Six air-sea flux products are compared in the Southern Ocean:

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(1) two products from the most commonly-used numerical weather prediction (NWP) models: NCEP-NCAR Reanalysis 1 (NCEP1) and the ECMWF operational model (ECMWF);
(2) two estimates that use NCEP1 and ECMWF meteorological and ocean surface fields as input into the state-of-the-art Coupled-Ocean-Atmosphere Response Experiment version 3.0 (COARE 3.0) bulk formulae to estimate latent and sensible heat flux components that are added to the NCEP1 and ECMWF net radiative flux to obtain the net air-sea heat flux;
(3) two recent products constructed as an improvement of NWP model fluxes: the Southern Ocean State Estimate (SOSE) and Large and Yeager dataset (LY09).

The net air-sea heat flux estimates from group (2) above were inferior to the corresponding estimates from groups (1) and (3). They are unbalanced fields showing insufficient ocean heat loss in subtropics, suggesting that in the Southern Ocean combining COARE turbulent heat flux estimates with the radiative heat flux estimates from NWP model does not uniformly improve the net air-sea heat flux estimate.

The quality of the recently obtained SOSE air-sea heat and freshwater flux estimates has been assessed by verifying that the SOSE differences from NCEP1 forcing fields largely correct the NCEP1 biases reported by the Working Group on Air-Sea Fluxes (WGASF), and also are largely in agreement with those of LY09 in large scale pattern although there are quantitative differences between SOSE and LY09 flux adjustments.

The major differences from NCEP1 common to both SOSE and LY09 datasets are an increase of ocean heat loss in high latitudes, a decrease of ocean heat loss in the subtropical Indian Ocean, a decrease of net evaporation in the subtropics and, a decrease of net precipitation in polar latitudes. The SOSE and LY09 turbulent heat flux adjustments have very similar patterns, but different magnitudes. Radiative heat flux adjustments differ in large scale pattern. Net air-sea heat flux differences from NCEP are predominantly determined by turbulent heat flux adjustments.

The monthly mean correlations averaged in time (years 2005-2007), zonally and meridionally over the ice-free ocean for the net heat flux and E-P fields show that none of the flux products from groups (1) and (3) are outliers. The highest correlation of 0.98 is between NCEP1 and ECMWF net heat flux.

The net heat flux correlations between all other datasets from groups (1) and (3) are higher than 0.9: NCEP1 and LY09 (0.94), NCEP1 and SOSE (0.93), SOSE and ECMWF (0.92), and SOSE and LY09 (0.90).

For all datasets the monthly E-P correlations are much smaller than the correlations between the net air-sea heat flux estimates from the same datasets: NCEP1 and ECMWF (0.74), NCEP1 and LY09 (0.48), NCEP1 and SOSE (0.39), SOSE and ECMWF (0.56), and SOSE and LY09 E-P estimates (0.34).