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Séminaire CNRM
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« ANALYSIS OF SOIL MOISTURE IN A MESOSCALE WEATHER PREDICTION MODEL »

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The analysis of soil moisture for the initialization of an operational mesoscale model (ALADIN) is considered for study. A variational technique is implemented to analyse the soil moisture by assimilating screen-level observations of temperature and relative humidity. A bi-dimensional (z and t) variational approach (2D-VAR) is considered, where the estimate of the observation operator is obtained, through finite differences, from extra integrations of the numerical model with a perturbed initial state. The perturbation effect is evaluated in order to verify two fundamental assumptions of the method: linearity of the observation operator and horizontal decoupling between grid points, that allow the 2D formalism. Thus, the variational method is applied on each grid point separately and the analysis is obtained directly using the observation operator matrix without any iterative process. The 2D-VAR technique takes into account the full physics of the model, so that the corrections applied to the control variable are adapted to the current meteorological conditions and the grip- point characteristics (texture and vegetation), as well as to the previous soil state. The linear estimate of the observation operator is studied in detail to optimize its evaluation. The horizontal influence of adjacent grid-points, as well as the analysis convergence period, are also evaluated. The validation of the method with real observations is performed with different time-windows: a sequential assimilation cycle on a 6-hour time-window allows the comparison with the optimum interpolation technique, while a 24-hour window is considered to extend the temporal consistency of the assimilated observations in the analysis. Results from the performed analyses with the 2D-VAR method show a good retrieval of soil moisture when compared with a more realistic soil moisture produced by the Safran-Isba-Modcou hydrologic off-line system. The benefits of the 2D-VAR analysis are also shown by an improvement of the forecast of the screen-level variables.

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