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Evaluation of three different data fusion approaches that uses satellite soil moisture from different passive microwave sensors to construct one consistent climate record

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Abstract:
Datasets that are derived from satellite observations are becoming increasingly important for measuring key parameters of the Earth's climate and are therefore crucial in research on climate change, giving the opportunity to researchers to detect anomalies and long-term trends globally. One of these key parameters is soil moisture (SM), which has a large impact on water, energy and biogeochemical cycles worldwide.

A long-term SM data record from active and passive microwave satellite observations was developed as part of ESA's Climate Change Initiative (ESA-CCI-SM, http://www.esa-soilmoisture-cci.org/). Currently the dataset covers a period from 1978 to 2014 and is updated regularly, observations from a several microwave satellites including: ERS-1, ERS-2, METOP-A, Nimbus 7 SMMR, DMSP SSM/I, TRMM TMI, Aqua AMSRE, Coriolis WindSat, and GCOM-W1 AMSR2.

In 2009, ESA launched the Soil Moisture and Ocean Salinity (SMOS, Kerr et al., 2010) mission, carrying onboard a unique L-band radiometer, but its SM retrievals are not yet part of this dataset. Due to the different radiometric characteristics of SMOS, integrating SMOS into the ESA-CCI-SM dataset is not straight forward. Therefore several approaches have been tested to fuse soil moisture retrievals from SMOS and AMSRE, which currently forms the basis of the passive microwave part within ESA-CCI-SM project.
These approaches are:

1. A Neural Network Fusion approach (Rodríguez-Fernández et al., 2015),

2. A regression approach (Wigneron et al., 2004; Al-Yaari et al., 2015) and

3. A radiative transfer based approach, using the Land Parameter Retrieval Model (Van der Schalie et al., 2016).

This study evaluates the three different approaches and tests their skills against multiple datasets, including MERRA-Land, ERA-Interim/Land, the current ESA-CCI-SM v2.2 and in situ measurements from the International Soil Moisture Network and present a recommendation for the potential integration of SMOS soil moisture into the ESA-CCI-SM dataset. This recommendation is based on a series of statistical metrics (i.e. correlation, unbiased root mean square error, bias, spatial correspondence and single to noise ratios (Gruber et al., 2015)) and will provide guidelines for a seamless integration.

References
Al-Yaari, A., Wigneron, J.P., Kerr, Y., De Jeu, R.A.M., Rodriguez-Fernandez, N., Van der Schalie, R., Al Bitar, A., Mialon, A., Richaume, P., Dolman, A., and Ducharne, A. (2015), "Testing regression equations to derive long-term global soil moisture datasets from passive microwave observations", Remote Sensing of Environment, IN PRESS.

Gruber, A., Su, C.-H., Zwieback, S., Crowd, W., Dorigo, W., and Wagner, W. (2015), "Recent advances in (soil moisture) triple collocation analysis", Int. J. Appl. Earth Observ. Geoinf, doi: http://dx.doi.org/10.1016/j.jag.2015.09.002.

Kerr, Y.H., Waldteufel, P., Wigneron, J.P., Delwart, S., Cabot, F., Boutin, J., Escorihuela, M.J., Font, J., Reul, N., Gruhier, C., Juglea, S.E., Drinkwater, M.R., Hahne, A., Martin-Neira, M., and Mecklenburg, S. (2010), "The SMOS mission: New tool for monitoring key elements of the global water cycle", Proceedings of the IEEE, vol. 98, no. 5, doi: 10.1109/JPROC.2010.2043043.

Rodríguez-Fernández, N.J., Aires, F., Richaume, P., Kerr, Y.H., Prigent, C., Kolassa, J., Cabot, F., Jiménez, C., Mahmoodi, A., and Drusch, M. (2015), "Soil Moisture Retrieval Using Neural Networks: Application to SMOS", IEEE Trans. on Geosc. and Remote Sens., vol. 53, no. 11, doi: 10.1109/TGRS.2015.2430845.

Van der Schalie, R., Kerr, Y.H., Wigneron, J.P., Rodriguez-Fernandez, N.J., Al-Yaari, A., and De Jeu, R.A.M. (2015), "Global SMOS Soil Moisture Retrievals from The Land Parameter Retrieval Model", Int. J. Appl. Earth Observ. Geoinf, doi: http://dx.doi.org/10.1016/j.jag.2015.08.005.

Wigneron J.-P., Calvet, J.-C., De Rosnay, P., Kerr, Y., Waldteufel, P., Saleh, K., Escorihuela, M.J. and Kruszewski, A. (2004), "Soil Moisture Retrievals from Bi-Angular L-band Passive Microwave Observations", IEEE Trans. Geosc. Remote Sens. Let., vol. 1, no. 4, pp. 277-281.