The Future
Overview of the Observing System
Fairall, Cronin, Gulev

Basic principles:

Where satellite or in situ observational global products have gaps or uncertainties, parameterizations are needed that can be evaluated with fields at hand.

Reference data are need to validate these products and parameterizations.

Recommendations for bulk turbulent fluxes

- expand wind speed range to 20-30 m/s
- improve gas exchange parameterization
  - Parameterize may depend upon mean square slope, bubbles, white caps, in addition to wind speed.
- identify best wave effect parameterization that is latitude independent and regionally universal.
- continue refining low wind speed flux parameterizations.

Recommendations for Radiative fluxes

- improve albedo parameterizations for mid- and high latitudes and for ice margins.
- identify state variables for surface clearsky models (aerosol, optical depth, precipitable water vapor,…?) and develop parameterizations and data bases for these state variables,
- more in situ radiation obs

Recommendations for precipitation

- What is the standard?
- Develop high quality, low cost, rain and snow sensor for ship, buoy, land applications.

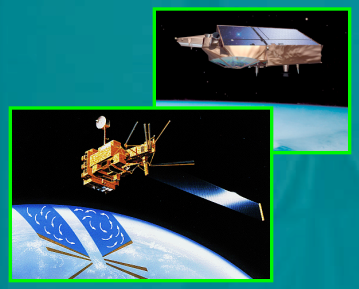
Conclusions and recommendations

In-situ "system of systems"

- Expansion of OceanSITES in subpolar and high latitudes, extension of packages to direct turbulent measurements including gases
- RV & underway: transfer of SAMOS to the truly international program with distributed or centralized DAC
- Drastic decline of VOS must be recognized and addressed

Global & regional closure

Cross-validated fluxes and sea ice characteristics



Satellites

- Maintenance of HR global scatterometry and microwave with overlapping periods of operation
- Priorities for improved retrievals of temperature, whitecaps, humidity, precip, and improved sampling for vector winds
- Improved access to SAR data on winds and sea-ice characteristics

NWP and reanalyses

- Improvement of the space-time resolution and temporal coverage
- Minimizing uncertainties by improving the whole system
- Coupled reanalyses will hold the best prospect for spurring NWP advances and reducing biases due to currents and waves

Engaging ocean in climate prediction

WCRP, WMO, IOC:

- International coordinating and facilitating body is needed

OceanObs'09 (Gulev et al 2010) *21-25 September – Venice, Italy*

Fairall et al. Recommendations from OceanObs09 see: http://oceanobs09.net/

1) The surface flux reference network under OceanSITES should be expanded

2) The number of ships making high quality routine flux-related measurements should be increased

3) VOS should be maintained and enhanced as a flux observation network.

4) Satellite flux observing system should be enhanced

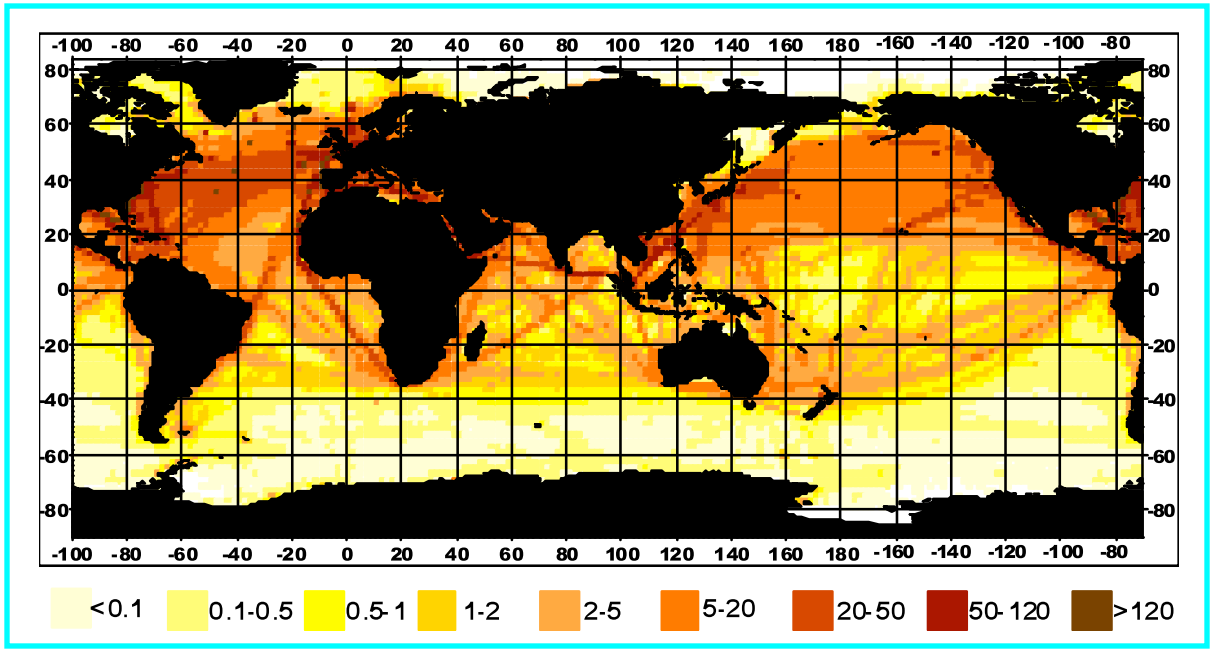
5) Flux observing system technologies should be improved

7) Flux parameterizations should be continually improved

8) A range of independent and well-characterised flux products is needed

9) Improved validation and parameterizations for NWP and reanalysis model fluxes is required

ICOADS VOS data: 1880-2007



Sampling is inhomogeneous in space and in time!