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The new stand-alone surface analysis at ECMWF

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In this talk I will explain and present results for a new land data assimilation system at the European Centre for Medium Range Weather forecasts (ECMWF). It is called the “screen-level and surface analysis only” (SSA) system. The SSA system is expected to (i) Shed light on the impact of land-atmosphere DA coupling for NWP (ii) Provide an efficient testing facility to estimate the impact of land surface changes on NWP scores (ii) Provide an affordable land surface reanalysis with land-atmosphere coupling.
At ECMWF, the initial conditions for the NWP forecasts are estimated using weakly coupled land-atmosphere data assimilation (WCDA). The atmospheric analysis is performed using hybrid 4D-Var. The soil moisture analysis consists of a Simplified Extended Kalman filter (SEKF) with the assimilation of ASCAT-derived soil moisture and screen-level observations of temperature and humidity. The atmospheric and soil moisture analyses are performed independently of each other, but the increments from both analyses are added back into a coupled forecast model between assimilation cycles. The SSA configuration is different to WCDA because it reads in an archived atmospheric analysis at the start of each cycle, rather than performing it explicitly. Therefore the computational cost is vastly reduced relative to WCDA. A coupled first guess provides feedback between the land surface and atmospheric model during the 12-hour assimilation window. Results from a sensitivity study are presented which demonstrate the impact of doubling the screen-level observation errors on the soil moisture analysis for (1) the WCDA setup, and (2) the SSA setup. Additionally, the soil moisture analyses are validated using in situ observations and the NWP atmospheric forecasts are validated against the ECMWF operational analysis. The results indicate a promising level of agreement between the two systems and help to explain various elements of land-atmosphere DA coupling.