Geophysical Research Abstracts
Vol. 17, EGU2015-9561, 2015
EGU General Assembly 2015

Long term global scale root zone soil moisture monitoring at ECMWF using a surface-only land data assimilation system

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In the framework of the H-SAF (Satellite Application Facility on Support to Operational Hydrology and Water Management) project of EUMETSAT, ECMWF is developing a re-analysis of soil moisture that will cover 1992-2014 and will make use of satellite derived surface soil moisture (SSM) from ERS-1&2, ASCAT. This study presents the first steps toward the conception of this long term global scale root zone soil moisture; a surface-only Land Data Assimilation System (so-LDAS) able to ingest satellite-derived SSM observations is tested at global scale to increase prediction accuracy for surface and root zone soil moisture.

The so-LDAS is defined as an offline sequential data assimilation system (simplified Extended Kalman Filter) based on a Land Surface Model (HTESSEL) uncoupled with the atmosphere, it is driven by ERA-Interim observations based atmospheric forcing. Its impact is assessed over 2010-2013 (1) using local in situ measurements of surface and root zone soil moisture and (2) at a basin scale initialising an event based Rainfall-Runoff hydrological model.

Additionally to an open loop experiment (OL no analysis) three data assimilation experiments are used with different specification of the error matrices. The first one (Asc1) has been set up to test the so-LDAS with a soil moisture standard deviation of σb=0.01 m3m-3 for the first three layers of soil analysed and σo=0.02 m3m-3 for ASCAT SSM. σb was then doubled (Asc2) and σo set to 0.05 m3m-3 to be more consistent with satellite derived SSM errors deduced from previous independent studies. In a third experiment (Asc3), σo is set to 0.05 m3m-3, σb, is set to $0.1 \times (\text{wfc} - \text{wwilt})$, where wfc and wwilt are the volumetric water content at field capacity and at permanent wilting point, which depend on soil texture.