EMME-CARE 2022 Autumn School

Organized by CARE-C & CyI Graduate School

Topic: Analysis of aerosols, air pollution and their sources in the Eastern Mediterranean

General Information

Location	Dates	Schedule
The Cyprus Institute	31 Oct –11 Nov 2022.	Check separate document

Course description

The scientific theme of the course is " Analysis of aerosols, air pollution and their sources in the Eastern Mediterranean ". The course involves a few short relevant lectures, with the main emphasis placed on intensive group work with support from the course teachers. The students will be divided into small groups, each having specific research questions related to the course theme. Students will analyze relevant data and present their analysis outcome in the form of a PowerPoint presentation during the course, as well as in the form of a written report to be submitted after the end of the course. *Note that students are expected to spend time on writing the report after the intensive course period.*

Intended learning outcomes

The course is designed to emulate real scientific research. During the course students will learn:

- How to access atmospheric data from repositories and online databases
- How to perform statistical analysis in practice using advanced programming tools such as MATLAB or Python
- How to combine observational data with theoretical frameworks
- How to draw and evaluate scientific conclusions based on the data analysis
- What good group work is, how to work effectively in a group, and how to learn collaboratively
- What multidisciplinary scientific research is and how to collaborate with others with different expertise / from different areas of science to your own
- How to present their findings in a platform presentation
- How to write a scientific report in collaboration with others

Course Assessment

Credits and workload: 5 ECTS, 125 h study load, 85 h during the intensive course and 40 h writing the course report after the intensive course.

Accrediting body: The Cyprus Institute

The course is graded on a scale fail – pass.

The assessment is based on the course report and returning of course feedback questionnaire. Students will be graded based on the performance of their group. All group members will be given the same grade. This method of assessment is selected as it mirrors the real scientific process in which results are reported in written form in peer reviewed scientific articles. This allows students to practice and improve their scientific writing skills. As real scientific papers have many authors, the course report also allows students to experience a real-world situation of writing collaboratively.

The format and deadlines for making the course report will be decided during the course.

Students will receive their grade, after filling and returning the course feedback questionnaire at the end of the course.

Course Materials

Reading material prior to the course

The below articles cover and provide background for the topics that will be discussed during the course. It may be useful to glance through the topics, introduction section, and figures of more than one paper before the course, though this is not a requirement. If you do not have access to any of the articles, contact the organizers at t.jokinen@cyi.ac.cy or rima.baalbaki@helsinki.fi and we will send it to you.

Aerosol and trace gas related
- Kulmala et al. (2013), Direct observations of atmospheric aerosol nucleation.
- Baalbaki et al., (2021), Towards understanding the characteristics of new particle formation in the Eastern Mediterranean.
- Pikridas et al., (2018), Spatial and temporal (short and long-term) variability of submicron, fine and sub-10 μm particulate matter (PM1, PM2.5, PM10) in Cyprus.
- Mallik et al., (2018), Oxidation processes in the eastern Mediterranean atmosphere: evidence from the modelling of HOx measurements over Cyprus.
- Sciare et al., (2008), Long-term measurements of carbonaceous aerosols in the Eastern Mediterranean: evidence of long-range transport of biomass burning.
- Shaheen et al., (2021), Winter AOD trend changes over the Eastern Mediterranean and Middle East region.
- Heikkinen et al. (2020), Long-term sub-micron aerosol chemical composition in the boreal forest: inter- and intra-annual variability.
- Kulmala et al. (2013), Direct observations of atmospheric aerosol nucleation.
- Luoma et al. (2019), Over a 10-year record of aerosol optical properties at SMEAR II.
- Nieminen et al. (2014), Trends in atmospheric new-particle formation: 16 years of observations in a boreal-forest environment.

Trace gas and VOC related
- Kleanthous et al., (2013), On the temporal and spatial variation of ozone in Cyprus.
- Barkley et al., (2017), OMI air-quality monitoring over the Middle East.
- Kaltsonoudis et al., (2016), Temporal variability and sources of VOCs in urban areas of the eastern Mediterranean.
- Debevec et., (2017), Origin and variability in volatile organic compounds observed at an Eastern Mediterranean background site (Cyprus).
- Derstroff et al., (2017), Volatile organic compounds (VOCs) in photochemically aged air from the eastern and western Mediterranean.
- Liakakou et al., (2007), Isoprene above the Eastern Mediterranean: Seasonal variation and contribution to the oxidation capacity of the atmosphere.

Meteorology related
- Lelieveld et al., (2016), Strongly increasing heat extremes in the Middle East and North Africa (MENA) in the 21st century.
- Zittis et al. (2021), Climate change and weather extremes in the Eastern Mediterranean and Middle East.
- Ntoumos et al., (2022), Projected Air Temperature Extremes and Maximum Heat Conditions Over the Middle-East-North Africa (MENA) Region.

Statistical methods

- Mikkonen et al. (2019), Effects of uncertainties and number of data points on line fitting – a case study on new particle formation.
- Laarne et al. (2021), Non-linear correlation detection with mutual information.

Data and course material

Many continuous measurements are available from the Cyprus Atmospheric Observatories (CAO): https://emme-care.cyi.ac.cy/data/

Cyprus air quality data (NO, NO_2, NOx, SO_2, O_3, CO, PM_{10}, $PM_{2.5}$, C_6H_6) can be found from: https://www.data.gov.cy/node/1451?language=en

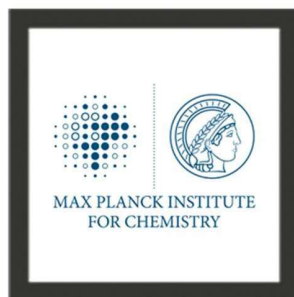Historical air quality data: https://www.data.gov.cy/node/3849?language=en

Other course material like lectures and presentations, analysis results, codes etc. will be shared during the course.

Other information

Practical information about attending the course in Cyprus will be shared with accepted students

Questions

For more information, please contact: t.jokinen@cyi.ac.cy and rima.baalbaki@helsinki.fi