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Validation of ERA-Interim precipitation estimates over the Baltic Sea

Karl Bumke
GEOMAR Helmholtz Centre for Ocean Research Kiel, Kiel, Germany (kbumke@geomar.de)

The closing of the energy and water budgets of the Baltic Sea is only possible, when beside an accurate knowledge of the in- and outflows through the Danish Sounds, evaporation and precipitation are exactly known. Due to a lack of in-situ observations of precipitation over sea it is common to use data from numerical models or remote sensing, although e.g. Andersson et al. (2011) pointed out that even state-of-the-art satellite retrievals and reanalysis data sets still disagree with respect to amounts or variability compared to observations. In our study we validate ERA-Interim reanalysis data of total precipitation against ten years (1995-2004) of in-situ precipitation measurements onboard of ships. ERA-Interim data consist of three hourly surface forecast fields on a regular grid with a 0.75° x 0.75° resolution, which are initiated twice a day.
Observations within the forecast period were collocated to the surrounding grid points of the reanalysis data. Since ship rain gauges are only suitable to measure rain, only measurements at air temperatures above 4°C were taken into account. The number of collocated data exceeds 200000.
Comparing all data gives a good agreement of mean rain rates of measurements and reanalysis data. But a closer look reveals an underestimation of ERA-Interim precipitation in spring and an overestimation in autumn, related to atmospheric stability. The atmospheric stability is linked to turbulent heat fluxes and indeed it is found that ERA-Interim underestimates rain rates by up to 40 percent under situations with low latent heat fluxes and overestimates rain rates strongly up to about 150 percent under conditions with high latent heat fluxes.
To ensure that this is not an artefact due to uncertainties in ERA-Interim fields of evaporation, meteorological data of ships have been extracted from the marine meteorological data archive of the Seewetteramt Hamburg, and were also collocated to the reanalysis data. These data were used to derive latent heat fluxes by applying a bulk flux scheme (Bumke et al., 2014). The estimated fluxes agree well with the ERA-Interim fluxes.
Also a number of statistical parameters for binary forecasts were computed. Simulations of point to area comparisons based on radar reflectivities of Rostock Weather Radar, located close to the Baltic Sea, show, that ERA-Interim agrees in terms of e.g. bias, success ratio or hit rate well with observations.
But due to the strong overestimation under conditions with high evaporation, which comes along with an underestimation of the ERA-Interim 2m humidity, one might speculate, that this is probably caused by uncertainties in the atmospheric convection scheme.

References

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