surface ocean solas lower atmosphere study

# Report for the year 2020 and future activities

**SOLAS *Israel***
***compiled by: Yoav Lehahn***

| **First things first…Please tell us what the IPO may do to help you in your current and future SOLAS activities. ?** |
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## PART 1 - Activities from January 2020 to Jan/Feb 2021

### 1. Scientific highlight

Airborne microplastic particles in the remote marine atmosphere

Anthropogenic pollution from marine microplastic particles is a growing concern, both as a source of toxic compounds, and because they can transport pathogens and other pollutants. Airborne microplastic particles were previously observed over terrestrial and coastal locations, but not in the remote ocean. Scientists associated with SOLAS-Israel and other colleagues have collected ambient aerosol samples in the North Atlantic Ocean, including the remote marine atmosphere, during the TaraPacific expedition in May-June 2016, and chemically characterized them using micro-Raman spectroscopy. The scientists have detected a range of airborne microplastics, including polystyrene, polyethylene, poly-propylene, and poly-silicone compounds. Polyethylene and polypropylene were also found in seawater, suggesting local production of airborne microplastic particles. Terminal velocity estimations and back trajectory analysis support this conclusion. For technical reasons, only particles larger than 5μm, at the upper end of a typical marine atmospheric size distribution,were analyzed, suggesting that the analyses underestimate the presence of airborne microplastic particles in the remote marine atmosphere.

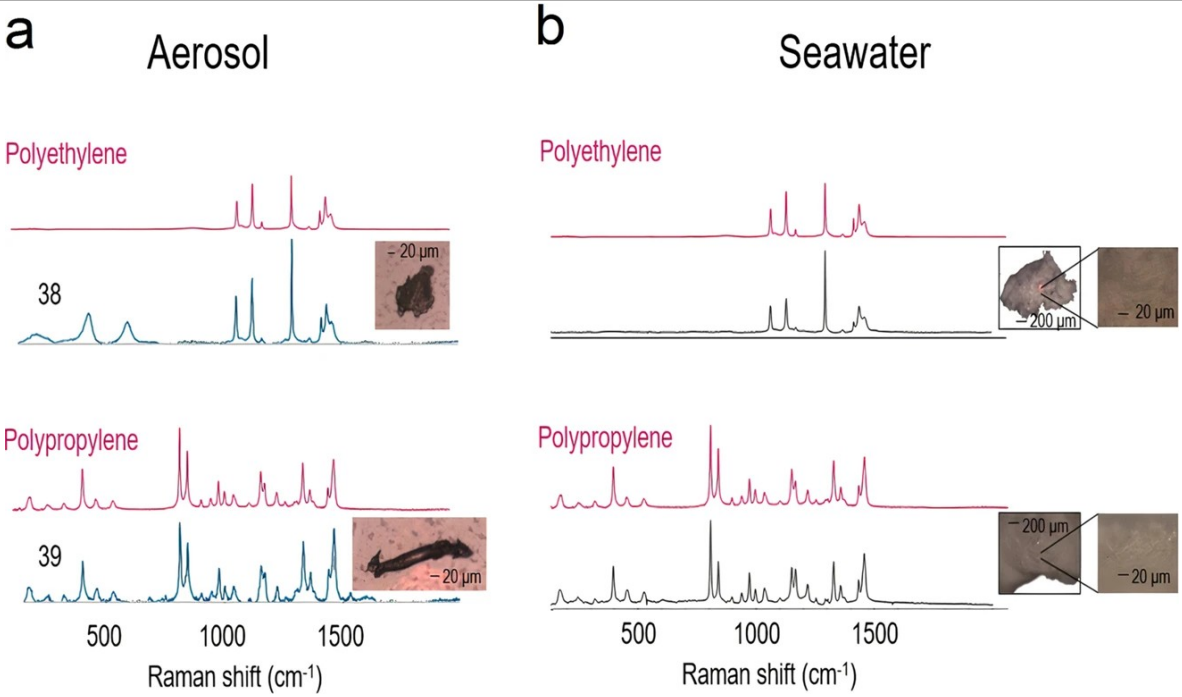


Figure: Comparison between airborne and seawater microplastic particles. a Raman spectra of airborne microplastic samples collected between June 22nd and 23rd 2016, between 26°N 66°W and 26°N 72°W (filters 38–39). b Raman spectra of seawater microplastic samples collected on June 22nd, 2016 at 26°N 68°W. Optical microscope images are presented for both airborne and seawater particles. Close up images of the locations where the Raman spectra were retrieved in the seawater microplastic particles are presented. The Raman spectra of the corresponding plastic polymer standards are shown in magenta.

Citation: Trainic, M., Flores, J.M., Pinkas, I. et al. Airborne microplastic particles detected in the remote marine atmosphere. Commun Earth Environ **1,** 64 (2020). https://doi.org/10.1038/s43247-020-00061-y

**2. Activities/main accomplishments in 2020 (e.g., projects; field campaigns; workshops and conferences; model and data intercomparisons; capacity building; international collaborations; contributions to int. assessments such as IPCC; collaborations with social sciences, humanities, medicine, economics and/or arts; interactions with policy makers, companies, and/or journalists and media).**

Israeli scientists are involved in SOLAS-related activities in the adjacent Mediterranean and Red sea, as well as in other parts of the World Ocean. A major contribution to SOLAS research in the easternmost part of Mediterranean comes from a net of marine stations located off the Israeli coast. The net consists of DEEPLEV that was launched by Bar-Ilan University and the Israel Oceanographic and Limnological Research (IOLR), and THEMO that was launched by Texas A&M and the University of Haifa. DEEPLAV is a permanent marine research station ('mooring'), the first of its kind in this region, placed off the coast of Israel, 50 kilometers west of Haifa. Anchored to the seabed at a water depth of 1500 m, the station contains a large number of state-of-the-art measuring instruments, spread over a cable running from the seabed almost to the sea surface, enabling continuous study of the physical and ecological system in the eastern Mediterranean Sea. THEMO is an observatory comprising of two sensor arrays attached to 2.25m diameter surface buoys. THEMO includes an operational shallow mooring (125 m) in the coastal zone of the Levant Basin of the Mediterranean Sea, and a deep mooring (1500 m) located 50 km from the northern shores of Haifa after the continental shelf. The two moorings have mealtime RF communication capabilities, and the data is received at a shore station and is displayed at near-real time at the University of Haifa. The data from the marine stations is complemented by monthly interdisciplinary

oceanographic cruises, which were carried out by researchers from different research institutes in Israel. In the Gulf of Aqaba, at the northern tip of the Red Sea, several SOLAS-related activities are performed by Inter-University Institute (IUI) researchers : (1) ongoing dust sampling time series, the first is a weekly resolved trap that has been deployed since 2006 and is operated by the National Monitoring Program, and the second is deployed for short time periods (~1-2 days) only during time of interest (e.g., dust storms) in order to obtain a more clear compositional fingerprint of the dust during different atmospheric settings; (2) Ongoing sediment trap mooring deployed at the north Gulf of Aqaba, a deep oligotrophic sea. This mooring has been deployed continuously since early 2014 and collects a coupled monthly and daily resolved samples. The samples are used, amongst other objectives, to identify the source to sink signal transfer of terrigenous particles (primarily atmospheric dust), and evaluate the connection between dust input, export production rates, and water column biogeochemical cycles; (3) Trace metal cycles and anthropogenic impacts in the Gulf of Aqaba. Trace metal concentrations and the Pb isotopic composition are measured monthly and sub-monthly in the dissolved phase of seawater profiles in the Gulf of Aqaba. The results are evaluated in the context of dust inputs and water column productivity and physical configuration.

**3. Top 5 publications in 2020 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.**

Kessler, N., Armoza-Zvuloni, R., Wang, S. et al. Selective collection of iron-rich dust particles by natural Trichodesmium colonies. *ISME* J **14,** 91–103 (2020). https://doi.org/10.1038/s41396-019-0505-x

Shaked, Y., Buck, K.N., Mellett, T. et al. Insights into the bioavailability of oceanic dissolved Fe from phytoplankton uptake kinetics. *ISME* J **14,** 1182–1193 (2020). https://doi.org/10.1038/s41396-020-0597-3

Trainic, M., Flores, J.M., Pinkas, I. et al. Airborne microplastic particles detected in the remote marine atmosphere. *Commun Earth Environ* **1,** 64 (2020). https://doi.org/10.1038/s43247-020-00061-y

Asfur, M., Silverman, J. & Price, C. Ocean acidification may be increasing the intensity of lightning over the oceans. *Sci Rep* **10,** 21847 (2020). https://doi.org/10.1038/s41598-020-79066-8

Rahav E, Paytan A, Mescioglu E, Bar-Zeev E, Martínez Ruiz F, Xian P, Herut B. Bio-Aerosols Negatively Affect Prochlorococcus in Oligotrophic Aerosol-Rich Marine Regions. *Atmosphere* **11**(5):540 (2020). https://doi.org/10.3390/atmos11050540

**4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2020? If yes, who? How did you engage?**

## PART 2 - Planned activities for 2021 and 2022

**1. Planned major national and international field studies and collaborative laboratory and modelling studies (incl. all information possible, dates, locations, teams, work, etc.).**

**2. Events like conferences, workshops, meetings, summer schools, capacity building etc. (incl. all information possible).**

The School of Marine Sciences at the University of Haifa is holding a graduate course on Edvanced Topics in Surface Ocean - Lower Atmosphere Research. In the coming academic year it is intended to make this course an inter-university endeavor, thus substentially increasin the number of students exposed to different aspects of SOLAS science.

**3. Funded national and international projects/activities underway.**

A new research project titled The Eastern Mediterranean Sea Centre- An Early-Warning Model-System for our Future Oceans: EMS Future Ocean REsearch (EMS FORE), will be launched in the coming monthes in the frame a German-Israeli Helmholtz International Laboratory. The goals of EMS FORE target fundamental questions regarding the impacts of climate change and anthropogenic stressors on our oceans and specifically on the EMS. EMS FORE focuses on the complex oligotrophic EMS, and intends to draw a direct linkbetween anthropogenic pressures and changes in biogeochemical processes and ecosystem structure and function in this ocean region.

**4. Plans / ideas for future national or international projects, programmes, proposals, etc. (please indicate the funding agencies and potential submission dates).**

**5. Engagements with other international projects, organisations, programmes, etc.**

**Comments**