

Report for the year 2015 and future activities

SOLAS Spain

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Please note that this report has two parts!

Part 1: reporting of activities in the period of January 2015 – December 2015

Part 2: reporting on planned activities for 2016 to 2018/19.

The information provided will be used for reporting, fundraising, networking and strategic development. In particular, **in 2016 SOLAS will develop its Implementation Plan, which will be largely based on the information from part 2 of the national reports, as well as input from international SOLAS initiatives and activities.** This info will be crucial in order to draft a realistic Implementation Plan representative of SOLAS, internationally.

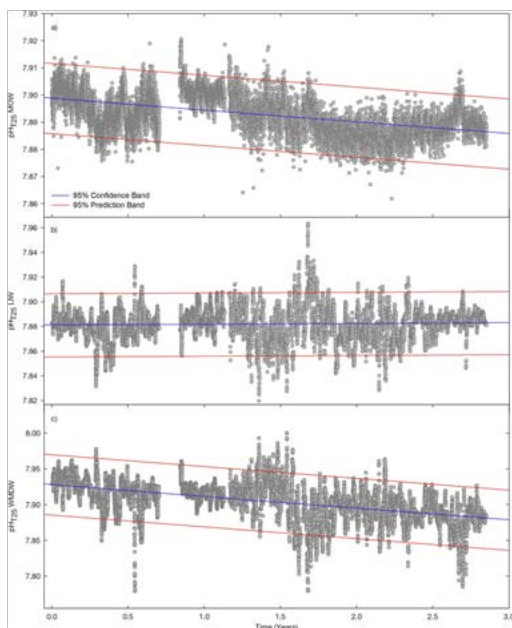
IMPORTANT: May we remind you that this report should reflect the efforts of the SOLAS community in the entire country you are representing (all universities, institutes, lab, units, groups)!

PART 1 - Activities from January 2015 to December 2015

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 international collaboration.

Assessing ocean acidification in the Mediterranean Sea



The trend of pH decrease with time in the Mediterranean Sea was assessed through high frequency observational data collected at the Strait of Gibraltar. Continuous pH measurements taken at the time series GIFT during 3 years documented a remarkable decreasing annual rate of -0.0044 ± 0.00006 pH units in the Mediterranean, which can be interpreted as an indicator of ocean acidification in the basin. Modelling pH data of the Mediterranean outflow water (MOW) allowed to discriminate between the pH values of its two main constituent water masses, the Levantine Intermediate Water (LIW) and the Western Mediterranean Deep Water (WMDW). Both water masses also exhibited a decline in pH with time, particularly the WMDW, which could be related to their different biogeochemical nature and processes occurring during transit time from respective formation sites to the Strait of Gibraltar.

Figure: Linear fitting of pH with time of the MOW and its forming water masses during the monitoring period: (a) MOW, (b) LIW and (c) WMDW. Blue and red lines represent the 95% confidence and prediction bands, respectively.

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Flecha, S., Pérez, F.F., García-Lafuente, J., Sammartino, S., Rios, A.F., Huertas, I.E. Trends of pH decrease in the Mediterranean Sea through high frequency observational data: indication of ocean acidification in the basin. *Scientific Reports-Nature*, 5, 16770, doi: 10.1038/srep16770. 2015

2. Activities/main accomplishments in 2015 (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, etc.)

Research Projects:

Carbon cycle and greenhouse fluxes over the Gulf of Cadiz (CTM2014-59244-C3-1-R). Period: 01/01/2015 - 31/12/2017. Contact: Jesús Forja, University of Cadiz, <jesus.forja@uca.es>

INGOS (Integrated non CO₂ greenhouse gas observing system), funded by the 7th Frame Program of the European Commission, 2011-2015. Spanish partners: CSIC and Fundación Centro de Estudios Ambientales del Mediterráneo. Contact: I. E. Huertas, ICMAN-CSIC <emma.huertas@icman.csic.es>

Field Campaigns:

Four oceanographic campaigns at the Strait of Gibraltar on board the RVs SOCIB (June and December) and Ramon Margaleff (June and November) were carried out to sample the ocean time series GIFT and to maintain the mooring line containing moored pCO₂ and pH sensors that are being used to monitor the temporal variability of CO₂ and ocean acidification in the Mediterranean Sea. PI and contact: E. Huertas, ICMAN-CSIC

International collaborations

The ICMAN-IIM (CSIC) group participated in the annual meeting of the SCOR (Scientific Committee for Oceanographic Research) Working Group 143 *Dissolved N₂O and CH₄ Measurements: Working Towards a Global Network of Ocean Time Series Measurements of N₂O and CH₄* held in Kiel (Germany) in September. Report from the first inter-calibration exercise amongst 10 WG members has been sent out.

Events

The ICM-CSIC, ICMAN-IIM (CSIC), IQFR-CSIC groups attended the 2015 SOLAS Open Science Conference in Kiel.

3. Top 5 publications in 2015 (only PUBLISHED articles) and if any weblinks to models, datasets, products, etc.

Flecha S, Pérez FF, García-Lafuente J, Sammartino S, Rios AF, Huertas IE. 2015. Trends of pH decrease in the Mediterranean Sea through high frequency observational data: indication of ocean acidification in the basin. *Scientific Reports-Nature*, 5, 16770, doi: 10.1038/srep16770.

Burgos, M., A. Sierra, T. Ortega, J.M. Forja, 2015, Anthropogenic effects on greenhouse gas (CH₄ and N₂O) emissions in the Guadalete River Estuary (SW Spain), *Science of the Total Environment*, 503, 179-189.

Bunse, C., Lundin, D., Karlsson, C.M.G., Akram, N., Vila-Costa, M., Palovaara, J., Svensson, L., Holmfeldt, K., González, J.M., Calvo, E., Pelejero, C., Marrasé, C., Dopson, M., Gasol, J.M. and Pinhassi J., 2016, Response of marine bacterioplankton pH homeostasis gene expression to elevated CO₂. *Nature Climate Change*, doi:

10.1038/nclimate2914.

de la Fuente, M., Skinner, L., Calvo, E., Pelejero, C. and Cacho, I., 2015, Evidence for increased reservoir ages and poorly ventilated deep waters in the glacial eastern equatorial Pacific. *Nature Communications*, doi:10.1038/ncomms8420.

Navarro, M., E. L. Atlas, A. Saiz-Lopez, X. Rodriguez-Lloveras, D. E. Kinnison, J-F. Lamarque, S. Tilmes, M. Filus, N. R. P. Harris, E. Meneguz, M. J. Ashfold, A. J. Manning, C. A. Cuevas, S. M. Schauffler, and V. Donets, 2015, Airborne measurements of organic bromine compounds in the Pacific tropical tropopause layer, *PNAS*, doi:10.1073/pnas.1511463112.

PART 2 - Planned activities from 2016 to 2018/19

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

Field studies

Periodic cruises for data collection at the GIFT time series located at the Strait of Gibraltar to monitor air-sea fluxes of GHGs (CO₂, CH₄, N₂O) and track ocean acidification in the Mediterranean basin.

Seasonal samplings at the coastal fringe comprising the complex Guadalquivir river estuary- Doñana wetlands are scheduled from 2016 to 2018 to compute air-water GHGs (CO₂, CH₄, N₂O) exchange. Close collaboration with University of Liege (Belgium).

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

School

The ICMAN-CSIC team will be in charge of organizing the workshop *Climate change and coastal wetlands: role on the atmospheric exchange of GHGs and impact on the ecosystem services* sponsored by the Universidad Internacional Menéndez Pelayo, which will be held in Seville in July 2016.

3. Funded national and international projects / activities underway (if possible please list in order of importance and indicate to which part(s) of the SOLAS 2015-2025 science plan the activity topics relate – including the themes on ‘SOLAS science and society’ and ‘Geoengineering’)

Projects

Effect of the permeabilization of Doñana marshland on the biogeochemical structure of the wetlands, funded by the Spanish Ministry of Food, Agriculture and Environment. 2015-2018. PI and contact: E. Huertas, ICMAN-CSIC <emma.huertas@icman.csic.es>, related to SOLAS activities 1.5, 2.1, 2.2 and 3.3.

4. Plans / ideas for future projects, programmes, proposals national or international etc. (please precise to which funding agencies and a timing for submission is any)

Several groups are actively seeking funds from national (Spanish National Plan for Research) and international (H2020, ERC, etc).

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

Comments