

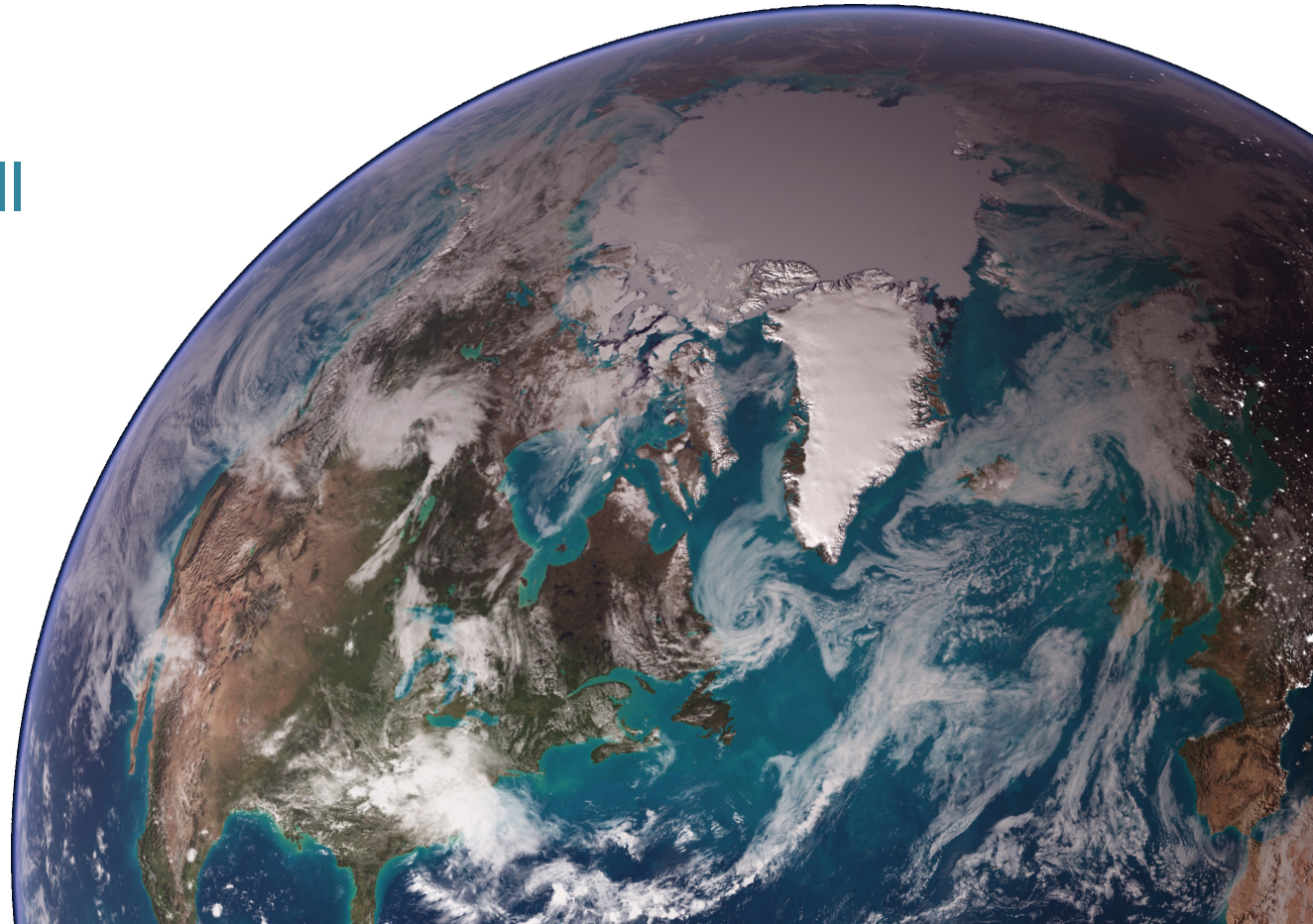


NOAA RESEARCH • ESRL • PHYSICAL SCIENCES DIVISION

Air–Sea Flux Products

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Background

<http://www.esrl.noaa.gov/psd/psd3/wgsf/>

- Measurement Technology
- Improve Observations from Buoys and Research Vessels
- Flux Estimation Algorithms
- **Direct Observations Databases**
- **Global Flux Products**

Direct data used principally to develop parameterizations, improve the observing system, and 'verify' model results

WCRP World Climate Research Program
Working Group on Surface Fluxes

This new working group is a follow-up to a temporary SCOR/WCRP working group on air-sea fluxes previously chaired by Dr. Peter K. Taylor (Southampton). The website <http://www.soc.soton.ac.uk/JRD/MET/WGASF/> contains detail from their WG.

The new WG is charged with reviewing and coordinating requirements of the various WCRP programs for air-sea fluxes (initially) and air-land fluxes (in a future phase).

Specific objectives include:

- developing flux data sets available from different sources (in-situ, remotely sensed, NWP-based);
- 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.

The WGSF will also serve as a bridge between WCRP and the Surface Ocean - Lower Atmosphere Study (SOLAS) of the International Geosphere-Biosphere Programme (IGBP) and the International Geosphere-Biosphere Programme (IGBP) and the International Geosphere-Biosphere Programme (IGBP). A powerpoint file that gives a bit more background can be obtained at the following [ftp site](#).

The JSC's proposed Terms of Reference (TORs) for WGSF:

- to review the requirements of the different WCRP programmes for air-sea fluxes;
- to develop communication and co-ordination between the research initiatives of WCRP and IGBP on air-sea fluxes;
- to encourage research and operational activities aimed at improving the knowledge of air-sea fluxes;
- to keep the scientific community and the JSC informed of progress achieved through regular reports, World Wide Web, and as necessary, scientific meetings.

Proposed specific objectives of WGSF for the nearest perspective:

- ongoing compilation, evaluation and intercomparison of existing flux data sets, including those of biogeochemical fluxes;
- further improvement of parameterisations of physical and biogeochemical fluxes, quantification of uncertainties in surface flux products and development of objective analysis schemes;
- assessment of model sensitivity to and limits on predictability from errors associated with surface fluxes and development of objective analysis schemes;
- development of strategy for merging and combining surface flux data sets to meet the requirements of WCRP and IGBP;
- development of the requirements for flux and flux-related observations in co-operation with IGBP, GCOS, GOOS and other relevant activities;
- interaction with and support to SOLAS.

Background

Membership

Meetings

Reports

Newsletter

Publications

[Flux Literature](#)

Work Group Pubs

Flux Measurement

[Handbook](#)

[Computer Programs](#)

[Data Sets](#)

Links:

[Project SEAFLEX](#)

[WHOI Flux Reference](#)

[Buoys](#)

[WHOI MATLAB Flux](#)

[Routines](#)

Flux Products

NWP

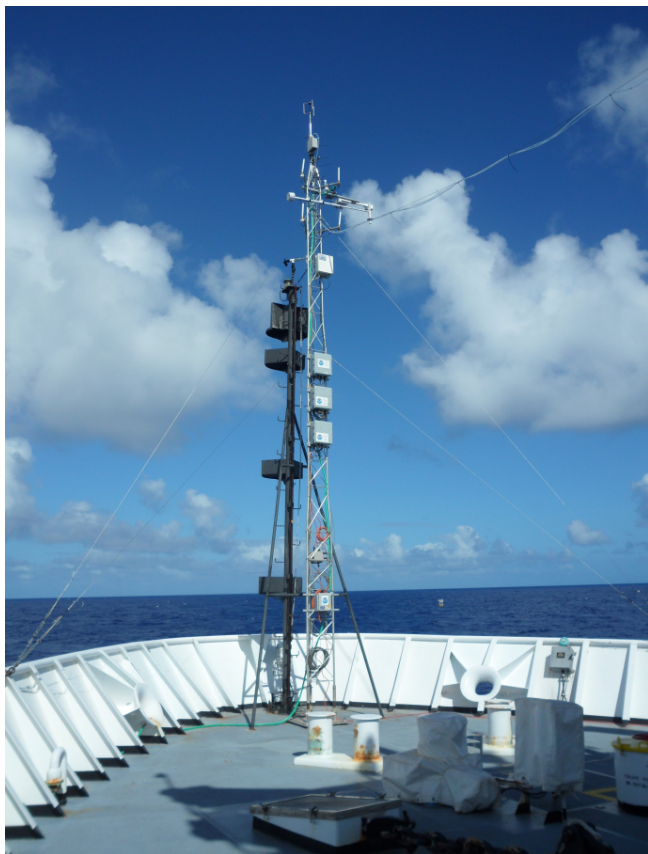
Satellite:

[ISCCP](#)

[TOPEX/Poseidon](#)

Technology

- Requirement:** There is a need for air-sea flux measurements of high accuracy and high time resolution: Intensive field programs, Satellite retrievals, NWP/Climate model products, Climate monitoring system.



<http://www.esrl.noaa.gov/psd/spotlight/2011/flux-system.html>

Table 1. Summary of recent research vessels with collaborations by the ESRL seagoing flux group.

| Nation | Ship | Institute | Contact |
|-----------|-----------------|-----------|------------|
| Korea | Araon | KOPRI | S. Park |
| UK | Clark | NOC | M. Yelland |
| Ireland | Celtic Explorer | U. Galway | B. Ward |
| Germany | Meteor | U.Hamburg | S. Kinne |
| France | L'Atalante | IFREMER | A. Weill |
| Australia | S. Surveyor | Aus. BOM | E. Schulz |
| India | Sindhu Sankalp | NIO Goa | V. Kumar |
| US | Sikuliaq | U. Alaska | M. Edwards |
| Japan | Mirai | JAMSTEC | Jun Inoue |



Fairall, C. & Co-Authors, 2010:
Observations to Quantify Air-Sea Fluxes and Their Role in Climate Variability and Predictability in Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., Harrison D.E. & Stammer, D., Eds., ESA Publication WPP-306.

NOAA COARE BULK FLUX MODELS: Developed and Maintained at PSD

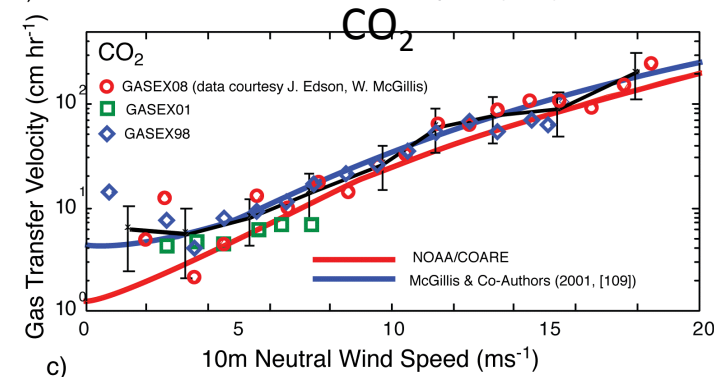
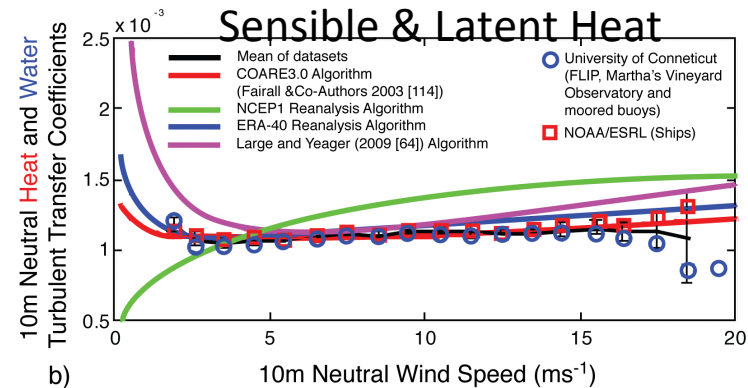
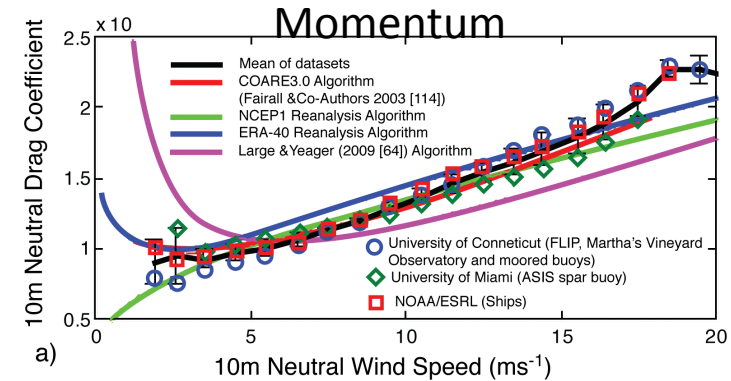
$$\text{Met Flux} : \overline{w'x'} = C_x U (X_s - X_r) = C_x U \Delta X$$

$$\text{Gas Flux} : \overline{w'x'} = k_x \alpha_x (X_{wr} / \alpha_x - X_{ar})$$

$$\text{Particles} : F_n = \text{Source}(r) - V_d(r) \overline{n(r)}$$

- 1996 Bulk Meteorological fluxes
- 2000 CO₂ [*U. Conn and Columbia U*]
- 2003 Hurricane Sea Spray
- 2004 DMS [*U. Hawaii*]
- 2005 Snow/Ice [*US Army CRREL*]
- 2006 Ozone [*U. Colorado*]
- 2008 PCBs and PCEs [*Mich. Tech. U*]
- 2010 79 Trace gases [*Johnson 2010*]
- **2011 COAREG3.1**
 - CO₂, DMS, ³He, CO, O₃, SF₆, Methanol
- **2014 COARE3.5**
- **2015 Hurricane spray version 12**

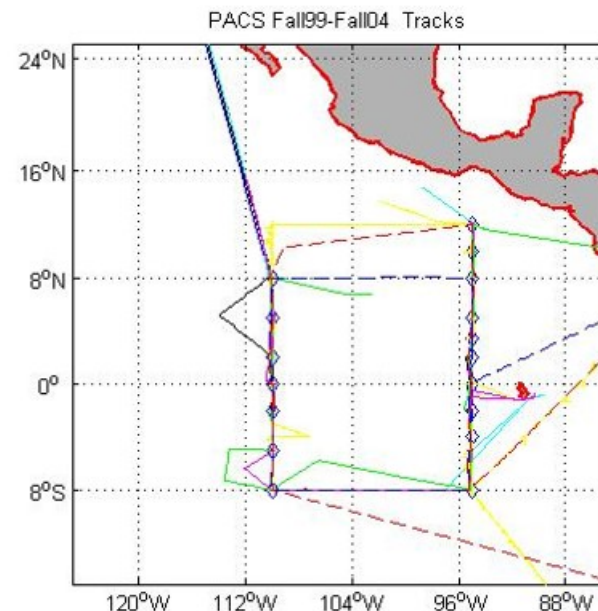
<ftp://ftp1.esrl.noaa.gov/users/cfairall/bulkalg/>



PSD Flux Data Sets

- PSD Cruise Data base
 - <ftp://ftp1.esrl.noaa.gov/psd3/cruises/>
 - 62 cruise individually archived
 - Raw and processed; images

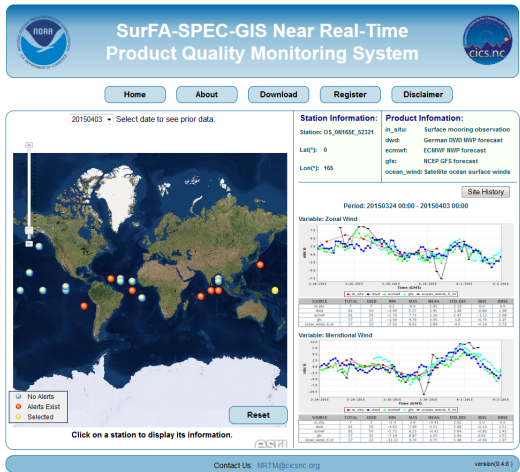
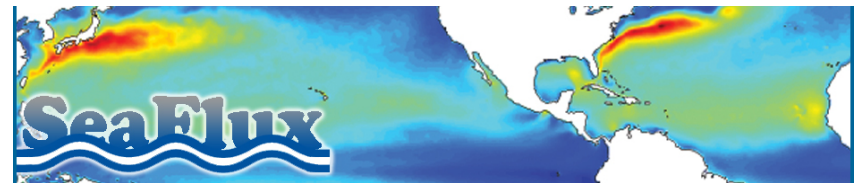
- PSD Direct Flux *Easy-to-Use* Composite Files
 - 14 cruise 1991-1999 Atlantic and Pacific
ftp://ftp1.esrl.noaa.gov/users/cfairall/fluxdata/combined_file/
 - 10 cruises 1999-2004 Equatorial E. Pacific
ftp://ftp1.esrl.noaa.gov/users/cfairall/EPIC/epicmonitor/combined_files/
 - Fluxes, clouds, rawinsondes
 - 8 cruise Stratus 2001-2010 Stratus region off Chile
ftp://ftp1.esrl.noaa.gov/users/cfairall/epic_stratus_integrated/
 - Fluxes, clouds, rawinsondes



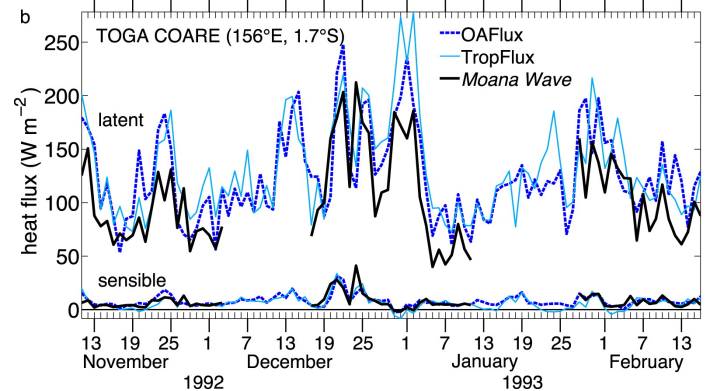
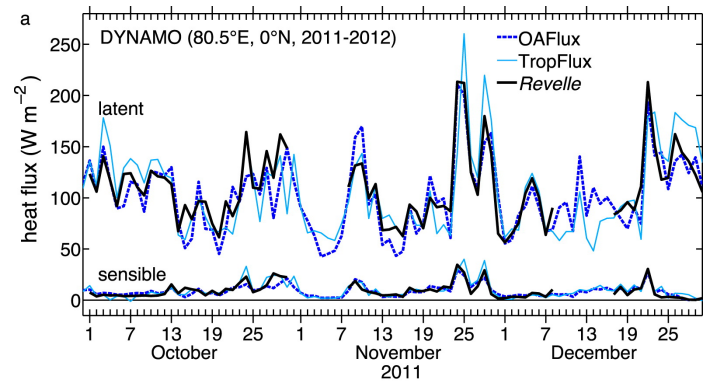
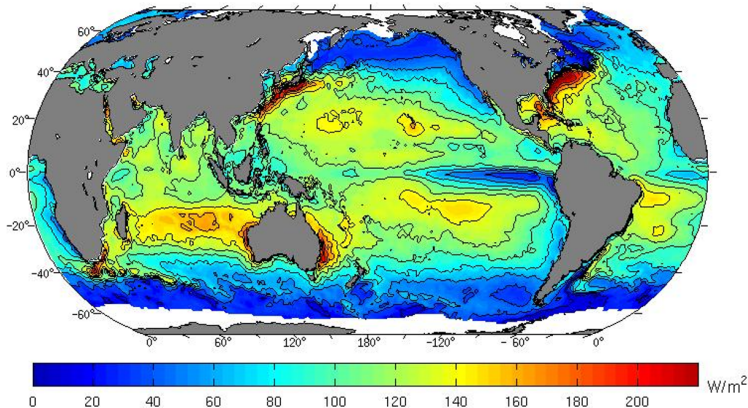
Community Flux Products:

NWP: **SURFA** Archived flux fields
from ECMWF, DWD, JMA

Satellite: **SEAFLUX**, GSSTF, HOAPS,
JOFURO, IFREMER



Blended: WHOI **OAFflux**, CORE,..
Mean Latent Heat Flux in 2010



Summary and Conclusions

- Central Theme: Results for NOAA's climate observing system and process research
- Products include technological advances, flux algorithms, direct flux databases, and collaborations with gridded global flux products.
- Applications include better measurements from ships and buoys, better fluxes for NWP and climate models, improved global flux products.