



HAL
open science

Long time series of soil moisture obtained using neural networks: application to AMSR-E and SMOS

Nemesio Rodriguez-fernandez, Yann H. Kerr, Richard de Jeu, Robin van Der Schalie, Jean-Pierre Wigneron, Amen Al-Yaari, Han Dolman, Matthias Drusch, Susanne Mecklenburg

► To cite this version:

Nemesio Rodriguez-fernandez, Yann H. Kerr, Richard de Jeu, Robin van Der Schalie, Jean-Pierre Wigneron, et al.. Long time series of soil moisture obtained using neural networks: application to AMSR-E and SMOS. EGU 2015, European Geosciences Union General Assembly, European Geosciences Union (EGU). DEU., Apr 2015, Vienne, Austria. hal-02738841

HAL Id: hal-02738841

<https://hal.inrae.fr/hal-02738841>

Submitted on 2 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Long time series of soil moisture obtained using neural networks: application to AMSR-E and SMOS

Nemesio J. Rodriguez-Fernandez (1), Yann H. Kerr (1), Richard A. M. de Jeu (2), Robin van der Schalie (2), Jean Pierre Wigneron (3), Amen al Ayaari (3), Han Dolman (3), Matthias Drusch (4), and Sussane Mecklenburg (5)

(1) CESBIO (CNES, CNRS, UPS, IRD), Toulouse, France (nemesio.rodriguez@cesbio.cnes.fr), (2) Faculty of Earth and Life Sciences, VU University Amsterdam, Amsterdam, Netherlands., (3) Institut National de Recherche Agronomique (INRA), Bordeaux, France., (4) European Space Research and Technology Centre (ESTEC), ESA, Noordwijk, Netherlands., (5) European Space Research Institute (ESRIN), ESA, Frascati, Italy.

The Soil Moisture and Ocean Salinity (SMOS) satellite is the first mission specifically designed to measure soil moisture (hereafter SM) from space. The instrument on-board SMOS is a L-band aperture synthesis radiometer, with full-polarization and multi-angular capabilities (Mecklenburg et al. 2012). The operational SM retrieval algorithm is based on a physical model (Kerr et al. 2012). In addition, Rodriguez-Fernandez et al. (2014) have recently implemented an inverse model based in neural networks using the approach of Aires & Prigent (2006), which consists in training the neural networks with numerical weather prediction models (ECMWF, Balsamo et al. 2009). In the context of an ESA funded project (de Jeu et al, this conference, session CL 5.7), we have studied this neural network approach to create a consistent soil moisture dataset from 2003 to 2014 using NASA/JAXA Advanced Scanning Microwave Radiometer (AMSR-E) and ESA SMOS radiometers as input data. Two neural networks algorithms have been defined and optimized using AMSR-E or SMOS as input data in the periods 2003-Oct 2011 and 2010-2014, respectively. The two missions overlapping period has been used to demonstrate the consistency of the SM dataset produced with both algorithms by comparing monthly averages of SM and by comparing with time series of in situ measurements at selected locations and other SM products such as the SMOS operational SM, ECMWF model SM, and AMSR-E LPRM SM (Owe et al. 2008). Finally, the long time series of SM obtained with neural networks will be compared to in-situ measurements and ECMWF ERA-Interim SM at selected locations. This long-term soil moisture dataset can be used for hydrological and climate applications and it is the first step towards a longer dataset which will include additional sensors.

References

- Aires, F. Prigent, C. Toward a new generation of satellite surface products? *Journal of Geophysical Research: Atmospheres* (1984–2012), Wiley Online Library, 2006, 11
- Balsamo, G.; Beljaars, A.; Scipal, K.; et al. A revised hydrology for the ECMWF model: Verification from field site to terrestrial water storage and impact in the Integrated Forecast System *Journal of hydrometeorology*, 2009, 10, 623-643
- Kerr, Y. H.; Waldteufel, P.; Richaume, P.; Wigneron et al. The SMOS Soil Moisture Retrieval Algorithm *IEEE Transactions on Geoscience and Remote Sensing*, 2012, 50, 1384-1403
- Mecklenburg, S.; Drusch, M.; Kerr, Y. H. et al. ESA's Soil Moisture and Ocean Salinity Mission: Mission Performance and Operations *IEEE Transactions on Geoscience and Remote Sensing*, IEEE, 2012, 50, 1354-1366
- Owe, M., R.A.M. De Jeu, and T.R.H. Holmes, 2008, "Multi-Sensor Historical Climatology of Satellite-Derived Global Land Surface Moisture", *J. Geophys. Res.*, 113,
- Rodríguez-Fernández, N. J.; Aires, F.; Richaume, P.; Kerr, Y. H.; et al. M. Soil moisture retrieval using neural networks: application to SMOS *IEEE Transactions on Geoscience and Remote Sensing*, 2015, submitted