surface ocean **solas** lower atmosphere study

Report for the year 2017 and future activities

SOLAS *'Mexico'*
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This report has two parts:

*- **Part 1:** reporting of activities in the period of January 2017 – Jan-Feb 2018*
*- **Part 2:** reporting on planned activities for 2018/2019 and 2020.*

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;
> 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).*
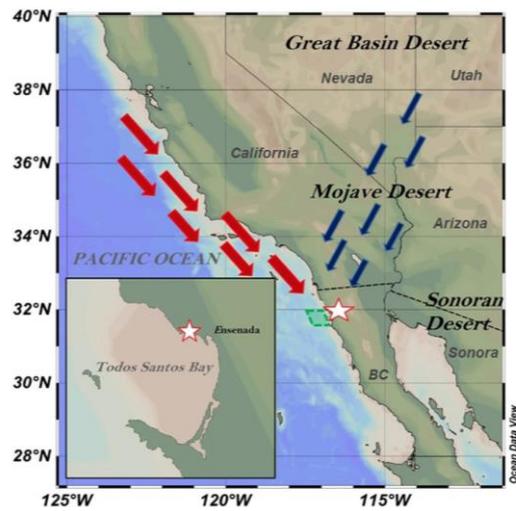
PART 1 - Activities from January 2017 to Jan/Feb 2018
1. Scientific highlight
Describe one scientific highlight with a title, text (max. 200 words), a figure with legend and full references. Please focus on a result that would not have happened without SOLAS, and we are most interested in results of international collaborations. (If you wish to include more than one highlight, feel free to do so).

The magnitude and temporal variability of mineral dust deposition and its associated Fe and Mn inputs to coastal waters of the California Current System (Fig.1) has been scarcely investigated. In this work a summer school SOLAS PHD student reported a 5 year time series (April 2010 to December 2014) of mineral dust (F_{dust}), Fe (F_{Fe}), and Mn (F_{Mn}) fluxes to the coastal zone of the southern CCS. Atmospheric deposition displayed a strong seasonal trend, with lowest F_{dust}, F_{Fe}, and F_{Mn} during the warm season (May–October), a period dominated by strong moisture-laden winds of oceanic origin. In contrast, the highest F_{dust}, F_{Fe}, and F_{Mn} were recorded during the cool season (November–April), a period characterized by strong winds devoid of moisture coming from the mainland (Fig.2). Our analysis suggests that Santa Ana Wind events could contribute with ∼15%, 20%, and 24%, respectively, to the total annual input of dust, Fe and Mn to the region.

Besides, atmospheric soluble Fe inputs are equivalent to between 11% (warm season) and 35% (cool season) of the dissolved Fe supplied by upwelling. Our calculations indicate that atmospheric Fe deposition could explain between ~5% (warm season) and 15% (cool season) of primary production reported for the southern CCS, suggesting that this route could also be an important input of Fe for primary producers in this region. Finally, the average F_{dust}, F_{Fe}, and F_{Mn} for the cool seasons showed a positive interannual trend that was significantly correlated with an intensification of drought conditions over the period 2010–2014 in northwest of Mexico and southwest of the United States.

Figure 1: Study area and position of the sampling station in Todos Santos Bay. Arrows indicate the dominant wind directions observed during the warm (May–October; red) and cool (November–April; blue) seasons in our study over the period 2010–2014. The green polygon represents the area for calculation of the relative contributions of dissolved Fe and Mn fluxes associated with upwelling and atmospheric dust deposition.
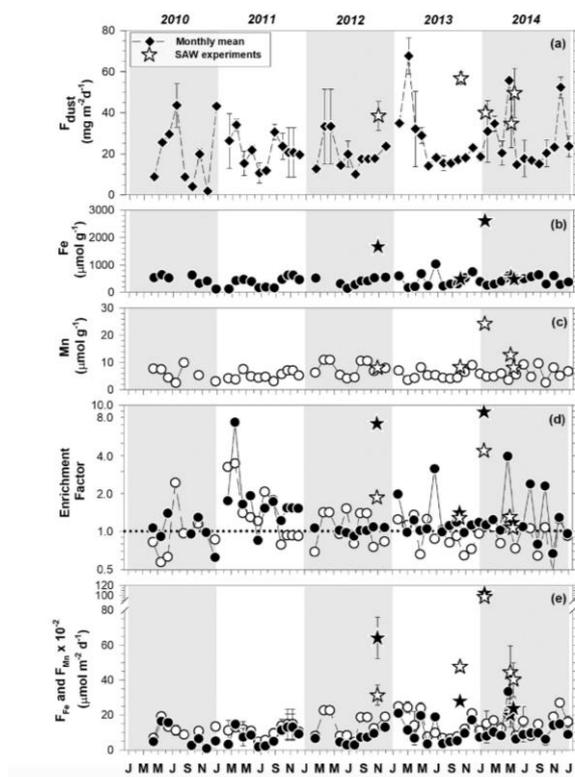

Figure 2: Time series of (a) monthly atmospheric dust deposition (F_{dust}), (b) Fe and (c) Mn dust concentration, (d) Fe (●) and Mn (O) enrichment factor (EF) values, and (e) atmospheric Fe (●_) and Mn (O) fluxes over the period of 2010–2014. In all plots, the stars are the results of experiments carried out during the Santa Ana Wind conditions. Error bars represent standard deviations of the monthly means. The horizontal dotted line in Figure 2d represents the value of EF=1; values higher and lower than 1 represent enrichment and impoverishment, respectively, with respect to the average background values reported for the Earth's crust (Li & Schoonmaker, 2003).

Citation: A Félix-Bermúdez et al., (2017). Atmospheric Inputs of Iron and Manganese to Coastal Waters of the Southern California Current System: Seasonality, Santa Ana Winds, and Biogeochemical Implications. JGR. doi.org/10.1002/2017JC013224

2. Activities/main accomplishments in 2017 (projects, field campaigns, events, model and data intercomparisons, capacity building, international collaborations, contributions to int. assessments such as IPCC, interactions with policy makers or socio-economics circles, social sciences, and media).

1) A FRENCH-MEXICAN OCEAN WORKSHOP was hosted by the Universidad Nacional Autónoma de Mexico (UNAM)**,** on its Mexico City's campus, on September 19-20 2017. This event, organized by UNAM's Institute of Marine and Limnology Sciences (ICMyL), the Scientific section of the French Embassy in Mexico, in partnership with IRD, CNRS and the French Ocean-Climate Platform, brought together about 40 participants, including 14 French researchers, representing among others the joint research units (UMR) CRIOBE [1], LEMAR [2], BOREA [3], LOCEAN [4], LEGOS [5] and MARBEC [6]. CNRS was also represented by Bruno Blanke - Deputy Scientific Director at INSU [7] -, Thierry Bouvier - Deputy Scientific Director at INEE [8], and Xavier Morise, Director of the North-America Office, located in Washington DC.

The main objectives were to :

- Share scientific knowledge and expertise – Assess gaps, needs and complementarities
- Define collaborative efforts on issues of common interests, such as Ocean-climate, Ecology and Marine Biology, Observatories and Natural Protected Areas
- Identify specific initiatives and projects, including academic and training actions, that could be undertaken on a bilateral basis

Despite the earthquake that struck Mexico on September 19 and had an impact on the course of the workshop (relocation, program and format changes…), the dynamics of exchanges between participants were not affected. Thus, after the two days of lively and fruitful discussions, participants agreed that French and Mexican Ocean research communities should join forces to develop collaborative endeavours in both the Pacific Ocean, the Caribbean Sea and the Atlantic Ocean, on the following main thematic :

- Climate variability, ocean circulation and biogeochemical cycles, in particular on oxygen related issues (hypoxia/anoxia, oxygen minimum zones, deoxygenation of the ocean), ocean dynamics, the carbon cycle (blue carbon, acidification), climate regionalization, and extreme events (hurricanes, floods, droughts…)
- Ecosystem degradation and anthropization, including pollution, eutrophication, habitat loss (coral reefs, mangroves), coastal issues (erosion, sea level rise]
- Ecology and Biodiversity, notably on domains such as fisheries, conservation and remediation (marine protected areas), connectivity, taxonomic and functional diversity, and human health

    Participants also concurred that modelling (climate, regional oceans), technological developments (sensors, probes, platforms…) and time-series observations are instrumental for the scientific partnerships that they intent to establish. They also emphasized that these partnerships must include cross-cutting topics, such as education

and training or societal impacts, notably towards decision-making.

[1] Centre de recherches insulaires et observatoire de l'environnement (CNRS, EPHE, UPVD)
[2] Laboratoire des sciences de l'environnement marin (CNRS, IRD, Ifremer, UBO)
[3] Biologie des organismes et écosystèmes aquatiques (CNRS, MNHN, IRD, UPMC, UCN, UAG)
[4] Laboratoire d'océanographie et du climat : expérimentations et approches numériques (CNRS, UPMC, MNHN, IRD)
[5] Laboratoire d'études en géophysique et océanographie spatiales (CNRS, UPST, IRD, CNES)
[6] Centre pour la diversité marine, l'exploitation et la conservation (CNRS, UM, IRD, Ifremer)
[7] INSU = National Institute for Earth Sciences and Astronomy
[8] INEE = Institute of Ecology and Environment

2) The first Latin-American Symposium held by the LAOCA Network on ocean acidification took place in Buenos Aires, Argentina, from October 24- 26, 2017. Students and researchers had discussions about ocean observing systems, modeling and regional projections, physiological and ecological effects of ocean acidification (taking into consideration organisms and ecosystems) as well as the human dimensions of this phenomenon. This was the first version, and our aim is that the entire community working on these topics should get to know each other and strengthen future collaborative projects", explained the scientist. The LAOCA Network is very important at a Latin-American level, because it brings together scientists with common interests and objectives regarding ocean acidification; this makes it possible to create a collaborative network and also allows each group to present what they are doing in their countries, showing the results of their research on ocean acidification in Latin America. For further about the program covered visit http://laoca.cl/congreso2017.

3. Top 5 publications in 2017 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

Cristian Carvajal, Charles K. Paull, David W. Caress, Andrea Fildani, Eve Lundsten, Krystle Anderson, Katherine L. Maier, Mary McGann, Roberto Gwiazda, Juan Carlos Herguera; Unraveling the Channel–Lobe Transition Zone With High-Resolution AUV Bathymetry: Navy Fan, Offshore Baja California, Mexico. *Journal of Sedimentary Research* ; 87 (10): 1049–1059. doi: https://doi.org/10.2110/jsr.2017.58.

Pasqueron de Fommervault, O., P. Pérez-Brunius, P. Damien, and J. Sheinbaum, 2017: Temporal variability of chlorophyll distribution in the Gulf of Mexico: Bio-optical data from profiling floats. *Biogeosciences*, **14**, 5647–5662, https://doi.org/10.5194/bg-14-5647-2017.

Norzagaray-López, C. O., Hernández-Ayón, J. M., Calderon Aguilera, L. E., Reyes-Bonilla, H., Chapa-Balcorta, C. and Ayala-Bocos, A. (2017). Aragonite saturation and pH variation in a fringing reef are strongly influenced by oceanic conditions. Limnol. Oceanography. doi:10.1002/lno.10571

Maske, H., Cajal-Medrano, R., & Villegas-Mendoza, J. (2017). Substrate-Limited and -Unlimited Coastal Microbial Communities Show Different Metabolic Responses with Regard to Temperature. *Frontiers in Microbiology*, *8*, 2270. http://doi.org/10.3389/fmicb.2017.02270

Ávila-López, M.C., Hernández-Ayón, J.M., Camacho-Ibar, V.F., Armando Félix Bermúdez, Adan Mejía-Trejo, Isaí Pacheco-Ruiz, Jose M. Sandoval-Gil (2017). **A**ir–Water CO_2 Fluxes and Net Ecosystem Production Changes in a Baja California Coastal Lagoon During the Anomalous North Pacific Warm Condition. Estuaries and Coasts. 40: 792. https://doi.org/10.1007/s12237-016-

0178x.

For journal articles please follow the format:
Author list (surname and initials, one space but no full stops between initials), year of publication, article title, full title of journal (italics), volume, page numbers, DOI.

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2017? If yes, who? How did you engage?

1) With Oyster Producers. We are working in pH and temperature monitoring.

PART 2 - Planned activities for 2018/2019 and 2020

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

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

A half-day PICES-Mexico Special Session will be held a day prior to the symposium (from 14:00-18:00 on April 23, 2018) to introduce PICES to Mexican scientific community and Mexican activities and achievements in marine science to PICES.

Topic Sessions
Concurrent Topic Sessions every day, following a morning plenary session

- Session 1: Effects of climate variability and change on the physics, biology, and fisheries in Pacific transitional areas
- Session 2: Challenges in managing highly migratory and transboundary resources in Pacific transitional areas
- Session 3: Challenges in observing and modeling Pacific transitional areas
- Session 4: Advances in understanding Pacific shelf-offshore transitional areas
- Session 5: Biodiversity changes in Pacific transitional areas
- Session 6: Transition zones in coastal habitats

3. Funded national and international projects / activities underway.

A Mexican oceanographic observation network of physical, geochemical and ecological processes in the Gulf of Mexico started in March of 2015 and will finish in 2020. The project was approved by the CONACYT (Consejo nacional de Ciencia y Tecnología)-SENER (Secretaria de Energía)-Hidrocarbons Fund to a consortium led by CICESE (Centro de Investigación Científica y De Educación Superior de Ensenada and participating institutions CINVESTAV -IPN (Centro de Investigación y de estudios Avanzados del Instituto Politécnico nacional) Mérida, CIDESI (centro de ingeniería y Desarrollo Industrial), UABC (Universidad Autónoma de Baja California), several research Institutes from UNAM (Universidad Nacional Autónoma de México, ICMyL (Instituto de Ciencias del Mar y Limnologia), CCA (Coordinación de Cooperación Académica) , IBT (Instituto de Biotecnologia), INECC (Instituto nacional de Ecología y Cambio Climático)-SEMARNAT (Secretaria del Medio Ambiente y Recursos naturales) and Baja Innova, SAPI de CV (Sociedades Anónimas Promotoras de Inversión). In addition international institution we also involved as, Scripps Institution of Oceanography, Woods Hole Oceanographic Institution, UC Santa Barbara, RSMUS-

UoF (Rosentiel School of Marine and Atmospheric Science), Texas A&M (USA), LOCEAN (Laboratoire d'Etudes en Géophysique et Océanographie Spatiale), UPMC (University Pierre and Marie Curie)-Paris and LEGOS (Laboratoire d'Etudes en Géophysique et Océanographie Spatiale), from France and GEOMAR from Germany. This interdisciplinary project proposes for five years the creation of a comprehensive system of oceanographic observations and numerical models to generate scenarios of potential impacts of large oil spills. The project objectives are to strengthen the scientific, technological infrastructure and human capacity of the Mexican oceanographic community to address the challenges associated with the exploitation of hydrocarbons in the Gulf of Mexico, using an interdisciplinary approach and implementing cutting edge technologies.

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

The GOOS Steering Committee will meet during the week of the 12th to the 15th of June at the INVEMAR facilities in Santa Marta, Colombia. During the first day, we are organizing a regional workshop inviting representatives of observing programs in the region from across the disciplines of biology, biogeochemistry and physics along with representatives of the GOOS Regional Alliances.

The goals of the workshop are to:

(1) strengthen and build links between Latin American communities (scientific community, observing networks, industry, navies, GRAs),

(2) showcase the work done at INVEMAR

(3) promote development of GOOS projects

Given your role as co-chair of LA-OCA, we would like to invite you to attend this workshop, and if interested and available, to stay for the rest of the week to attend the GOOS SC meeting.

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

Comments