The NOCSv2.0 Surface Flux Dataset

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The *in situ* ocean surface flux dataset from the National Oceanography Centre, Southampton (NOCS), has now been updated to include data up until the end of 2009.

NOCSv2.0 contains monthly-mean 1°-area gridded estimates of turbulent and radiative flux components along with the meteorological variables used in the flux calculation. Random and systematic uncertainty estimates are also available for each variable.

The data are available via:

http://www.noc.soton.ac.uk/noc_flux

The flux estimates are based on ship data from the International Comprehensive Ocean-Amosphere Data Set (ICOADS, Worley et al., 2005). ICOADS ship measurements of sea surface temperature (SST), air temperature, near surface humidity, winds and pressure are used as input to the flux "bulk formulae" (Smith 1980, 1988) to estimate the surface sensible and latent heat fluxes. Cloud cover is also needed to estimate theradiative flux components.

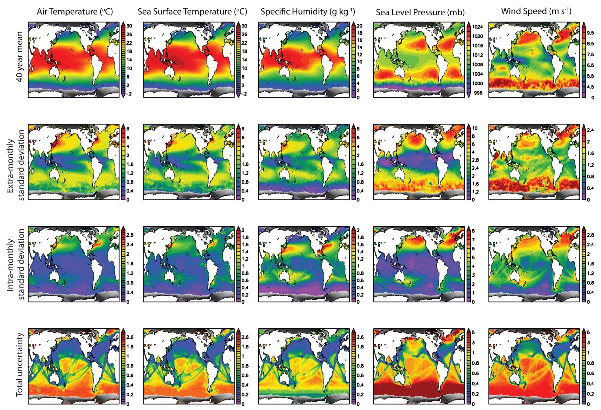
Optimal Interpolation (OI) is used to first produce daily fields of SST, air temperature, near surface humidity, winds and pressure on a 1˚x1˚ area grid. These daily fields are then used to calculate fluxes using the bulk formulae. The OI scheme produces uncertainty estimates which are propagated through the bulk formulae to give uncertainties in the flux fields. The daily fields of the meteorological variables and fluxes are then averaged to give monthly fields. The calculation of uncertainty in the monthly fields is complicated by the need to account for correlated uncertainties (see Berry and Kent 2011 for more details).

Long-term means, variability and uncertainty estimates

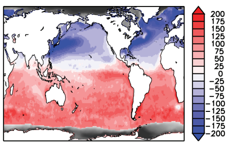
The panels to the right show long-term (40-year) statistics for the variables required as input to the turbulent flux formulae. The top row shows the familiar patterns of the mean values. The poorer sampling at high latitutes, particuarly in the south, is evident as noise in the more variable parameters - even in a 40-year average. The second row shows the standard deviation of the monthly means and the third row the mean of the standard deviation of the daily estimates within each month. The bottom row shows the average of estimate of the total uncertainty in the monthly mean over the 40-year period (not the uncertainty in the 40-year mean).

Comparison of the estimates of variability within and between months shows that some important features are captured. The within-month variability (3rd row) typically shows smaller space scales, but in poorly-sampled regions (shown by high uncertainty estimates) is severely underestimated. In constrast the intermonthly variability (2nd row) tends to be noisy in poorly sampled regions as individual monthly values can be based on a small number of observations.

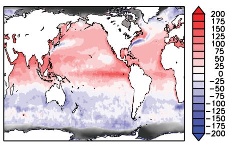
These data and uncertainties are used to calculate the fluxes, plotted in the panel below.



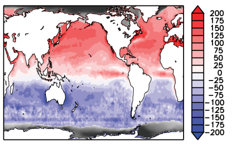
Seasonal Mean Net Heat Flux (Wm^{-2})



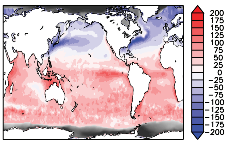
December:January:February



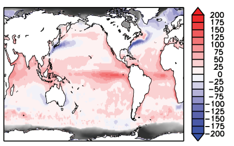
March:April:May



June:July:August



September:October:November



Annual Mean

Average over period 1970-2010

-ve values indicate heat loss from the ocean

The seasonal cycle of heat gain and loss is clear, along with the major heat loss over the Gulf Stream and Kuroshio regions which persists throughout most of the year.

The annual mean plot shows the global mean imbalance in the heat budget: 24 Wm^{-2} additional heat gain by the ocean. The heat imbalance reduces from over 30Wm^{-2} in the early 1970s to around 15 Wm^{-2} at the end of the period. The increasing heat loss estimates over the period (actually a reduction in heat gain) are largely due to increases in the wind speed, leading to increasing turbulent heat loss.

We believe that at least part of the change we see in the wind speed is due to changing measurement bias, but there is also likely to be a real component to the change. We would also like to use measurements of the radiative fluxes from Research Vessels to explore the uncertainties in the radiative flux estimates.

Future Plans

- An extension to cover 50 years should be available in the next few months
- More work is needed to produce estimates of precipitation with uncertainty estimates and also wind stress components
- We hope that the next release of the dataset will contain improvements to the bias adjustments, the characterisation of random uncertainty, the method of weighting data within the OI scheme and the time and space scales used.
- We also hope to include satellite estimates of some of the input parameters to improve the sampling characteristics of the dataset.

For more information or to access the daily fields used in the calculations please contact either David Berry or Elizabeth Kent :

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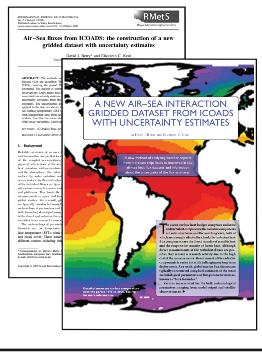

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Acknowledgements

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