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Intercomparison of precipitation data sets from reanalyses and satellite products over the ocean

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Ocean surface precipitation is critically important for estimation of surface fresh water fluxes and building forcing functions for global ocean modelling. Due to the lack of direct observations over the ocean, different applications typically use long-term precipitation time series available from reanalyses and satellite products. Reliability of these datasets is, however, questionable and comprehensive intercomparison efforts are required. We perform the intercomparison of global precipitation fields over the global ocean from five reanalyses NCEP-1, NCEP-DOE, ERA-Interim, MERRA and NCEP-CFSR and two major satellite products (GPCP and TRMM). The strategy was to estimate biases of precipitation statistics from reanalyses to those from GPCP and TRMM. Intercomparisons were performed for the two periods of overlap of reanalyses with satellite products - 1998-2010 (TRMM period, latitudinal band from 40S to 40N) and 1979-2010 (GPCP period, global). For comparison of precipitation statistics daily precipitation fields fro all products were interpolated onto a single 1/2 degree grid.

Comparative assessment included analysis of precipitation totals, intensity of rainfall, number of wet days as well as characteristics of precipitation probability distributions. We analyzed mean seasonal climatologies and interannual variability patterns. Although qualitatively all products are quite consistent, quantitative differences can be quite significant, with the largest spread being in the Equatorial zone and in the Pacific tropics, where the differences between different products may reach several tens of percents. ERA-Interim shows the closest to satellite products precipitation statistics, although disagreements in the Equatorial zone are quite large. MERRA shows a little consistency with satellite products in the areas of light precipitation. Of the two first generation NCEP reanalyses, NCEP-DOE is considered to be "too wet" showing large overestimation of precipitation in the Equatorial zone. New generation NCEP-CFSR reanalysis based on a fully coupled atmosphere-ocean and sea ice model still overestimates precipitation showing larger values compared to satellite data. The largest discrepancies between different products were revealed during summer months. Analysis of temporal change in precipitation shows that reanalysis data sets demonstrate large spread of linear trend estimates with very few areas showing consistency of trends. We conclude that time variability in reanalysis precipitation products is largely influenced by data assimilation input and should be considered with great caution. On shorter interannual scale precipitation anomalies in ERA-Interim MERRA and NCEP-CFSR demonstrate much stronger correlation with satellite products than NCEP-1 and NCEP-DOE reanalyses.