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The data assimilation system in the ERA-20C reanalysis

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Within the ERA-CLIM project, ECMWF is producing a pilot reanalysis of the 20th-century assimilating surface observations only. The ERA-20C reanalysis is essentially a repeat of the 20th Century Reanalysis conducted by Compo et al. (2011), but covering a shorter time period and with different or upgraded components (model, data assimilation, and observations). ERA-20C covers the years 1899 to 2010, employs an Ensemble of Data Assimilations (EDA), uses model forcings as specified in CMIP-5, and assimilates atmospheric surface pressure and atmospheric surface wind observations. Production started in December 2012. Furthermore, ERA-20C serves as a testbed for several data assimilation developments as compared to the operational Numerical Weather Prediction EDA configuration in use at ECMWF in 2012. The first novelty is a 24-hour assimilation window for the four-dimensional variational (4D-Var) upper-air analysis employed by each of the ten EDA members. The second novelty is a two-step improvement that enables to specify space- and time-varying background errors which are cycled and updated online. As will be shown, the recomputation of background error covariances at regular intervals allows, as intended, to help capture the slow improvements in space and in time of the reanalysis quality, as the observation coverage improves regionally. We find indications that in the earlier part of the century the information extracted from sparse observations is used to correct errors in the large-scale short-term forecast background. At the end of the century, the analyses make smaller corrections, and over smaller areas around observations. This illustrates the efficiency of the approach to optimally extract quantitative information with varying characteristics depending on the background accuracy (which is the cumulated result of prior assimilations and the observing system of the previous months). Initial results of ERA-20C product evaluation based on the available production will also be shown.