SOLAS Spain

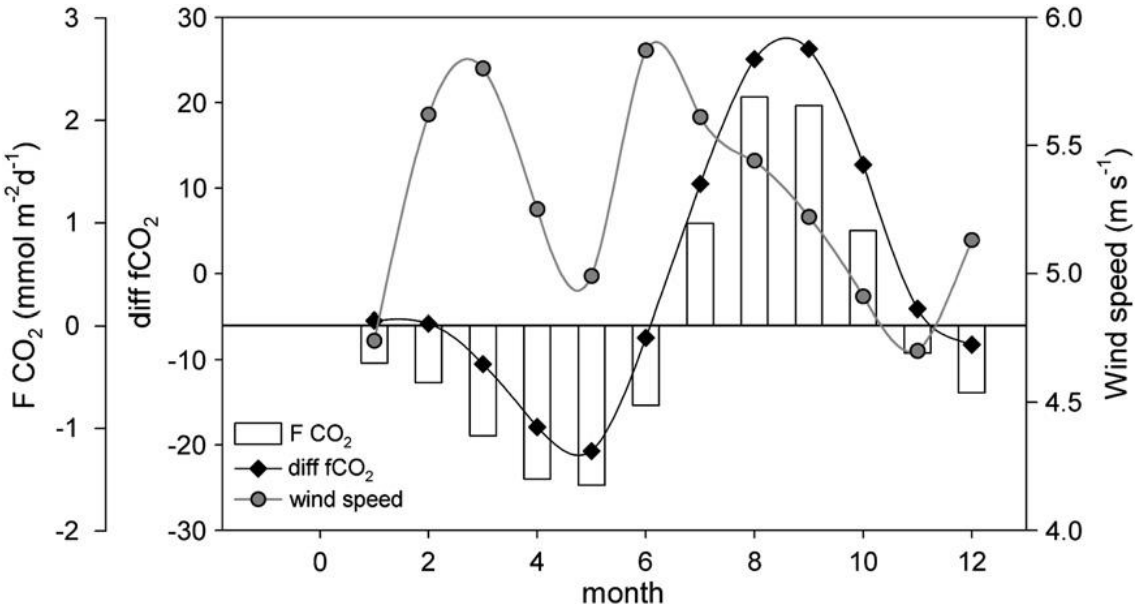
compiled by Rafel Simó

Notes:
Reporting Period is January 2011 – December 2011
Information will be used for: reporting, fundraising, networking, strategic development & outreach

1. Key scientific SOLAS-relevant highlights/findings (you may include figures and references)

CO_2 exchange patterns in the Strait of Gibraltar

Reconstruction of the temporal variability of the air-sea CO_2 exchange in the Strait of Gibraltar from 1997 to 2009 (data gathered in 36 cruises conducted in the area) has allowed to construct the seasonality of the marine source/sink of this important gas in that region of the sea. Contact person: E. Huertas (ICMAN-CSIC).



Climatological seasonal cycle of the monthly wind speed, air-water fCO_2 gradient and CO_2 fluxes in the Strait of Gibraltar (de la Paz et al. *Mar. Chem*. 2011).

Upwelling of CO_2-rich Antarctic waters was more important than the action of marine microorganism to account for the CO_2 increase during the last deglaciation

Research at the Institut de Ciències del Mar of Barcelona (CSIC) shows that, during the last deglaciation that began nearly 17.000 years ago, the retrait of Antarctic sea ice and the consequent upwelling of CO2-rich water from the deep was more determinant tan the action of planktonic microorganisms for the simultaneous rise of atmospheric CO2.

The research team is led by Eva Calvo and Carles Pelejero with co-investigators Isabel Cacho (University of Barcelona), Leopoldo D. Pena (University of Columbia) and Graham A. Logan (Geoscience Australia). Contact person: E. Calvo (ICM-CSIC).

La investigación ayuda comprender mejor los mecanismos naturales que determinan la concentración y distribución de CO_2 en el planeta, de especial relevancia en el contexto actual de aumento de emisiones y de calentamiento global.

The evolution of phytoplankton, and particularly diatoms and coccolithophores, in the Eastern Equatorial Pacific over the last 40,000 years was investigated for its role in CO2 regulation. Diatoms are known to be more efficient at removing CO2 from seawater and atmosphere because the process of calcification in coccolithophores cause a return of part of the utilized CO2. The study of biomarkers in sediment cores reveals that, at the onset of deglaciation, the upwelling of deep waters around Antarctica and their transport northwards favored the outburst of diatoms over coccolithophores. The associated potential increase in the capacity to remove CO2 was outcompeted by the efflux caused by the increased upwelling.

(Calvo et al. *PNAS* 2011)

2. Activities/main accomplishments (research projects, cruises, special events, workshops, remote sensing used, model and data intercomparisons etc)

Research Projects:

-The CSIC and the University of Las Palmas de Gran Canarias are partners of CARBOCHANGE (Changes in carbon uptake and emissions by oceans in a changing climate, # 264879) funded by European Commission (7^{th} frame program), 2011-2014.

- The CSIC and the CEAM are partners of INGOS (Integrated non CO_2 greenhouse gas observing system) funded by European Commission (7^{th} frame program), 2011-2015.

-ICOS (Integrated Carbon Observation System)-SPAIN funded by the Spanish Ministry of Sciences and Innovation and aimed at establishing the national network of carbon observatories in terrestrial ecosystems, atmosphere and ocean, 2011-2012.

- Contribution of Doñana (NP) wetlands to the regional atmospheric CO_2 exchange (049/2010), funded by the Spanish Ministry of Environment, 2011-2013. PI: E. Huertas (ICMAN-CSIC)

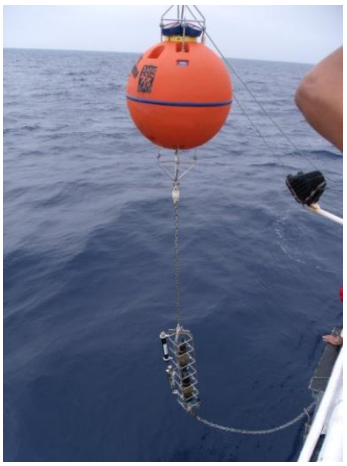
Cruises:

-The Malaspina 2010-11 Expedition, coordinated by C. Duarte (IMEDEA-CSIC), completed its trip around the global oceans (Dec 2010-Jul 2011). SOLAS activities aboard the RV Hespérides and Sarmiento de Gamboa included measurements of O2, CO2, isotopic ratios in CO2 and water vapour, pH, alkalinity, NH3, total volatile carbon, DMS, semivolatile organics, organic pollutants, aerosols, bioaerosols, atmospheric halogens, plankton metabolism, N2 fixation.

-E. Huertas (ICMAN-CSIC) led three oceanographic campaigns at the Strait of Gibraltar on board the RV García del Cid (July and November) and Cornide de Saavedra (August) to sample the GIFT time series to keep tracking carbon fluxes between the North Atlantic and Mediterranean Sea.

-Mooring of the autonomous sensors SAMI-pCO_2 and SAMI-pH in the Strait of Gibraltar for

monitoring temporal variability of CO_2 and ocean acidification in the outflow of Mediterranean water



-Mooring of SAMI-pCO_2 in Doñana wetlands to assess spatio-temporal variability of CO_2 in permanent freshwater lagoons.

-R. Simó (ICM-CSIC) led the SUMMER cruise (12-23/9/2011) to the Western Mediterranean. Drifters were deployed for a lagrangian study of a surface water patch over two weeks. The effects of the changing underwater light fields on plankton and trace gas dynamics at hourly to weekly timescales were investigated. High temporal and spatial resolution vertical profiles of DMS concentration were obtained for the first time with the use of a yoyo pump coupled to a miniCIMS instrument.

3. Human dimensions (outreach, capacity building, public engagement etc)

R. Simó (2011). The role of marine microbiota in short-term climate regulation. En *The Role of Marine Biota in the Functioning of the Biosphere* (C. Duarte, ed.). Fundación BBVA, Rubes Ed., Bilbao, pp. 107-130.

Collaborations with the media have been frequent during 2011 as a consequence of the Malaspina 2010-11 Expedition, which has been taken as a good opportunity to tell the society about the functioning of the coupled ocean-atmosphere-climate system.

4. Top 10 publications in 2011 (Reports, articles, models, datasets, products, website etc)

Calvo E., C Pelejero, LD. Pena, I Cacho and GA. Logan (2011). Eastern Equatorial Pacific productivity and related-CO_2 changes since the last glacial period. *Proc. Nat. Acad. Sci. USA*, doi: 10.1073/pnas.1009761108

Berrojalbiz,N., J Dachs,S Del Vento,MJ Ojeda,MC Valle,J Castro-Jimenez,G Mariani, J Wollgast,G Hanke (2011). Persistent Organic Pollutants in Mediterranean Seawater and Processes Affecting Their Accumulation in Plankton. *Environ. Sci. Technol*. 45, 4315–4322

Berrojalbiz N,J Dachs,MJ Ojeda, MC Valle,J Castro-Jiménez, J Wollgast, M Ghiani, G Hanke, JM Zaldivar (2011). Biogeochemical and physical controls on concentrations of polycyclic aromatic hydrocarbons in water and plankton of the Mediterranean and Black Seas. *Global Biogeochem. Cycles* 25, GB4003, doi:10.1029/2010GB003775.

Lana A., T.G. Bell, R. Simó, S.M. Vallina, J. Ballabrera-Poy, A.J. Kettle, J. Dachs, L. Bopp, E.S. Saltzman, J. Stefels, J.E. Johnson, P.S. Liss (2011). An updated climatology of surface dimethlysulfide concentrations and emission fluxes in the global ocean. *Global Biogeochem Cycles* 25, GB1004, doi:10.1029/2010GB003850.

Galí M., V. Saló, R. Almeda, A. Calbet, R. Simó (2011). Stimulation of gross dimethylsulfide (DMS) production by solar radiation. *Geophys Res Lett* 38, L15612, doi:10.1029/2011GL048051.

de la Paz M, Huertas IE, Padín XA, Gónzalez-Dávila M, Santana-Casiano M, Forja JM, Orbi A, Pérez FF, Ríos AF (2011) Reconstruction of the seasonal cycle of air-sea CO_2 fluxes in the Strait of Gibraltar. *Mar. Chem* 126, 155-172.

Calvo E., R. Simó, R. Coma, M. Ribes, J. Pascual, A. Sabatés, J.M. Gili, C. Pelejero (2011). Impact of climate change on Mediterranean marine ecosystems: The case of the Catalan Sea. *Clim Res* 50: 1–29.

Flecha S, Pérez FF, Navarro G, Ruiz J, Olive I, Rodriguez-Galvez S, Costas E, Huertas IE (2011) Anthropogenic carbon inventory in the Gulf of Cadiz. *J. Mar. Syst*.10.1016/j.jmarsys.2011.10.010

Padin, X. A., Castro, C.G., Ríos, A. F., and Pérez, F. F. (2011). Oceanic CO_2 uptake and biogeochemical variability during the formation of the Eastern North Atlantic Central water under two contrasting NAO scenarios, *J. Mar. Syst*. 84, 3-4, 96-105.

Pardo, P. C., Vázquez-Rodríguez, M., Pérez, F. F. and Ríos, A. F. (2011). CO_2 air-sea disequilibrium and preformed alkalinity in the Pacific and Indian oceans calculated from subsurface layer data, *J. Mar. Syst* 84, 3-4, 67-77.

5. International interactions and collaborations (including contributions to international assessments such as the IPCC, links with observation communities etc)

E. Huertas (ICMAN, CSIC) has been elected to the Executive Board of ICOS (Integrating Carbon Observation System) to implement the insertion of the ocean component in the infrastructure

6. Goals, priorities and plans for future activities/events

2012 brings the launch of a new project: ADEPT (Aerosol deposition and ocean plankton dynamics), led by F. Peters (ICM-CSIC). ADEPT addresses the study of the effect of atmospheric aerosol deposition on the dynamics of a marine LNLC (low nutrient low chlorophyll) system, namely the Mediterranean. To achieve its goal, ADEPT uses a multiscale and complementary approach. Relationships between atmospheric deposition and ocean nutrient and plankton dynamics are studied at a coastal scale and at the Mediterranean basin scale. Laboratory experiments focus to understand some of the underlying mechanisms.

7. Other comments