

MHRD Scheme on Global Initiative on Academic Network (GIAN)

Course title: Life and lightning: atmospheric electricity implications for biological systems and human health

Invited faculty:

Prof. Yoav Yair / Dean, School of Sustainability, Reichman University, Israel

Dates: 5 – 10 March 2023

No of hours: 20

Maximum Number of participants: 50

Overview

This course deals with the electrical nature of the atmosphere and its implications for human safety and well-being. The atmosphere is a weakly-electrified medium and this affects all life on earth. In fair-weather conditions, there exists an electric field with an average strength at sea level of 130 V/m, that changes periodically along daily and annual patterns. During episodes of pollution or dust storms, this electric field is greatly enhanced, adversely affecting sensitive populations (e.g., by migraines). In stormy regions, thunderstorms, and lightning pose acute natural hazards, lethal and destructive with severe implications on urban and rural societies. They are often accompanied by hail and flash floods that entail significant economic and human losses. Public health effects of thunderstorms - on top of direct lightning strikes of people - may be the result of flooding, fallen trees, objects hurled by strong winds, impact of heavy hail, and the consequences of disruptions to daily routines such as industrial accidents, loss of electricity, car accidents and limitation to air travel. Lightning is responsible for igniting forest fires and affecting natural habitats. If occurring during the flowering season of specific plants thunderstorm downdrafts may carry pollen and ruptured fragments to the ground. This may result in "*Thunderstorm Asthma*" epidemics which are expressed as severe respiratory problems, especially in sensitive populations (infants, elderly, and people with prior allergic susceptibility). The course will focus on human safety and health issues, considering the large number of lightning fatalities in India.

Objectives

The course objectives are as follows:

1. Introducing students to key concepts that are used in atmospheric electricity, and giving them a broad overview of modern aspects of lightning research
2. Familiarizing students with biological implications of atmospheric electricity.
3. Allowing the participants to utilize available lightning information for research and applied projects, related to aviation, human safety, and forecasting
4. Providing an understanding of inter-relationships and feedback mechanisms between cities, pollution, thunderstorms, and lightning
5. Understanding of lightning effects on biological systems, and applying safety issues for avoidance of danger and damage

Fee structure:

The participation fees for taking the course are as follows:

Participants out of India: US \$500

Industry/Research Organizations: Rs 2000

Faculty from academic Institutions: Rs 1500

Students: Rs 1000/-

The above fees include all instructional materials and on campus wi-fi access, breakfast and lunch.

Course Outline

Day 1 - March 6th, 2023	Lecture 1: 9:30 to 10:30 AM – Introduction to atmospheric electricity Lecture 2: 10:45 to 11:45 AM - The electric field in fair weather and disturbed conditions Tutorial 1: 2:00 to 4:00 PM – Applications of electric field data
Day 2 – March 7th, 2023	Lecture 3: 9:30 to 10:30 AM - Global lightning activity in era of climate change Lecture 4: 10:45 to 11:45 AM – Lightning discharge properties Tutorial 2: 2:00 to 4:00 PM - Analyzing lightning and rain data and establishing inter-relationships
Day 3 – March 8th, 2023	Lecture 5: 9:30 to 10:30 AM - Meteorology and lightning, severe weather Lecture 6: 10:45 to 11:45 AM – Emergence of life, lightning on earth and in the solar system Tutorial 3: 2:00 to 4:00 PM - Mentored student teamwork (in groups of 4) on selected problems
Day 4 – March 9th, 2023	Lecture 7: 9:30 to 10:30 AM - Thunderstorm asthma – theories and practice Lecture 8: 10:45 to 11:45 AM - Lightning safety, medical implications of lightning strikes Lecture 9: 11:45-12:45 Bioaerosols and health hazards Varsha Kelkar Mane Tutorial 4: 2:00 to 4:00 PM – Lightning in India
Day 5– March 10th, 2023	Lecture 10: 9:30 to 10:30 AM - Cities, pollution, and lightning Lecture 11: 10:45 to 11:45 AM - Summary of course, review of future trends in research and applications Tutorial 5: 2:00 to 4:00 PM - Student topical presentations on their selected project

You can attend if you are:

- Graduate and Masters' students in sciences, health care or engineering
- Executives and managers in disaster and risk management, public health experts with background (degree) in the Natural Sciences
- Faculty and researchers from universities and research institutions interested in climate readiness.

Certificates of participation will be given upon completion.



Teaching Faculty

Prof. Yoav Yair (b.1958) is the Dean of the School of Sustainability at Reichman University (IDC Herzliya). His main research fields include atmospheric electricity, lightning (on Earth and other planets), space weather, solar-terrestrial relations, sprites (TLEs) and climate change. During 1998-2003 he was the project coordinator for the Mediterranean Israeli Dust Experiment (MEIDEX), conducted on board the space shuttle Columbia during its last tragic mission. Afterwards, he led the ILAN campaigns (Imaging of Lightning And Nocturnal emissions) for studying sprites in the Eastern Mediterranean, involving multiple observation points and coordinated optical and electromagnetic measurements. In 2011, he conducted observations of lightning and TLEs from the International Space Station (ISS) in collaboration with Japan's Space Agency [JAXA] and in 2015, repeated it with the European Space Agency [ESA].

In 2022 he repeated the experiment with Israel 2nd astronaut on board the ISS. Prof. Yair is the author of several textbooks in the atmospheric sciences and authored (and co-) over 105 refereed papers. He is an experienced session chair, convener and organizer of numerous scientific sessions in lightning research in international conferences and a board member of the International Commission on Atmospheric Electricity (ICAE). Prof. Yair is an enthusiastic science communicator, gives public lectures and popular radio talks on various topics in planetary and earth science, climate change and space physics, and is being frequently interviewed by the Israeli media on related topics. In September 2016 he taught the GIAN course "Selected topics in atmospheric electricity" at the University of Mumbai. Full publication list may be found [\[here\]](#)



Host Faculty

Prof. Varsha Kelkar Mane has been a faculty and head at the department of Biotechnology, the University of Mumbai since over a decade and more. She has been an elected Fellow of the Royal Society of Chemistry as well as a Life Fellow of the Indian Chemical Society. Her demonstrated expertise spans the gamut of areas of biochemistry, environmental and biotechnology. She has over 40 publications in national as well as international journal, expounding managerial experience at National and International level and has mobilized multi-million-dollar projects within last 5 years. She pioneered scientific research underlining the role of microbial ecosystems in deterioration as well as preservation of archival papers, polymers, rock surfaces as well as bone fossilization in India. She has developed green air purifiers, and green/ zero waste method of production of wool from bamboo, and agro industry waste. The details of the profile can be found [\[here\]](#)

Contact Details of Host Faculty

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