surface ocean solas lower atmosphere study

# Report for the year 2019 and future activities

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

*This report has two parts:*

***- Part 1:*** *reporting of activities in the period of January 2019 - Jan/Feb 2020*
***- Part 2:*** *reporting on planned activities for 2020 and 2021.*

*The information provided will be used for reporting, fundraising, networking, strategic development and updating of the live web-based implementation plan. As much as possible, please indicate the specific SOLAS 2015-2025 Science Plan Themes addressed by each activity* **or specify an overlap between Themes or Cross-Cutting Themes.**

1 Greenhouse gases and the oceans;
2 Air-sea interfaces and fluxes of mass and energy;
3 Atmospheric deposition and ocean biogeochemistry;
4 Interconnections between aerosols, clouds, and marine ecosystems;
5 Ocean biogeochemical control on atmospheric chemistry;
Integrated studies of high sensitivity systems;
Environmental impacts of geoengineering;
Science and society**.**

***IMPORTANT****: This report should reflect the efforts of the SOLAS community in the* ***entire country*** *you are representing (all universities, institutes, lab, units, groups, cities).*

| **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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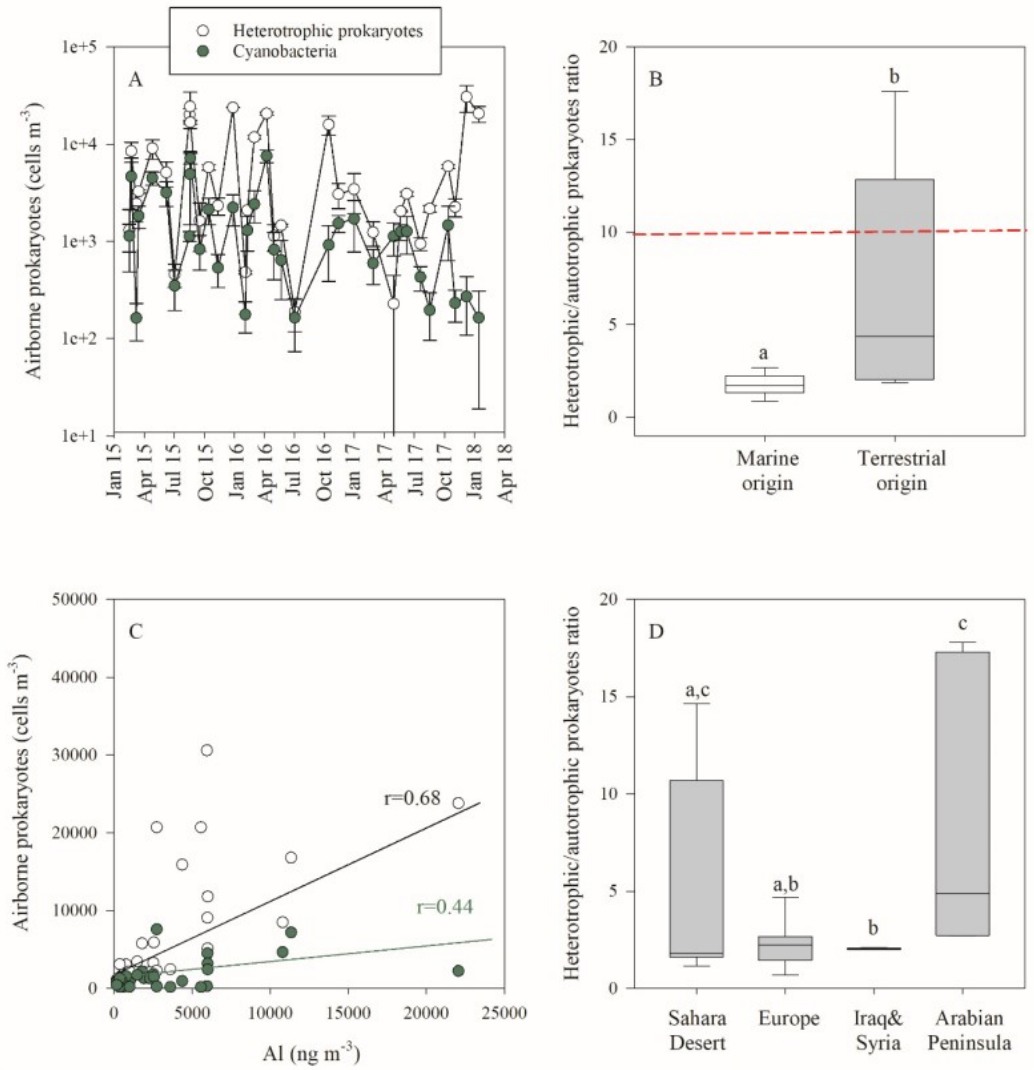
## PART 1 - Activities from January 2019 to Jan/Feb 2020

### 1. Scientific highlight

Airborne prokaryotes are transported along with dust/aerosols, yet very little attention is given to their temporal variability above the oceans and the factors that govern their abundance. We analyzed the abundance of autotrophic (cyanobacteria) and heterotopic airborne microbes in 34 sampling events between 2015–2018 at a coastal site in the SE Mediterranean Sea. We show that airborne autotrophic (0.2–7.6 cells × 10 3 $m^{-3}$ ) and heterotrophic (0.2–30.6 cells × 10 3 $m^{-3}$ ) abundances were affected by the origin and air mass trajectory, and the concentration of dust/aerosols in the air, while seasonality was not coherent. The averaged ratio between heterotrophic and autotrophic prokaryotes in marine-dominated trajectories was ~1.7 ± 0.6, significantly lower than for terrestrial routes (6.8 ± 6.1). Airborne prokaryotic abundances were linearly and positively correlated to the concentrations of total aerosol, while negatively correlated with the aerosol's anthropogenic fraction (using Pb/Al or Cu/Al ratios as proxies). While aerosols may play a major role in dispersing terrestrial and marine airborne microbes in the SE Mediterranean Sea, the mechanisms involved in the dispersal and diversity of airborne microorganisms remain to be studied and should include standardization in collection and analysis protocols.




Temporal variability of dust-associated airborne heterotrophic (white) and autotrophic (green) bacteria between 2015–2018 at the SE Mediterranean coast. Values presented are the averages and corresponding standard deviation in each time point (n = 3). (B) The relationship between autotrophic and heterotrophic airborne prokaryotes based on air-mass back trajectories. The dashed red line signifies the "typical" heterotrophic to autotrophic prokaryotic ratio in the SE Mediterranean seawater. (C) The relationship between Al concentration and airborne heterotrophic (white) and autotrophic (green) bacteria (Pearson linear regression, $p < 0.05$). (D) The relationship between autotrophic and heterotrophic airborne prokaryotes based on the main backward trajectory prior dust/aerosols collection. The letters above the box plots represent significant differences for mean values between sampling sites.

**2. Activities/main accomplishments in 2019 (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 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 2019 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.**

Liberzon, D., Vreme, A., Knobler, S., and Bentwich, I. (2019). Detection of breaking waves in single wave gauge records of surface elevation fluctuations. *Journal of Atmospheric and Oceanic Technology*, JTECH-D-19-0011.1. https://doi.org/10.1175/JTECH-D-19-0011.1.

Chien C-T., Benaltabet T., Torfstein A. and Paytan A. (2019) Contributions of atmospheric deposition to Pb concentration and isotopic composition in seawater and particulate matter in the Gulf of Aqaba, Red Sea. *Environmental Science & Technology* 53, 6162-6170.

Tzafriri-Milo R., Benaltabet T., Torfstein A. and Shenkar N. (2019) The potential use of invasive ascidians for biomonitoring heavy metal pollution. *Frontiers in Marine Science* 6, 1-17.

Rahav E., Belkin,N., Paytan, A. and Herut, B. (2019) The relationship between air-mass trajectories and the abundance of dust-borne prokaryotes at the SE Mediterranean sea. *Atmosphere* 10 (5), 280.

Mescioglu E., et al. (2019), Dust-Associated Airborne Microbes Affect Primary and Bacterial Production Rates, and Eukaryotes Diversity, in the Northern Red Sea: A Mesocosm Approach. *Atmosphere* 10, 358; doi:10.3390/atmos10070358.

**4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2019? If yes, who? How did you engage?**

## PART 2 - Planned activities for 2019/2020 and 2021

**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).**

Part of the annual meeting of the Israeli Association for Aquatic Sciences (IAAS) will be dedicated to discussion on-going and planned SOLAS activities. In addition, a course on “advanced topics in surface-ocean lower-atmosphere science”, which will be open to students from all academic institutes in Israel, is planned to be given at the University of Haifa.

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

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| **4. Plans / ideas for future national or international projects, programmes, proposals, etc. (please indicate the funding agencies and potential submission dates).** |
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| **5. Engagements with other international projects, organisations, programmes, etc.** |
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| **Comments** |
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