US CLIVAR High-Latitude Surface Flux Working Group

US CLIVAR Summit, July 2010, Denver

Photo: Peter Guest, SHEBA, 1998,
http://www.weather.nps.navy.mil/~psguest/sheba/pictures/maui_rescue.html

Working Group Started with 2 Objectives

- Document present state of high-latitude fluxes, considering momentum, heat, freshwater, and CO_2. Focus primarily on ocean-atmosphere and ocean-ice-atmosphere fluxes.
- Organize community workshop to coordinate efforts to improve flux estimates at high latitudes.

Photo: Peter Guest, SHEBA
http://www.weather.nps.navy.mil/~psguest/sheba/pictures/artsy.html

Membership

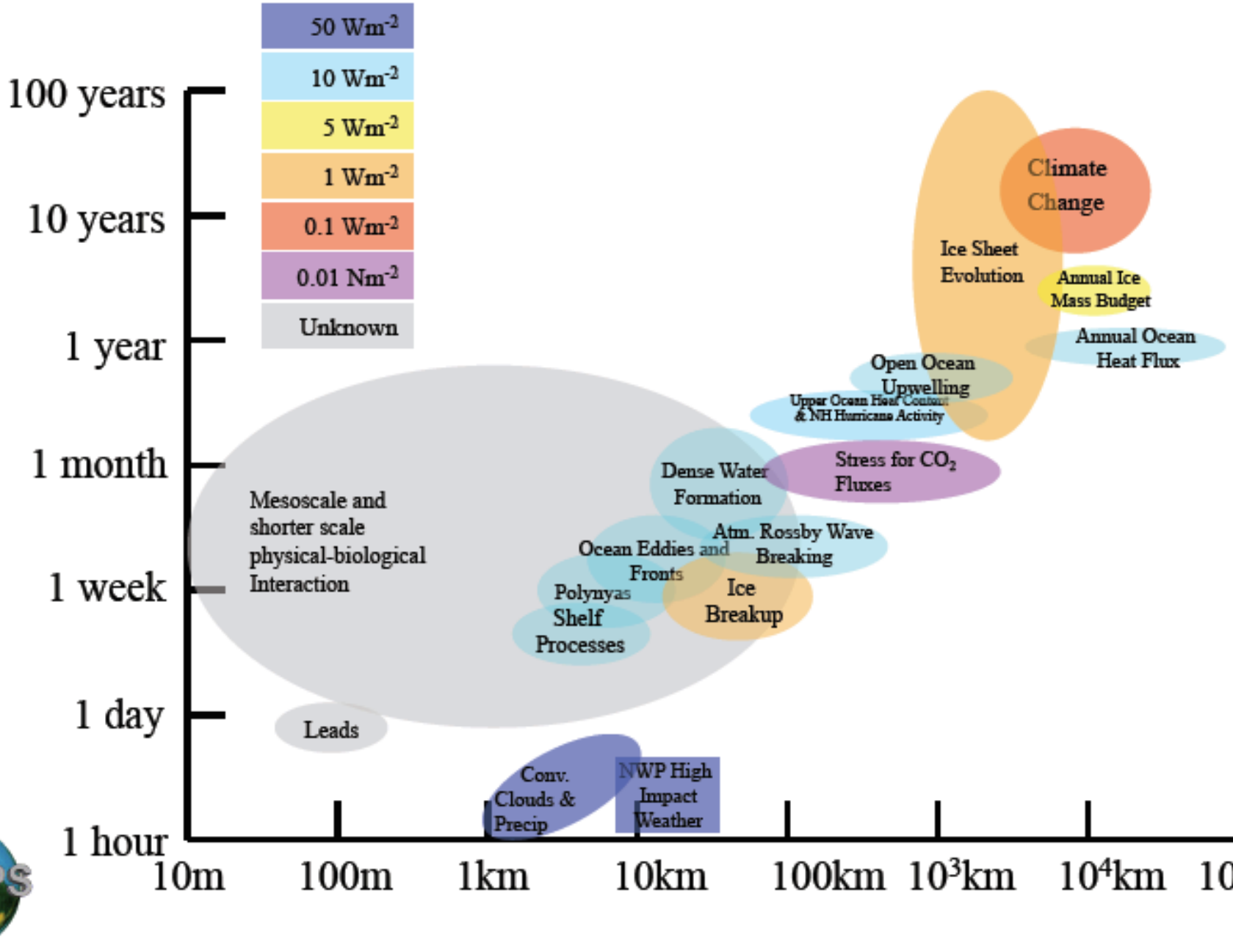
- Ed Andreas (associate)
- Cecelia Bitz
- Mark Bourassa (co-chair)
- Dave Carlson
- Ivana Cerovecki (associate)
- Meghan Cronin (associate)
- Will Drennan
- Chris Fairall
- Sarah Gille (co-chair)
- Ross Hoffman
- Gudrun Magnusdottir
- Rachel Pinker (associate)
- Ian Renfrew (associate)
- Mark Serreze
- Kevin Speer
- Lynne Talley
- Gary Wick

Documenting State of Fluxes

- Since March 2008, regular telecons, plus a one-day meeting following AMS meeting in Phoenix in January 2009.
- BAMS manuscript summarizing current state of fluxes (in revision)
- Newsletter items:
  - US CLIVAR Variations
  - FluxNews
- OceanObs contribution

Photo: 20 m/s winds as seen from ship.
Southern Ocean GasEx (Chris Fairall)

Flux Accuracies and Applications



Joint US CLIVAR/SeaFlux Workshop

Workshop participants, Day 3

- Open community workshop held in Boulder, Colorado, 17-19 March 2010, NCAR Center Green
- Capacity crowd (70 participants).
- Agenda included plenary talks, separate breakouts on satellite issues (“SeaFlux”) and applications and in situ observations (“CLIVAR”).
- Talks posted on-line: http://www.joss.ucar.edu/events/2010/seaflux/agenda.html

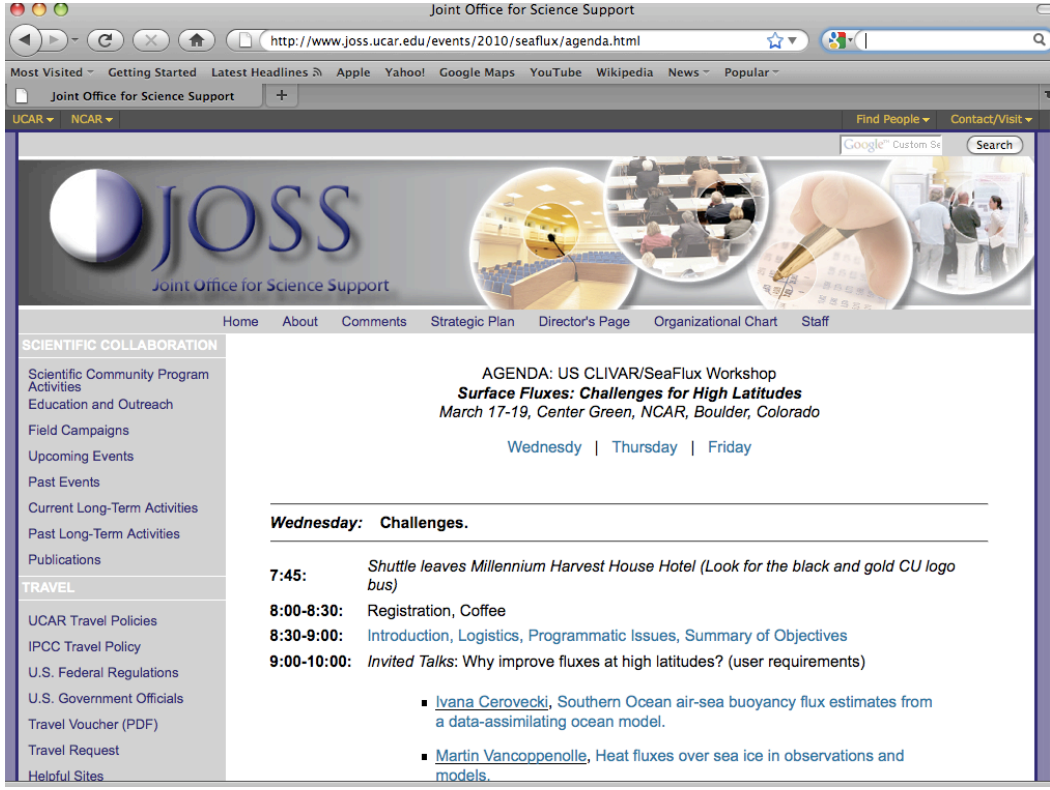
Workshop Objectives

- Share results on applications that rely on fluxes, and look at flux requirements implied by applications.
- Share results on gridded flux products and regional observational (process) studies.
- Disseminate findings.
- Articulate a prioritized plan for improved fluxes.

Photo: Riming on Eppley pyranometer, August 21, 2009
Southern Ocean GasEx, Chris Fairall

Disseminate workshop results

- Presentations posted
- *J. Climate* (AMS) special collection (submissions due October 1)
  - Any high latitude surface flux contributions will be considered (need not have been presented at workshop).
  - Other AMS journals OK too (*JPO*, *J. Tech*)
  - 25 submissions expected
- *US CLIVAR Variations* meeting summary just mailed.
- *EOS* workshop summary in review.



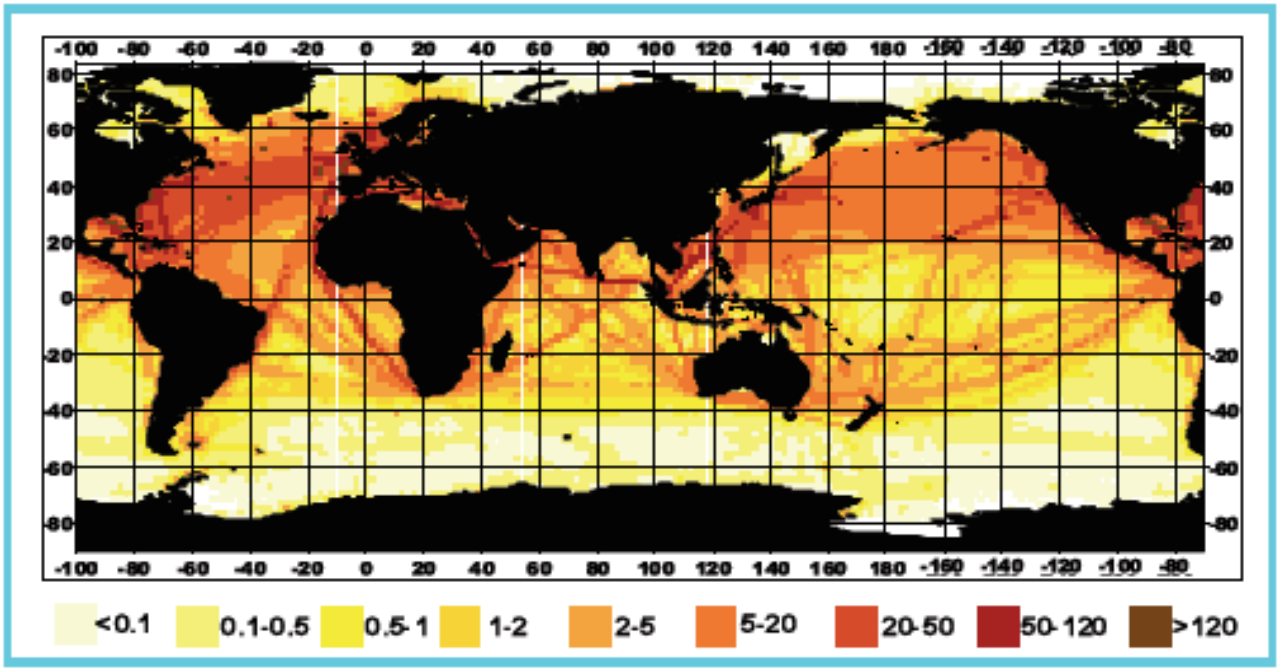
Workshop Consensus Strategies for Improving Fluxes

- ***More routine observations***: Moorings, or routine ship-board observations of momentum and turbulent heat fluxes.
- ***More process studies***: Arctic and Antarctic observations desirable.
- ***New satellites***: Prospect of obtaining momentum, latent heat, sensible heat, radiative fluxes through a well-defined set of sensors, possibly in multi-satellite formation ("Flux Train").
- ***Improved access to observations and reanalyses***: Good meta-data, quality control and uncertainty information.
- Data providers suggested need for ***improved data users***. More caution urged on selecting data products appropriate for application and testing multiple data products (rather than using first one located.)
    - Data providers should provide easily interpreted information to aid in these decisions

Need for observations

- Historic observations sparse, but it will be crucial to analyze historical data carefully and to make use of new data as it becomes available
- New buoy observations are under development (Agulhas, and have been advocated in planning documents)
- Since workshop, Fairall et al. have suggested instrumenting a NOAA ship operating in Bering Sea.

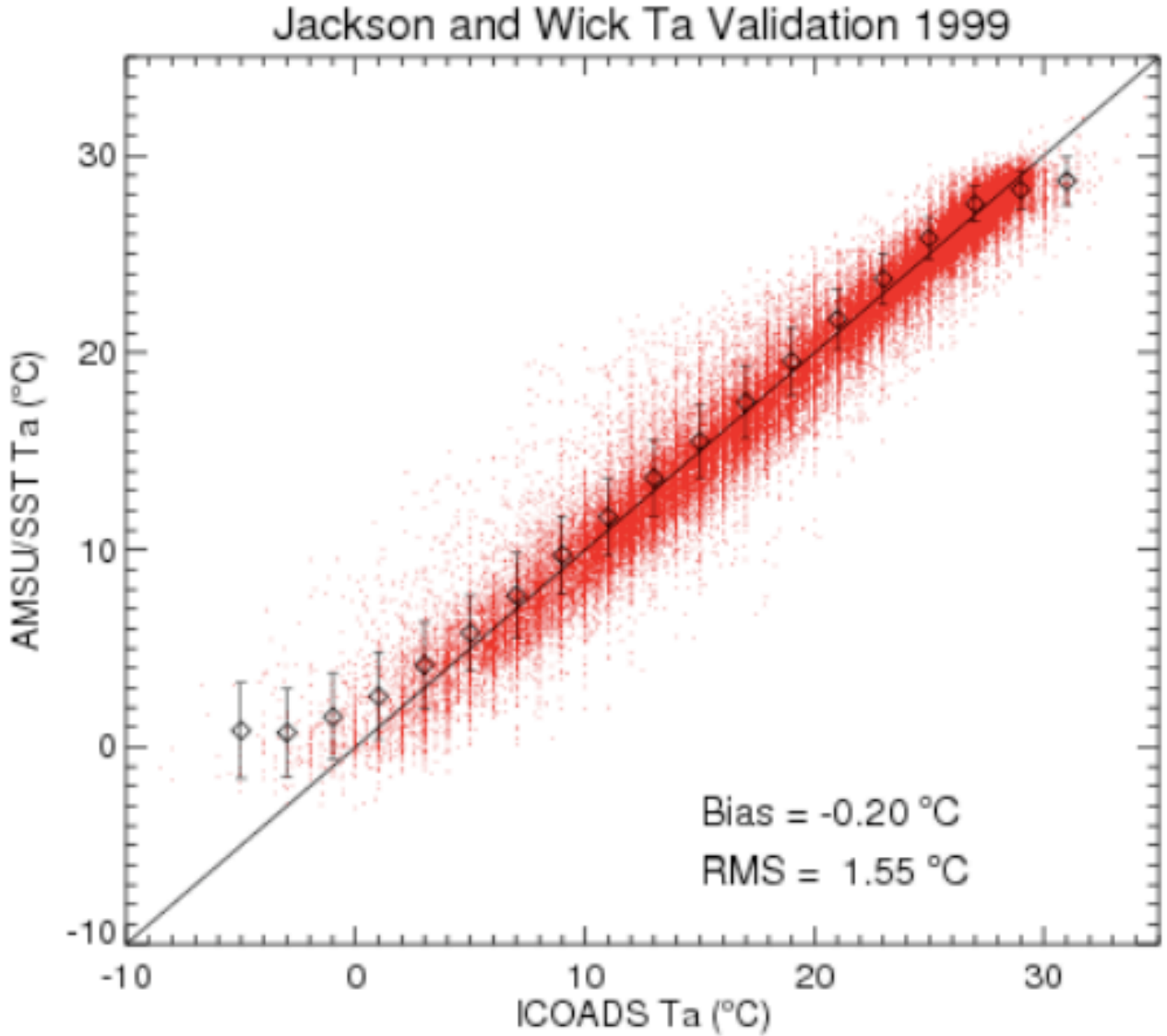
ICOADS VOS data: 1880-2007



Sampling is inhomogeneous in space and in time!

Satellites: Prospects for heat flux as well as momentum

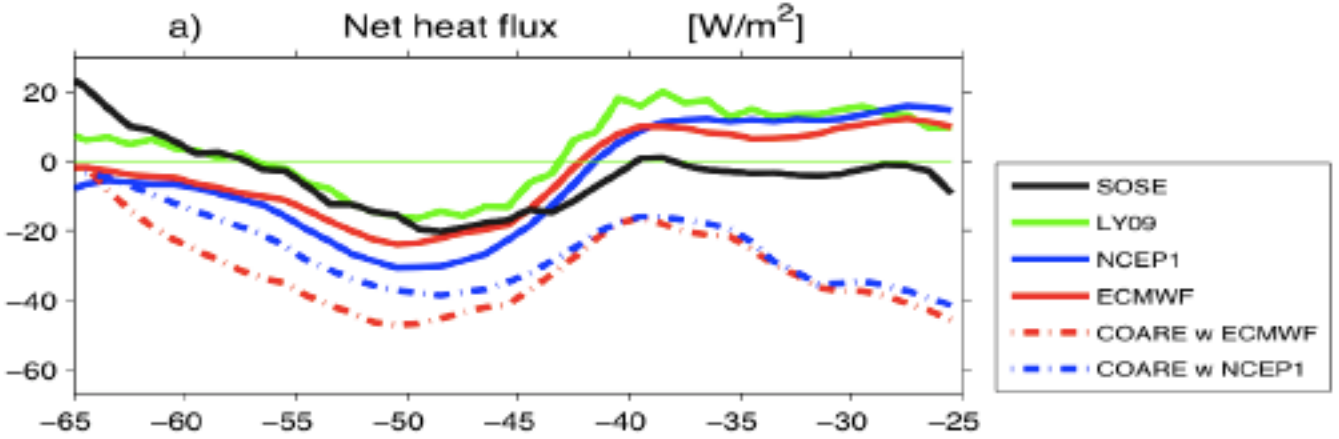
Example Retrievals of 10m Air Temperature



- Multiple linear Regression technique
- Pretty good for most conditions
- Issues for very low temperature and very high temperatures

Next generation gridded products: SeaFlux

- SeaFlux focused on gridded products, with substantial contributions from satellite observations and reanalysis.
- Assessment crucial. US CLIVAR may be able to help with flux assessment (e.g. a Flux Intercomparison Project or a flux component in a future Model Intercomparison Project). IESA workshop in Baltimore may be a good forum ….
- All users can help make sure flux products are put through tests with a variety of applications.



Example flux comparison: Zonal average, 2005-07 (Cerovecki et al., 2010)

SOSE (Southern Ocean State Estimate); LY09 (Large and Yeager, 2009)

Steaming ahead ….

Photo: Chris Fairall, Southern Ocean GasEx