological, social and economic research in Greece.

OUR GOALS AND OBJECTIVES

- **Study climate change**, its impacts and interconnection with human societies and ecosystems.
- Identify **water, land, and food security** issues in the Mediterranean region in relation to socioeconomic development.
- **Bring together** scientists, business and policy makers to discuss the complex issues of environmental management and sustainable development.
- **Develop solutions and business-policy roadmaps** under ongoing climate and anthropogenic changes and evaluate their feasibility in Greece and in the Mediterranean region.
- **Follow and address missions and priorities** defined by the European Commission to tackle global challenges through research and collaboration activities and business partnership.



NEO STEERING COMMITTEE

THE AWESOME PEOPLE DRIVING NEO



GEORGIA DESTOUNI
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STOCKHOLM UNIVERSITY



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(CHAIRPERSON)
ADJUNCT PROFESSOR
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NEO TEAM

THE AWESOME PEOPLE BEHIND NEO



**ZAHRA KALANTARI
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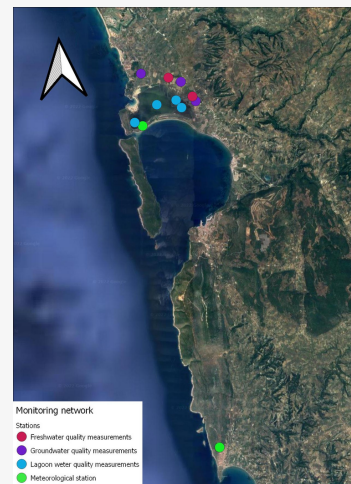
RESEARCH INFRASTRUCTURE & DATA

ATMOSPHERIC STATION

NEO has established an atmospheric station (Methoni, Greece) since 2011, to track climate change signals and air pollution.

The atmospheric station serves as one of the 3 sites selected in Greece to concentrate national and international efforts in the study of atmospheric composition, and it is **part of the “PANhellenic infrastructure for Atmospheric Composition and climate change (PANACEA)”** (<http://panacea-ri.gr/>), which was launched in September 2018.

The NEO RI is actively linked with relevant European Infrastructures (ACTRIS/ESFRI and ICOS/ERIC) that target aerosol, clouds, trace gases and the carbon observation, and aims at developing a coordinated system for monitoring of atmospheric composition, solar radiation variations, climate change and related natural hazards in Greece, merging all existing facilities and upgrading its infrastructure

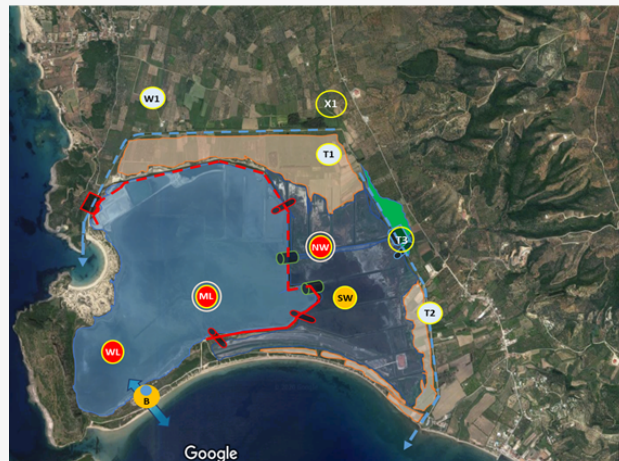


WATER QUALITY STATIONS

Since 2016, NEO has established a network of automated water quality monitoring stations within the Gialova Lagoon wetland.

The network was updated in 2020 with the installation of more advanced sensors and the monitoring of new sites at the surrounding groundwater resources.

The data collection is supplemented with field campaigns (water, sediment, fish samples) and observations (waterbirds) to assess the overall environmental status of the wetland.



Station description

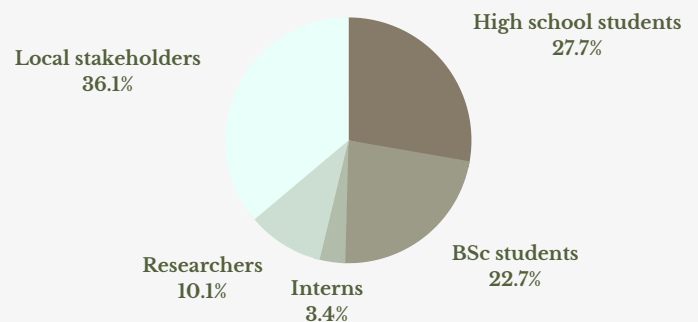
- Meteorological station**
Precipitation, Temperature, Wind speed/direction, Barometric pressure, Solar radiation
- Wetland station (CTD):**
Salinity, Temperature, Depth
- Wetland station (Sonde):**
Salinity, Temperature, Depth, pH, DO, Redox
- Groundwater station:**
Salinity, Temperature, Depth
- Water samples for nutrient analysis**
(monthly, started on April)
- Sediment samples for benthic analysis**
(April, October)

Location/Station	B	WL	ML	NW	SW
Distance from sea/lagoon canal (m)	0	400	900	1950	1850
Distance from Tyflomitis ditch (m)	2650	2700	1750	700	750
Sensor depth (mm)	200	200	200	200	200
Installation date	Apr 1	Aug 27	Jul 23	May 6	Aug 27

2021 ACTIVITIES AT A GLANCE

The COVID-19 pandemic created implications for many NEO activities, and especially on students' field courses. The class from the NaSa-programme at Värmdö Gymnasium (Stockholm) was the only educational visit that took place in 2021, as other planned visits were cancelled. Despite the challenges, the summer internships were covered by 7 interns, while in autumn three workshops took place at NEO field station. A field campaign on Pindos mountains and several fields campaigns at Gialova Lagoon wetland were also realised in 2021.

VISITORS AT NEO



NEO researchers have been active in publishing new research articles in international journals (14) and (virtual) conferences (12). In terms of EU research projects in 2021, NEO continued the work under the **COASTAL EU H2020** project focusing on the development of quantitative System Dynamics models for business and policy analysis for the two cases of SW Messinia and Norrström/Baltic Sea. In 2022, NEO will participate in two new EU projects, one funded by **PRIMA** foundation focusing on research and innovation (SALAM_MED: Sustainable Approaches to LAnd and water Management in MEditerranean Drylands), and the other funded by **ERASMUS+** focusing on education through Virtual Reality Technologies (GeoVT).

Under the **GIALOVA project**, coordinated by NEO, the team updated the network of water stations inside the wetland, installed new sensors to monitor groundwater resources at the surrounding area, and collected water and sediment samples for analysis. The data, along with suggestions for restoration actions, were reported and discussed with societal and policy stakeholders, following an iterative process which started in 2020 and is planned to continue at the same pace in 2022 and 2023.



Based on the NEO Communication Platform, which was developed in 2020, the management team structured a dissemination strategy on which various new materials were prepared for communication and dissemination purposes. More specifically, the team updated the NEO [website](#) and [leaflet](#), created the first NEO [fact sheet](#) and produced a new introductory [video](#) about NEO.

WITH THE HOPE THAT THE COVID-19 SITUATION WILL IMPROVE IN NEAR FUTURE, WE ARE LOOKING FORWARD TO SEE YOU IN-PERSON AT NEO IN 2022!

PUBLISHED WORK RESEARCH PUBLICATION



1. **Ferreira, C., Kalantari, Z.,** Pereira, P., (2021). Liveable cities: Current environmental challenges and paths to urban sustainability. *Journal of Environmental Management*, 227, 111458. DOI:10.1016/j.jenvman.2020.111458
<https://www.sciencedirect.com/science/article/pii/S03014797>.
2. Hansson, H.-C.; Tunved, P.; Krejci, R.; Freud, E.; Kalivitis, N.; Hennig, T.; **Maneas, G.; Gerasopoulos, E.** (2021). The Atmospheric Aerosol over Western Greece-Six Years of Aerosol Observations at the Navarino Environmental Observatory. *Atmosphere* 2021, 12, 445.
<https://doi.org/10.3390/atmos12040445>.
3. Kreplin, H.N., **Ferreira, C.S.S., Destouni, G.,** Keesstra, S.D., Salvati, L., **Kalantari, Z.** (2021). Arctic wetland system dynamics under warming. *WIREs Water*, in press. DOI: [10.1002/wat2.1526](https://doi.org/10.1002/wat2.1526).
4. Solomun, M.K., **Ferreira, C.S.S.,** Eremija, S., Tošić, R., Lazović, N., Češljarić, G. (2021). Long-term fire effects on vegetation and topsoil properties in beech forests of Manjaca Mountain (Western of Bosnia and Herzegovina). *International Journal of Wildland Fire*.
<https://doi.org/10.1071/WF20111> and [doi:10.1071/WF20111_AC](https://doi.org/10.1071/WF20111_AC).
5. Tiller RG, **Destouni G,** Golumbeanu M, **Kalantari Z,** Kastanidi E, Lazar L, Lescot J-M, **Maneas G,** Martínez-López J, Notebaert B, **Seifollahi-Aghmiuni S,** Timofte F, de Vente J, Vernier F and de Kok J-L (2021) Understanding Stakeholder Synergies Through System Dynamics: Integrating Multi-Sectoral Stakeholder Narratives Into Quantitative Environmental Models. *Front. Sustain.* 2:701180. <https://doi.org/10.3389/frsus.2021.701180>.
6. Skoulikidis, N.T.; Nikolaidis, N.P.; Panagopoulos, A.; Fischer-Kowalski, M.; Zogaris, S.; Petridis, P.; Pinaras, V.; Efstathiou, D.; Petanidou, T.; **Maneas, G.**; et al. The LTER-Greece Environmental Observatory Network: Design and Initial Achievements. *Water* 2021, 13, 2971.
<https://doi.org/10.3390/w13212971>.
7. Evans, D., Janes-Bassett, V., Borrelli, P., Chenu, C., **Ferreira, C.S.S.,** Griffiths, R., **Kalantari, Z.,** Keesstra, S., Lal, R., Panagos, P., Robinson, D., **Seifollahi-Aghmiuni, S.,** Smith, P., Steenhuis, T., Thomas, A., Visser, S., 2021. Sustainable futures over the next decade are rooted in soil science. *European Journal of Soil Science*, 1-16. DOI: [10.1111/ejss.13145](https://doi.org/10.1111/ejss.13145).
8. Pezzagno, M., Frigione, B.M., **Ferreira, C.S.S.,** 2021. Reading Urban Green Morphology to Enhance Urban Resilience: A Case Study of Six Southern European Cities. *Sustainability*, 13, 9163. <https://doi.org/10.3390/su13169163>.
9. Nacher, M.E., **Ferreira, C.S.S.,** Jones, M., **Kalantari, Z.,** 2021. Application of the Adaptive Cycle and Panarchy in La Marjalera Social-Ecological System: Reflections for Operability. *Land*, 10, 980. <https://doi.org/10.3390/land10090980>.
10. Ciampa, F., **Seifollahi-Aghmiuni, S., Kalantari, Z., Ferreira, C.S.S.,** 2021. Flood Mitigation in Mediterranean Coastal Regions: Problems, Solutions, and Stakeholder Involvement. *Sustainability*, 13, 474. <https://doi.org/10.3390/su131810474>.
11. Wagner, A., Y. Bennouna, A-M. Blechschmidt, G. Brasseur, S. Chabrillat, Y. Christophe, Q. Errera, H. Eskes, J. Flemming, KM Hansen, A. Inness, J. Kapsomenakis, B. Langerock, A. Richter, N. Sudarchikova, V. Thouret, **C. Zerefos,** 2021. "Comprehensive evaluation of the Copernicus Atmosphere Monitoring Service (CAMS) reanalysis against independent observations: Reactive gases", *Elementa: Science of the Anthropocene* 9(1), <https://doi.org/10.1525/elementa.2020.00171>.
12. Solomos, S., P.T. Nastos, D. Emmanouloudis, A. Koutsouraki, **C. Zerefos,** 2021. "Modeling Study on the Downslope Wind of 'Katevatos' in Greece and Implications for the Battle of Arachova in 1826", *Atmosphere*, 12, 993. <https://doi.org/10.3390/atmos12080993>.
13. Eleftheratos, K., D. Kouklaki, **C. Zerefos,** 2021. "Sixteen Years of Measurements of Ozone over Athens, Greece with a Brewer Spectrophotometer", *Oxygen*, 1, 32-45, <https://doi.org/10.3390/oxygen1010005>.
14. Dimitriadou, L., P. Nastos, **C. Zerefos,** 2021. "Defining Heatwaves with Respect to Human Biometeorology. The Case of Attica Region, Greece", *Atmosphere*, 12, 1100. <https://doi.org/10.3390/atmos12091100>.

NEO PARTICIPATION AT EGU GENERAL ASSEMBLY 2021



1. Bogunovic I., Telak L.J., Dugan I., **Ferreira, C.S.S.**, Pereira P. Tillage-induced management impact on soil properties and initial soil erosion in degraded calcareous soils in Mediterranean fig orchard. Virtual European Geoscience Union (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-1309>.
2. Boulet A.K., Alarcão C., **Ferreira C.**, Veiga A., Campos L., Ferreira A., Hessel R. Introduction of legume cover crops practice in intensive grain corn crop system to mitigate soil threats in the Mediterranean region. Virtual European Geoscience Union General Assembly (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-6199>.
3. Dudnikova T., Minkina T., Vasilyeva G., Bauer T., Barakhov A., Sushkova S., Pinskii D., Mazarji M., **Ferreira C.S.S.** Comparative sorption of benzo[a]pyrene by soil and carbonaceous adsorbents. Virtual European Geoscience Union (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-15977>.
4. **Ferreira, C.S.S., Seifollahi-Aghmiuni, S., Destouni, G.**, Solomun, M.K., Ghajarnia, N., Ferreira, A.J.D., **Kalantari, Z.** Status, processes, and drivers of soil degradation in the Mediterranean region. Virtual European Geoscience Union General Assembly (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-10093>.
5. Ghajarnia, N., **Kalantari, Z., Destouni, G.** Is large-scale terrestrial hydrological cycling well represented in Earth System Models? Virtual European Geoscience Union (vEGU), April 2021. <https://doi.org/10.5194/egusphere-egu21-5332>
6. Isaka S., Hendrychová M., Campos I., Bastos A.K., Pelayo O.G., Caetano A., Abrantes N., Martins M., Jongen M., **Ferreira C.S.S.**, Verheijen F. Can biochar restore soil quality in a degraded forest and vineyard soil in a one-year percolation lysimeter study, in Portugal? Virtual European Geoscience Union (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-10400>.
7. Klíč R., **Ferreira C.S.S.**, Ferreira A., Kravka M. Comparison of water-stable aggregates on different soil types and land-uses in a Portuguese Mediterranean catchment. Virtual European Geoscience Union (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-1787>.
8. **Maneas G.**, Kastanidi E., Panagopoulos Y., **Berg H., Manzoni S.**, De Kok J.L., Viaene P. Systems-Dynamic modelling for salinity restoration in wetlands. The case of SW Messinia, Greece. Virtual European Geoscience Union (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-16165>.
9. Pinto, L.V., **Ferreira, C.S.S.**, Pereira, P. Environmental and socio-economic factors influencing the use of urban parks in Coimbra (Portugal). Virtual European Geoscience Union (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-1042>.
10. **Seifollahi-Aghmiuni, S., Kalantari, Z., and Destouni, G.** Use of co-created causal loop diagrams and fuzzy-cognitive scenario analysis for water quality management. Virtual European Geoscience Union (vEGU), April 2021. <https://doi.org/10.5194/egusphere-egu21-5210>.
11. Solomun M.K., **Ferreira, C.S.S.**, Ristić R., **Kalantari Z.**, Rahmati O. Nature-based solution for ecosystem restoration in Southern Europe. Virtual European Geoscience Union (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-3908>.
12. Walsh R.P.D., **Ferreira C.S.S.**, Blake W. H., Higon S., Ferreira A.J.D. Multi-fractional sediment fingerprinting in monitoring sediment sources in a peri-urban Portuguese catchment. Virtual European Geoscience Union (vEGU), April 2021, <https://doi.org/10.5194/egusphere-egu21-16224>.