A 10-yr offline reanalyses of the land surface variables over Western Africa using LDAS-Monde

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Résumé

LDAS-Monde, an offline land data assimilation system with global capacity forced by ERA5 ECMWF latest reanalysis, is applied over Western Africa to increase monitoring accuracy for land surface moisture energy and water states and fluxes, including evapotranspiration and stream flow as well as vegetation growth. LDAS-Monde ingests information from satellite-derived Surface Soil Moisture (SSM) and Leaf Area Index (LAI) estimates to constrain the ISBA land surface model (LSM) coupled with the CNRM version of the Total Runoff Integrating Pathways continental hydrologicalsystem. LDAS-Monde uses the CO2-responsive version of ISBA which models leaf-scale physiological processes and plant growth, while transfer of water and heat through the soil rely on a multilayer diffusion scheme. SSM from the ESA Climate Change Initiative project and LAI estimates from the Copernicus Global Land Service project are assimilated using a Simplified Extended Kalman Filter (SEKF).

ERA5 uses one of the most recent versions of the model and data assimilation methods applied at ECMWF, which makes it able to use modern parameterizations of Earth processes compared to older versions used in ERA-Interim. Two important features of ERA5 are the improved temporal and spatial resolution, from 6-hourly in ERA-Interim to hourly analysis in ERA5, and from 79 km in the horizontal dimension and 60 levels in the vertical, to 31 km and 137 levels in ERA5. A first 10-year segment of ERA5 atmospheric reanalysis has recently been released over 2008-2017 by ECMWF and is updated with about 3-month latency. ERA5 atmospheric reanalysis is re-scaled to a 0.25 degree spatial resolution to force LDAS-Monde leading to a 10-yr quarter degree reanalysis of the land surface variables.

After an assessment of ERA5 impact in the ISBA LSM with respect to ERA-Interim over North America, LDAS-Monde analysis impact over 2008-2017 is evaluated using satellite-driven model estimates of land evapo-transpiration from the Global Land Evaporation Amsterdam Model (GLEAM) project and upscaled ground-based observations of gross primary productivity from the FLUXCOM project. In-situ measurements of soil moisture from AMMA-CATCH are used, too. Those data sets highlight the added value of LDAS-Monde compared to an open-loop simulation (i.e. no assimilation).

Mots-Clés: modelisation des variables de surfaces, teledetection, assimilation de donnees

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