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Changes in hydrological Earth rotation excitation using ECMWF ERA-Interim data

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Global continental hydrological models use atmospheric weather data like precipitation and evaporation to force the simulation of continental water storage variations and river discharge. The predominant dependency of the modelled hydrological results from the incoming precipitation-evaporation budget is especially obvious when calculating global geodetic parameters such as Earth rotation excitation and gravity field changes. Many geodetically oriented hydrological studies are based on forcing data from the ERA-40 re-analysis of the European Centre for Medium-Range Weather Forecasts (ECMWF). In 2006 ECMWF started to develop a new interim re-analysis system derived from the latest version of their operational system. The ERA-Interim re-analysis starts 1989 and is now available until 2005. Using an improved assimilation background model and additional observation data several of the problems experienced in ERA-40 have been eliminated or significantly reduced in ERA-Interim, most notably the too-strong tropical oceanic precipitation from the early 1990s onwards. Nevertheless precipitation over tropical continental regions like in Africa is still higher than the estimates from the Global Precipitation Climate Centre (GPCC). The differences between ERA-40 and ERA-Interim forcing data significantly change hydrological Earth rotation excitation. The hydrological land surface discharge model LSDM was used to determine these differences in polar motion, length of day and low degree gravity coefficients. The detected biases indicate that the overall continental water storage is reduced, and part of the water masses are shifted between continents and seasons. The trends in excitation time series due to unbalanced precipitation-evaporation budgets vanish, whereas the seasonal timing of regional water storage events remains almost unaffected. Additional results from regional studies like in the Nile basin help to analyse the quality of the new ERA-Interim data and to classify their benefits for geodetic Earth system models.