

SOLAS Focus-2 Meeting: Heidelberg 2006 September 4-8

Summary of meetings with the WCRP WGSF and the Heidelberg Symposium on Transport at the Air Sea Interface

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Executive Summary

International SOLAS Focus-2 Implementation group met throughout the week of September 4-8, 2006. On 4 and 5, Focus-2 group met jointly with the WCRP WGSF. On Wednesday-Friday 06.-08. September 2006, Heidelberg, Germany many international scientists participated in the International Workshop on Transport at the Air Sea Interface. Modelers, remote sensing, and experimentalists met with the focus of SOLAS Focus-2 science themes. Details of the workshop can be found on: <http://klimt.iwr.uni-heidelberg.de/ws-transport/>. The International Workshop on Transport at the Air Sea Interface was hosted by organizers Christoph Garbe (University of Heidelberg, Germany), Robert Handler (NRL, Washington USA), and Bernd Jähne (University of Heidelberg, Germany).

The SOLAS Focus-2 Working Group represents the 2nd of the 3 SOLAS scientific FOCl. Focus-2, led by Wade McGillis and Daniela Turk, is responsible for providing planning, logistics, and integration of SOLAS Focus 2 (www.int-solas.org). The SOLAS Focus-2 scientific aim is "to develop a quantitative understanding of processes responsible for air-sea exchange of climate and weather relevant compounds (CWRCs), momentum and energy to permit accurate calculation and predictions of regional and global fluxes." This focus is critical to understanding the processes and links between the oceans, atmosphere, climate, and weather. It is an obvious complement to the WCRP Working Group for Surface Fluxes (WGSF), chaired by Chris Fairall (NOAA, USA). The WGSF was established to review the requirements of the different WCRP programs for surface sea fluxes including biogeochemical fluxes, develop communication and co-ordination between various related research initiatives, encourage research and operational activities on surface fluxes, and keep the scientific community and the WCRP JSC informed of the progress. Furthermore, the WGSF is charged with generating flux data sets, improving measurement technologies, parameterizations and flux field production algorithms, and assessments of sensitivity of climate models and limits of predictability associated with uncertainties in surface fluxes. Therefore, SOLAS/Focus-2 and WCRP/WGSF work together to establish the dependence of interfacial transfer processes on physical, biological, and chemical factors: at the interface; and throughout the atmospheric and oceanic boundary layers; and the contribution of horizontal and vertical transport and transformation of CWRCs.

SOLAS Focus-2 and the WCRP WGSF first met jointly in Montreal in May 2004. Subsequent meetings have occurred in Halifax (October 2004), Montreal (March 2005), and in Tokyo (May 2005). A joint Working Group meeting was held in Honolulu (February 2006) during the 2006 AGU/ASLO/TOS Ocean Sciences Meeting. Focus-2 and WGSF activities include the development of review manuscripts on both air-sea gas and aerosol fluxes, the production of a handbook for ship-based flux observations (authored by Frank Bradley and Chris Fairall), this joint meeting in Heidelberg, Germany. The next meeting will take place in Xiamen, China (March 2007). Future meetings include New York City (2008), Europe (2009), and at the Air-Water Gas Transfer Conference in Kyoto, Japan (2010).

Action Items and Highlights of Meetings:

Sergey Gulev and Nadia Kovaleva distributed the WCRP WGSF FLUX NEWS newsletter.
Vladimir Ryabinin <ul style="list-style-type: none"> Emphasized that we should do what we think is the right thing to do, since we know best. Suggests models and operational products are good for WCRP and possible linkages with GEWEX.
Focus-2 and WGSF will continue to have official and ad hoc meetings.
SOLAS Focus-2 mission statement (below).
Scientific and Research Activity Protocols are encouraged and endorsed (see table 1).
A SOLAS Focus-2 website will be developed.
Sergey Gulev will explore Russian Ship opportunities for GasEx-Southern Ocean “2 nd ship”.
2006 Hawaii meeting of Focus-2 and WGSF; 2006 Hawaii meeting of SOLAS SSC discussing Focus-2; 2006 Hawaii Special SOLAS AGU sessions; 2006 Handbook on Shipboard Micrometeorological Measurements (Bradley and Fairall); 2006 Heidelberg Focus-2/WGSF meeting September 4-5; 2006 Heidelberg Focus-2/WGSF Symposium on Transport at the Air Sea Interface; 2006 WGSF SURFA Meeting in Boulder Colorado.
2006/2007 Review Manuscripts on Aerosols and Air-Water Gas Exchange – push for publication.
2007 Xiamen SOLAS open science conference: <ul style="list-style-type: none"> CLIMAS Special Discussion Section: Discussion of modeling in SOLAS (Erickson and Gunson will lead); High-Winds Gas Exchange Special Discussion Section: Discussion of results, planning, and synthesis. (Nightingale and Ho will lead).
2008 Low-Wind Gas Exchange Synthesis Workshop: science and research synthesis.
2009 WCRP workshop symposium on WGSF/Focus-2 Science: to be explored by Sergey Gulev.
Daniela Turk recognized the strong connections with SOLAS/WCRP and programs at the European Science Foundation (ESF), in particular, EuroCLIMATE (Climate Variability and the (past, present and future) Carbon Cycle). The Focus-2/WGSF Group meeting and the Symposium on Transport at the Air Sea Interface provide a new, strong complement to the EuroCLIMATE programme.
2010 KYOTO Air-Water Gas Transfer Conference: Chair: Professor Komori. For more information:

SOLAS Focus-2 and WCRP WGSF: Heidelberg 2006 September 4-5

Drs. Vladimir Ryabinin (WCRP) and Jeffrey Hare (SOLAS IPO) discussed the interests and enthusiasm of the joint SOLAS Focus-2 and WCRP/WGSF collaborations. Nadia Kovaleva and Sergy Gulev provided the WGSF FLUX NEWS that highlights the Focus-2 WGSF collaboration. They presented the activities of the respective organizations to the joint Focus-2 and WGSF participants. Both Drs. Ryabinin and Hare continue to be supportive of joint Working Group activities and participated for the joint meeting. Chris Fairall discussed WGSF activities and Wade McGillis/Daniela Turk discussed Focus-2 activities. Christoph Garbe, member of the WGSF and from the University of Heidelberg, was the local host and co-leader of the symposium on the International Workshop on Transport at the Air Sea Interface.

HOT TOPICS in Focus-2/WGSF

Hot topics and presentations were discussed and shown. This agenda item includes urgent international research activities and collaborations. The presentations included:

- David Ho: *Southern Ocean air-sea gas exchange experiment;*
- Phil Nightingale: *DOGEE (pronounced DOG-E) and everything you wanted to know about a gas transfer field experiment;*
- Christoph Garbe: *Novel techniques and highly resolved measurements of small-scale air-sea interactions and usability in laboratory facilities and in the field;*
- Jacqueline Boutin: *Remote sensing: the only way to get global gas-transfer on short time scales.*

The SOLAS Focus-2 Science and Implementation Plans have been completed (www.solas-int.org). The SOLAS Focus-2 has come up with a 5-year strategic operational plan to perform the implementation of SOLAS Focus-2. Main areas are to perform strong data management activities, maintain close connections with SOLAS Focus 1 and 3 groups, and the WCRP WGSF group.

The mission statement of SOLAS Focus-2 is to:

[1] Encourage, inspire, and compile FOCUS-2 collaboration projects in the international protocol; Generate an ongoing database for past, present, and future observational, modeling, and theoretical activities; Establish IMP-2 web site; Seek program activity support;

[2] Provide information, engage and foster collaborations with SOLAS FOCUS 1 and 3 and WCRP WGSF; Plan joint studies, workshops, and data synthesis meetings; Organize joint meetings with FOCUS 1 and 3 and WGSF; Perform international planning; collaborations; and logistics;

[3] Contribution to WGSF and SOLAS newsletters; and writing of combined scientific review journal manuscripts;

[4] Facilitate organization, lectures, field experiments, and funding for entraining students and young scientists;

[5] Provide SOLAS data strategy and facilitate and advocate open data exchange; Maintain strong data management linkages, infrastructure and resource sharing between national programs.

Table 1: Example Template of Science and Research SOLAS and WCRP Activity Protocol.

International SOLAS Activity	GasEx-2001: Equatorial Pacific Carbon Dioxide Exchange Study
SOLAS Project Contact	Dick Feely, Wade McGillis, Rik Wanninkhof wrm2102@columbia.edu
Time	January 26 – March 8, 2001
Study Region	Equatorial Pacific 3S 125 W
International Collaborations	Dutch, USA (8 Institutions), Germany, <i>UK invited</i>
Climate and Weather Relevant Compounds	Carbon, DMS, Water, Nutrients
Processes	Air-water Gas Exchange, Surfactants, Diurnal Mixed Layer, Low winds, High CO ₂ source, low productivity.
Infrastructure	R/V Ronald H. Brown, CARIOCA Buoy, Shipboard Boom and Mast, LADAS, SPIP, ASIS, CTDS, Carbon Isotopic Production, SAMI, SkinDeep, MAERI, Scatterometer, Surface Sampler, Crane deployed surface ocean profiling, 200 W 10 micron pulsed Laser, Infrared Radiometry and Imaging.
Logistics	Langrangian Mode Sampling.
Program Linkages	IGAC, ENSO, GCP.
International Experimental Synthesis	Seattle Data Synthesis Meeting December 2001; Data Synthesis Meeting Honolulu 2002;
Reporting	Congregation of Manuscripts in Journal of Geophysical Research 2004.
Funding Support	NOAA, NSF, KMNI.
Notes:	There are many regions on the ocean that have different atmospheric forcing, ocean forcing, biology, and chemistry. The Eastern Equatorial Pacific is a significant source of carbon dioxide to the atmosphere. The surface mixed layer and low productivity are a very unique environment.

Science and Research SOLAS and WCRP Activity Protocol

Project dreams, planned, on-going, or to be performed are encouraged to submit a Science and Research Activity Protocol to Wade McGillis (wrm2102@columbia.edu) for compiling and distributing a database. Theoretical, modeling, remote sensing, time series, and process study activities are all encouraged. The benefits of this have been surprisingly high and this process will produce collaborations, logistical management, data linkages, and dissemination of results, and ideas to bolster/strengthen the science, research, and applications of air-sea exchange scientific field.

European Science Foundation: Daniela Turk

The EuroCLIMATE (Climate Variability and the (past, present and future) Carbon Cycle) Programme supports research addressing climate variability and the past, present and future dynamics of the carbon cycle, and their inter-relationship. The future climate and its variability are expected to be largely different from those of the recent past. Only paleoclimate studies extending further back in time offer an essential tool for analysing a broader response range of the climate system to internal and external forcings, and for better understanding of the underlying physical, chemical, biological and geological processes.

The GasEx-Southern Ocean Study

Sergey Gulev will explore Russian Ship opportunities for GasEx-Southern Ocean “2nd ship”.

Discussion on SOLAS Focus-2 operational support and finances

- ESF Research Networking Programs - 2006 Call for Proposals
- National Programs

Discussion: 2010 KYOTO Air-Water Gas Transfer Conference

Format, Style, Session Topics to assist Professor Komori

www.fluid.me.kyoto-u.ac.jp/awgt2010

SURFA

WCRP held an independent session to discuss the upcoming SURFA meeting in Boulder Colorado USA.

GROUP Activity: Tour of Heidelberg Laboratories and Facilities

Attachments to this message include: [1] the Handbook of making Marine Air-Sea Fluxes by Bradley and Fairall; and [2] The WCRP newsletter put together by Nadia and Sergey.

SOLAS Focus-2 and the Heidelberg Symposium on Transport at the Air Sea Interface: Heidelberg 2006 September 6-8

Presentations included the wide range of research conducted in SOLAS Focus-2. Presentations included:

Shear Free Surface Flows

Herlina: *Turbulent gas flux measurements near the air-water interface in a grid-stirred tank.*

Evan Variano and Edwin A. Cowen: *Quantitative imaging of CO₂ transfer at an unsheared free surface.*

Aldo Tamburrino, Claudius Aravena, and John S. Gulliver: *Visualization of 2-D divergence on the free surface and its relation to gas transfer.*

Small Scale Processes

Patrick Rosendahl: *Modeling the influence of small-scale processes in the upper water layer on air-sea CO₂ Exchange.*

Martin Gade: *Microwave remote sensing of small-scale features at the water surface that influence air-sea CO₂ exchange.*

Alastair D. Jenkins: *The interaction of ocean surface processes, waves, and turbulence in the adjacent boundary layers.*

Gas Exchange

Gerhard Peters: *Estimation of "small" surface fluxes by eddy covariance.*

Achim Falkenroth, Alexandra Herzog, and Bernd Jähne: *Visualization of concentration fields by oxygen quenching and pH indicators.*

Kai Degreif and Bernd Jähne: *The Schmidt number dependency of air sea gas transfer: new results and models.*

Heat Transfer

Chris Fairall: *Measurement and parameterization of latent heat transfer over the ocean.*

Hannah Linag, Kapil Phadnis, Mohamed Atmane, Christopher Zappa, Mark Loewen, William Asher, and Andrew Jessup: *A laboratory study of passive and active IR techniques to measure heat flux.*

Bernd Jähne, Christopher Popp, Uwe Schimpf, and Christoph Garbe: *Analysis of the heat transfer process across the aqueous heat boundary layer by active thermography: mean transfer velocities and intermittence.*

Christoph Garbe and Bernd Jähne: *Measuring and modeling parameters of heat transfer from surface flow fields by IR image sequence analysis.*

Tour of the Heidelberg Aeolotron

Temperature Structure of the Interface

Nicholas Scott, Geoffrey Smith, Robert Handler: *The structure of the surface temperature field at an air-water interface at low to moderate wind speeds.*

Brian Ward: *Thermometric measurements of the molecular sublayer at the air-water interface.*

Wave Breaking

Johannes Gemrich: *Momentum flux and energy dissipation associated with breaking waves.*

W.L. Peirson, C. Welch, J.W. Walker, and M.L. Banner: *Understanding the enhancement of air-water interfacial oxygen exchange rate by microscale breaking waves.*

Christopher J. Zappa, Felix A. Tubiana, Wade R. McGillis, J. Bent, Gerrit de Leeuw, Marcel M. Moerman: *Investigating wave processes important to air-sea fluxes using infrared techniques.*

Gerrit de Leeuw et al.: *Eddy correlation measurements of sea spray aerosol fluxes.*

Workshop Dinner in the Kulturbrauerei

Turbulence

Guillemette Caulliez, Richard Dupont, and Victor I. Shrira: *Turbulence generation processes in the wind-driven subsurface water flow.*

Haitao Xu, Nicholas T. Ouellette, Mickael Bourgoïn, Ewe-Wei Saw, Evan Variano, Raymond Shaw and Eberhard Bodenschatz: *Experimental investigations of turbulent relative dispersion and the spray characteristics of a waterfall.*

Tetsu Hara, John Wendelbo, E. Vaninwegen, Christoph Garbe, Uwe Schimpf, and Nelson Frew: *Estimation of air-sea gas and heat fluxes from infrared imagery based on near surface turbulence.*

Wu-ting Tsai: *Numerical simulation of turbulent boundary layer beneath a wavy water surface.*

Rain

David Ho: *Rain and air-water gas exchange.*

S. Komori, N. Takagaki, R. Saiki, and N. Suzuki: *The effects of raindrops on interfacial turbulence and air-water gas transfer.*

Anne-Kristin Anweiler: *Lab experiments on the influence of rain on air-sea CO₂ exchange.*

Parameterizations

Sanjoy Banerjee: *The air water interface: turbulence and scalar exchange.*

Wade McGillis: *Using meteorological techniques to parameterize processes controlling air-water gas fluxes.*

Rik Wanninkhof: *The impact of different gas exchange parameterizations on global air-sea CO₂ fluxes.*

A peer-reviewed compilation of manuscripts is now underway.