A Comparison of Atmospheric Reanalysis Surface Products over the Ocean and Implications for Uncertainties in Air-Sea Boundary Forcing

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We investigate the uncertainties related to atmospheric fields from reanalysis products used in forcing ocean models. Four reanalysis products, namely from (1) European Centre for Medium Weather Forecasts (ERA-Interim), (2) Common Reference Ocean-Ice Experiments (CORE-2), (3) Japanese Reanalysis Project (JRA-25) and (4) National Centers for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR), are evaluated against satellite-derived observations for eight different fields (zonal and meridional wind stress, precipitation, specific humidity, river runoff, surface air temperature, downwelling longwave and shortwave radiation fluxes). No single product is found to agree better in *all* fields with satellite-derived observations. Reanalysis products are mostly comparable to each other due to similar physical assumptions and assimilation of common observations. Adjusted atmospheric fields from ECCO optimizations are also in agreement with other reanalysis products. Timemean and time-variable errors are estimated separately and mapped globally in space, based on 14-day average fields to focus on monthly to interannual periods. Time-variable errors are larger, in both magnitude and in comparison to the signal, than time-mean errors for most fields, thus justifying the need to separate them for studying uncertainties as well as formulating optimization procedures. Precipitation and wind stress fields show significant time-mean and time-variable errors whereas downwelling radiation, air temperature and humidity fields show small time-mean errors but large time-variable errors particularly in the tropics. Uncertainties based on evaluating multiple products presented here are considerably larger than uncertainties based on single product pairs.

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