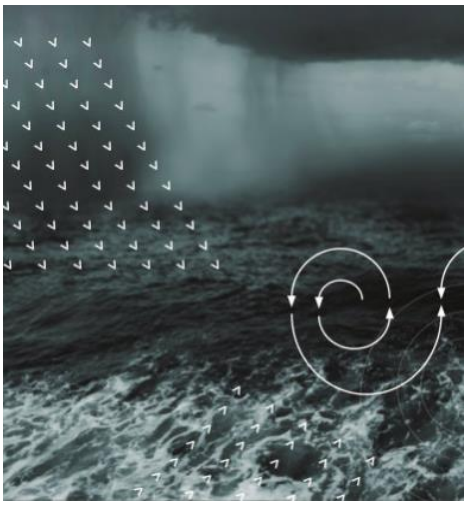

Air-sea Gas Flux; Progress and Future Prospects Science Workshop

Agenda

Location: IFREMER, Brest, France
6-9 September 2016

Lucien Laubier Conference Room

Jointly organised by Ifremer and ESA

In association with the OceanFlux GHG-Evolution project : *www.oceanflux-ghg.org*

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The atmosphere-ocean (air-sea) exchange of climate active gases, such as CO_2, N_2O, CH_4, DMS and CH_3Br is a critical part of the climate system and a major factor in the biogeochemical function of the oceans. More accurate and higher resolution calculations of these gas fluxes are required if we are to fully understand and predict the chemistry of our atmosphere and hence future climate. This endeavour requires the maintenance of major observing systems (shipboard, satellite-borne and land-based) and a deep understanding of the transfer processes. It is a challenging task that requires interdisciplinary collaboration and cost-effective solutions.
The European Space Agency (ESA) and the International Surface Ocean Lower Atmosphere Study (SOLAS) community came together in 2010 to support a new initiative in this area and the OceanFlux Greenhouse gas projects arose. At the same time, there have been enormous efforts internationally on collecting and collating data, strengthening and organising the measurement of dissolved gases (e.g. by LDEO and SOCAT) and exploring new methods of measuring and modelling the transfer processes and exchange coefficients.

In 2013, the first Air-sea Gas Fluxes workshop was held. The workshop was a great success and the participants identified the need for this interdisciplinary community to meet again in the future. Many advances have been made since 2013, so we now invite the community back to a second international workshop in France in September 2016 to present recent advances and identify future goals and prospects.

Progress from the most recent OceanFlux project research will be presented. Renowned international scientists and groups will present overviews and results from key initiatives. We solicit oral and poster presentations on **all aspects of air-sea gas transfer of any climatically important gases, including reactive gases.** We especially encourage research focusing on: Arctic and marginal ice zones, extreme winds, atmospheric modeling and inversion techniques and heat fluxes. Together we will build a picture of the existing capability in studying air-sea gas fluxes. Importantly, we will look ahead together to new challenges and opportunities. The European Space Agency and other funding agencies are setting their own priorities and strategies. This workshop is an important opportunity to rationalize and explain the priorities of the scientific community.

The ultimate aim of the workshop is to facilitate and accelerate the research and technology development necessary for an accurate evaluation of the air-sea flux of climate active gases, by identifying key challenges and opportunities and setting appropriate priorities for the scientific community and for supporting and guiding agencies (notably space agencies).

Specific aims of the workshop are:

Identifying key challenges facing the air-sea gas flux community:

- Maintaining the ship-based observing system.
- Maintaining the marine earth observation capability.
- Addressing remaining gaps in fundamental knowledge.
- Understanding and addressing the full set of uncertainties.

Identifying opportunities and setting priorities:

- The requirements of the climate science and policy communities.
- New Earth observation technologies and missions.
- New measurement techniques and opportunities for more autonomous measurements.
- New modelling and statistical techniques.
- The rapidly expanding capacity of cloud and other computing architecture.

Contact

Please contact us for further information regarding the meeting agenda. For logistical issues and options for demonstrations, installations or related promotional issues you would like to propose at the meeting please write to: ***oceanflux-workshop at ifremer.fr.***

WebSite

http://www.oceanflux-ghg.org/Workshop

Scientific steering committee

- Jamie Shutler, University of Exeter, UK
- David Woolf, Heriot Watt University, UK
- Bertrand Chapron, Ifremer, France
- Jacek Piskozub, IOPAN, Poland
- Lonneke Goddijn-Murphy, Environmental Research Institute, Thurso, UK
- Andy Watson, University of Exeter, UK
- Craig Donlon, European Space Agency, The Netherlands
- Dorothee Bakker, University of East Anglia, UK
- Ute Schuster, University of Exeter, UK
- Phil Nightingale, Plymouth Marine Laboratory, UK
- Christian Roedenbeck, Max Planck Institute for Biogeochemistry, Germany
- Rik Wanninkhof, NOAA, US
- Chris Fairall, NOAA, US
- Magdalena Anguelova, Naval Research Laboratory, US
- Christa Marandino, GEOMAR, Germany
- David Ho, University of Hawaii, US
- Bill Asher, University of Washington, US
- Jacqueline Boutin, LOCEAN, France

Organizing committee

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- Francine Loubrieu, Ifremer, France
- Audrey Abiven, Ifremer, France
- Denise Guillerm, Ifremer, France
- Swen Jullien, Ifremer, France
- Jamie Shutler, University of Exeter, UK
- Craig Donlon, European Space Agency, The Netherlands
- Diego Fernandez, European Space Agency, Italy
- Roberto Sabia, European Space Agency, Italy

Session Overview and Detailed Agenda

Day 1 - Sept 6 – Tuesday		
08:10 - 08:50	Bus for Ifremer (bus stop Brest Train Station)	
08:50 - 09:30	*Registration in the Hall*	
Welcome - Lucien Laubier Conference Room		
09:30 - 09 :40	Welcome	Jamie SHUTLER, Uni. of Exeter. UK. Diego FERNANDEZ, ESA, Italy
09:40 - 09:45	Welcome to Ifremer	Bertrand CHAPRON, Ifremer, France.
Session 1 Updates from International initiatives ***Chair : Phil Nightingale***		
09:45 - 10:15 **Keynote**	Surface Ocean Lower Atmosphere Study (SOLAS): Air-sea interface and fluxes of mass and energy	Brian WARD, AirSea Laboratory NUIG, Ireland
10:15 - 10:35	ICOS Ocean Thematic Center a tool to secure long term funding for ocean carbon system observation systems	Truls JOHANNESSEN, Geophysical Institute and the ICOS Ocean Thematic Centre, Norway.
10:35 - 10:55	The Surface Ocean CO_2 Atlas (SOCAT) enables quantification of the ocean carbon sink and ocean acidification	Dorothee BAKKER, Uni. of East Anglia, UK.
10:55 - 11:15	The ESA OceanFlux Greenhouse Gases Evolution project	Jamie SHUTLER, Uni. of Exeter, UK.
11:15 - 11:30	*Coffee break*	
Session 2 Regional processes in time or space ***Chair :***		
11:30 - 11:50	Air exposure of coral causes significant dimethylsulfide (DMS) emissions	Tom BELL, Plymouth Marine Laboratory, UK.
11:50 - 12:10	Strengthening trade winds and an enhanced Equatorial Pacific carbon source	Sarah SCHLUNEGGER, Princeton Uni., US.
12:10 - 12:30	Filling the gap of in situ CO_2 fluxes during low wind conditions	Mariana RIBAS RIBAS, Uni. of Oldenberg, Germany.
12:30 - 12:50	The other CO_2 problem: Studying Ocean Acidification using satellite Earth observation in the Amazon plume, Caribbean, Bay of Bengal, Arctic and globally	Jamie SHUTLER, Uni. of Exeter, UK.
13:00 - 14:00	*Lunch at Ifremer restaurant*	
Session 3 Resolving differences and exploiting linkages between regional and global air-sea exchange ***Chair :***		

14:00 - 14:20	Are open-ocean wind speed/gas exchange parameterizations applicable to coastal and inland waters?	David HO, Uni. of Hawaii, US.
14:20 - 14:40	On the fetch dependency of air-water gas exchange	Angelika KLEIN, IUP Germany,
14:40 - 15:00	Mind the Gap; Regional scale analyses are key to connecting process studies and global inventories	David WOOLF Heriot Watt Uni., UK.
15:00 - 15:20	Hourly to decadal variability of sea surface carbon parameters in the north western Mediterranean Sea	Jacqueline BOUTIN, LOCEAN/CNRS, France.
15:20 - 15:40	The effect of changing wind speeds on global air-sea CO_2 fluxes	Rik WANNINKHOF, NOAA, US.
15:40 - 16:00	Data-based estimates of the ocean carbon sink variability results of the Surface Ocean pCO_2 Mapping intercomparison (SOCOM)	Christian RODENBECK, MPI BGC, Germany.
Session 4 : First poster session and Welcome Cocktail ***16:00 – 18:30***		
18:30	Bus for Brest City Centre	

Day 2 - Sept 7 – Wednesday		
08:10 - 08:50	Bus for Ifremer (bus stop Brest Train Station)	
Session 5 Multiple simultaneously measured gases I ***Chair : Dorothee Bakker***		
9:00 - 9:30 **Keynote**	Challenges in evaluating the influence of the ocean on atmospheric composition	Jim BUTLER, NOAA, US.
9:30 - 09:50	A newly developed equilibration system for continuous sea surface CO_2, CH_4 and N_2O measurements characterization and results from two cruises in the Benguela upwelling system	Jan WERNER, Institute for Baltic Sea Research, Germany
09:50 - 10:10	Measurements of air-sea gas transfer in upwelling filaments off Mauritania	Phil NIGHTINGALE, Plymouth Marine Laboratory, UK.
10:10 - 10:30	Air-Sea Fluxes of CO_2 and CH_4 from the Penlee Point Atmospheric Observatory on the South West Coast of the UK	Mingxi YANG, Plymouth Marine Laboratory, UK.
10:30 - 10:50	MEMENTO, the marine N_2O and CH_4 database: towards a new estimate of global CH_4 and N_2O emissions	Annette KOCK, GEOMAR, Germany.
10:50 - 11:20	*Coffee break & posters in the Hall*	
Session 6 Multiple simultaneously measured gases II ***Chair : Jim Butler***		
11:20 - 11:40	Air-sea gas transfer velocity for gases of different solubility (CO_2, O_2, H_2O and CH_4)	Anna RUTGERSSON, Uppsala Uni., Sweden.
11:40 - 12:00	Continuous measurement of CH_4 and pCO_2 in the Baltic Sea using off- axis integrated cavity output spectroscopy on a voluntary observation ship	Gregor REHDER, Leibniz Institute for Baltic Sea Research Warnemunde, Germany.
12:00 - 12:50 **(50 mins)**	**Open Discussion I (Multiple Gases): Can we do more with multiple gases? , what is needed to exploit them further? Should we be using Satellite observed atmospheric gas measurements?**	
13:00 - 14:00	*Lunch at Ifremer restaurant*	
Session 7 Physical controls on exchange - slicks, vertical water structure, motion, spray and heat ***Chair : Sarah Gille***		
14:00 - 14:20	Effect of surface contamination on isotropic-turbulence-driven interfacial gas transfer	Jan WISSINK, Brunel Uni. London, UK.
14:20 - 14:40	Towards improved estimate of turbulent heat flux over Global Oceans	Abderrahim BENTAMY, Ifremer, France.
14:40 - 15:00	Spatially-coherent organized motion in the upper ocean turbulent boundary layer: Langmuir circulation and ramp-like structures	Alexander SOLOVIEV, Nova Southeastern Uni., US.
15:00 - 15:20	Surfactant enrichment factors in the surface microlayer of the Atlantic Ocean: implications for air-sea gas exchange	Bita SABBAGHZADEH, Newcastle University, UK.
15 :20 -15 :30	*Short break*	

15:30 - 15:50	Surfactant control of air-sea gas exchange along an offshore coastal and open ocean transect: results from a laboratory gas exchange tank	Ryan PEREIRA, Heriot Watt Uni, UK.
15:50 - 16:10	Effects of near surface ocean gradients upon shelf sea air/sea gas exchange estimate	Richard SIMS, Plymouth Marine Laboratory, UK.
16:10 - 16:30	White cap measurements and parameterizations based on the dissipation source term	Oyvind BREIVIK, Met Norway, Norway
Session 8 ***: Second poster session and coffee break*** ***16:30 - 18:30***		
18:30 - 20:30 20:30	**Crepes at the Ifremer restaurant** Bus departure for Brest city	

Day 3 - Sept 8 – Thursday		
08:10 - 08:50	Bus for Ifremer (bus stop Brest Train Station)	
Session 9 Novel measurements, techniques and datasets ***Chair : Christa Marandino***		
9:00 - 9:20	Copernicus and the Sentinels – New advances, satellite sensors and opportunities	Craig DONLON, ESA, The Netherlands.
9:20 - 9:40	Laboratory measurements of CO_2 transfer by capillary waves	Philippe BARDET, George Washington Uni., US.
9:40 - 10:00	Optical Measurement of very near-surface currents	Brian HAUS, Uni. of Miami, US.
10:00 - 10:20	Comparison of bubble plume data with wind/wave parameters, foam measurements, and carbon dioxide concentration	Adrian MATEI, Uni. College London, UK.
10:20 - 10:40	Eddy-Correlation fluxes measurements using the OCARINA autonomous platform during the BBWAVES 2015 cruise.	Louis MARIE, Ifremer, France.
10:40 - 11:10	*Coffee break & posters in the Hall*	
Session 10 *Beyond proxies for parameterising gas exchange* ***Chairs : Bertrand Chapron and Rik Wanninkhof***		
11:10 - 11:30	The retrieval of air-sea gas transfer velocity from space using the hybrid model	Lonneke GODDIJN-MURPHY, Environnemental Research Institute, UK.
11:30 - 11:50	Horizontal distribution of air-sea exchange parameters inferred from satellite images of sea surface roughness	Nicolas RASCLE, Ifremer, France.
11:50 - 12:50 **(1 hour)**	**Open discussion II (beyond proxies)** ***Can we now move beyond proxies for parameterising gas exchange?***	
13:00 - 14:00	*Lunch at Ifremer restaurant*	
Session 11 *High latitude and Polar studies* ***Chair : Brice Loose and Jamie Shutler***		
14:00 - 14:30 **Keynote**	Heat and carbon air-sea exchange in the Southern Ocean	Sarah GILLE, Scripps Institution of Oceanography, US.
14:30 - 14:50	Air-sea exchange of carbon dioxide in the Southern Ocean and Antarctic marginal ice zone	Brian BUTTERWORTH, Atmospheric Sciences Research Center, US.
14:50 - 15:10	Atmosphere-ocean gas transfer within areas of broken sea ice	Ian ASHTON, University of Exeter, UK.
15:10 - 15:30	Air-sea fluxes of CO_2 over a high latitude fjord in Greenland	Lise Lotte SORENSEN , Aarhus University, Denmark.
15:30 - 16:20 **(50 mins)**	**Open Discussion III: (polar regions)** ***Where can we gain most through synergy in Polar regions? Can we do more to study the links and flows between land-ocean-atmosphere?***	
16:20 - 16:50	*Coffee break & posters in the Hall*	

Session 12 ***Wave breaking*** ***Chair : Jacek Piskozub***		
16:50 - 17:10	On the variation of the effective breaking strength in oceanic sea states and its application to gas transfer	Chris ZAPPA, Columbia Uni., US.
17:10 - 17:30	Improved insights into whitecap foam evolution from laboratory breaking waves	Adrian CALLAGHAN, Scripps Institution of Oceanography, US.
17:30 - 17:50	Parameterizations of whitecap fraction: status update	Magdalena ANGUELOVA, Naval Research Laboratory, US.
17:50 - 18:10	Modulation of air-sea fluxes by microscale breaking waves	Peter SUTHERLAND , Ifremer, France.
18:20	Bus for Brest City Centre	

Day 4 – Sept 9 – Friday		
08:10 - 08:50	Bus for Ifremer (bus stop Brest Train Station)	
Session 13 High winds ***Chair : David Woolf***		
09:00 - 09:20	Wind and wave forcing of gas transfer velocity from HIWINGS“ Results from the 2013 High Wind Gas Exchange Study in the Labrador	Chris FAIRALL, NOAA ESRL/PSD, US.
09:20 - 09:40	Detailed bubble plume measurements from the HiWINGS campaign, and reflections on the maximum possible contribution of subsurface bubble plumes to gas fluxes	Helen CZERSKI, Uni. College London, UK.
09:40 - 10:00	Air entrainment, and the dynamics and statistics of breaking waves: implications for field measurements of gas transfer	Ken MELVILLE, Scripps Institute of Oceanography, US.
10:00 - 10:20	How do tropical cyclones affect the global air-sea flux of CO_2 ?	Ute SCHUSTER, Uni. of Exeter, UK.
10:20 - 10:40	Performance of simple, single-parameter to complex, physical-based models of gas transfer velocity under high winds in varying sea state	Sophia BRUMER, Columbia Uni., US.
10:40 - 11:00	Investigating the mechanisms of air-sea gas exchange at hurricane wind speeds in wind/wave tunnel experiments	Kerstin KRALL, Institute of Environmental Physics, Germany.
11:00 - 11:20	*Coffee break*	
Session 14 *Wave breaking and high winds* ***Chair :***		
11: 20 - 11:40	Sea spray production by bag-breakup mode of fragmentation of the air-water interface at strong and hurricane wind	Yuliya TROITSKAYA, IAP RAS, Russia.
11:40 - 12:00	The distribution of sea spray spume particles observed above actively breaking wind- waves in the laboratory	David G.ORTIZ-SUSLOW, Uni. of Miami, US.
Session 15 *Open Discussion* ***Chair : Craig Donlon and Jamie Shutler***		
12:00 - 13:00 **(1 hour)**	**Open discussion IV (Continuing relationship) – The continuing ESA-SOLAS relationship, where and what next? What are the next frontiers? Should we continue with this workshop series? How can we raise the profile of this work? Collaborations with non-European partners and agencies (e.g. US).**	
13:00	*End of the meeting*	
13:00 - 14:00	*Lunch at Ifremer restaurant*	

Poster Presentations

Anguelova Magdalena, Michael H. Bettenhausen, John Prytherch, Ian M. Brooks, Magdalena D. Anguelova, Sarah J., Norris, Ivan B. Savelyev, Margaret J. Yelland, Robin W. Pascal, Dominic J. Salisbury. USA **Empirical model for sea spray production.**

Asseray M., M. N. Bouin, J.L. Redelsperger, L. Marié, D. Bourras, V. Garnier. France. **Impact of a SST front on the atmospheric boundary layer and turbulent fluxes.**

Bange H.W., S.T. Wilson and members of SCOR WG#143.Germany. **Dissolved N2O and CH4 measurements: working towards a global network of ocean time series measurements.**

Bell Thomas G - U.K. **Attribution of atmospheric sulfur dioxide over the English Channel to dimethylsulfide and changing ship emissions.**

Danielson Richard, Igor Esau, Abderrahim Bentamy, Antoine Grouazel, Johnny A. Johannessen, Jean-Francois Piolle, Normay. **A characterization of global analyses of surface heat flux in terms of a simple affine error model.**

Gutiérrez-Loza L. and F.J. Ocampo-Torres - Mexico. **The effect of the breaking waves on air-sea CO2 gas transfer in the coastal zone.**

Hackerott Joao A., Luciano P. Pezzi, Mostafa Bakhoday Paskyabi, Joachim Reuder, Ronald B. Souza, Ricardo de Camargo – Brazil.**Turbulent fluxes observed during the Air-Sea Interaction at Brazil-Malvinas Confluence (INTERCONF) 2014.**

Keraghel Mehdia Asma, Ferial Louanchi – Algeria. **Annual cycle reconstitution of pCO2 over the Western Mediterranean for the year 2011.**

Lennartz, S.T., von Hobe, M., Pozzer, A., Bruhl, C., Quack, B., Kruger, K., Marandino C.A. – Germany. **The role of oceanic emissions in the atmospheric budget of Carbonyl Sulfide.**

Markuszewski P., T. Petelski, P. Makuch, T. Zielinski, J. Piskozub, P. Pakszys, I. WrÃ³bel, V. Drozdowska, D. Gutowska, A. Rozwadowska – Poland. **Turbulent fluxes in near water boundary layer observation on board s/y Oceania in the European Arctic and Southern Baltic Sea areas.**

Paget C. Aaron, Jim Edson -USA. **Direct ASCAT and RapidScat Vector Winds Comparison.**

Pineau-Guillou L., F. Ardhuin, M.-N. Bouin, J.-L. Redelsperger, B. Chapron, J. Bidlot - France **Sensitivity to wind stress formulation in a coupled wave-atmosphere model.**

Piskozub Jacek, Iwona Wrobel - Poland. **Why different gas flux velocity parameterizations result in so similar flux results in the North Atlantic ?**

Porter J.G., W. De Bruyn, S. D. Miller, and E. S. Saltzman - USA. **Eddy covariance flux measurements of sulfur dioxide to the sea surface: Air-side resistance of a highly soluble gas.**

Rickard Philippa, Guenther Uher and Robert Upstill-Goddard.- UK. **Surfactant photo-reactivity and air-sea gas exchange.**

Saket Arvin, William L. Peirson, Michael L. Banner and Xavier Barthelemy - Australia. **Determining the onset of breaking: Laboratory investigations.**

Santini Marcelo F., Ronald B. Souza, Luciano P. Pezzi, J. Hackerott - Brazil.**Behavior and magnitudes of air-sea heat fluxes and MABL under two distinct atmospheric conditions at Brazil-Malvinas Confluence.**

Schulz Harry Edmar - Brazil .**Verifying the Random Square Waves statistics for 1D formulation of turbulence characteristics at gas-liquid interfaces.**

Stopa Justin E., Fabrice Ardhuin, Romain Husson, Bertrand Chapron, and Fabrice Collard - France. **Swell dissipation from 10 years of Envisat advanced synthetic aperture radar in wave mode.**

Tatsuki Tokoro, Tomohiro Kuwae – Japan. **Characteristics of coastal CO2 flux estimated from comparison of eddy covariance method with conventional method.**

Vanaki Sh.M., K. A. Suara , and R. J. Brown - Australia. **Use of drifter technology for measuring gas concentrations at air-sea interface in coastal waters.**

Wrobel Iwona., Drozdowska V., Gutowska D., Makuch P., Markuszewski P., Pakszys P., Petelski T., Piskozub J., Zielinski T., Institute of Oceanology Polish Academy of Sciences – Poland. **What is going on in the North Atlantic and European Arctic - future scenario.**

Zavarsky A., D. Booge, A. Fiehn, K. Kruger, T. Steinhoff, C. A. Marandino - Germany. **DMS flux in the Indian Ocean during summer monsoon.**

Zunino Patricia, Pascale Lherminier, Herlé Mercier, Xose A. Padin, Aida F. Ríos, Fiz F. Pérez - France. **Budgets of dissolved inorganic carbon in the eastern Subpolar North Atlantic in the 2000s from** *in situ* **data.**

List of participants

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