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Inter-comparison of hydrological model simulations with dense time series of SAR-derived soil moisture maps

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Over the last years, a vast number of experimental and theoretical studies has widely demonstrated the sensitivity of SAR data to soil moisture content, however, operational services integrating SAR measurements into land process models are not yet available.
Important progresses in this field are expected, on the one hand, from SAR missions characterized by a short revisiting time, such as the COSMO-SkyMed or the forthcoming Sentinel-1 and ALOS-2 missions, on the other hand, from a strong effort in implementing hydrological models able to reproduce the dynamic of soil moisture content of the top layer (5 cm depth) of soil. With this latter purpose, we used the DREAM model [Manfreda et al., 2005], realized in a GIS-based approach, that explicitly takes into account the spatial heterogeneity of hydrological processes. The DREAM model carries out continuous hydrological simulations using the daily and the hourly scales. The distinctive feature of the model, which consists of evaluating the lateral flow through a water content redistribution weighted by the topographic index, was preserved. The latter provided the basis for the nested implementation of the Richard equation which has been used for evaluating vertical flows in the top soil layer (5cm).The Richard routine exploits the numerical solution proposed by Simunek et al. [2009] and runs, for each cell of the river basin, in a sub-module of 60 minutes with a vertical (i.e. depth) and temporal resolution of 1 cm and 1 s, respectively.
The model was applied to the portion of the Celone at Foggia San Severo river basin downstream the San Giusto Dam, which is a tributary of the Candelaro river, in Puglia region (Southern Italy). Over this area quasi-dense time series of ALOS/PALSAR ScanSAR WB1 and COSMO-SkyMedStripMap images were acquired in 2007 and 2010, respectively. The SAR data have been used to derive time-series of soil moisture maps by means of the SMOSAR software developed for Sentinel-1 data [Balenzano et al., 2011; Mattia et al., 2011; Balenzano et al., 2012] and adapted to the X- [Mattia et al., 2012] and L-band [Satalino et al., 2010].
First results are promising, showing that the model is able to reproduce the general trend and has a good sensitivity to rainfall inputs. Such a kind of results open wide perspectives for model calibration/validation with external data as well as for assessing the proposed modelling structure, providing strong enhancements in terms of model scientific validation [e.g. Biondi et al. 2011].

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REFERENCES

Balenzano, A., G. Satalino, V. Pauwels, and F. Mattia, " Soil Moisture retrieval from dense temporal series of C-band SAR data over agricultural sites", Proceedings of the 2011 IEEE International Geoscience and Remote Sensing Symposium, pp. 3136-3139, Vancouver, Canada, 24-29 July, 2011.
Balenzano, A., F. Mattia, G. Satalino, V. Pauwels, and P. Snoeij, "SMOSAR algorithm for soil moisture retrieval using Sentinel-1 data", submitted to the 2012 IEEE International Geoscience and Remote Sensing Symposium, Munich, Germany, 22-27 July, 2012.
Biondi, D., G. Freni, V. Iacobellis, G. Mascaro, A. Montanari, Validation of hydrological models: conceptual basis, methodological approaches and a proposal for a code of practice, Physics and Chemistry of the Earth, Parts A/B/C (August 2011) doi:10.1016/j.pce.2011.07.037, 2011.
Manfreda, S., Fiorentino, M., Iacobellis, V., 2005. DREAM: a distributed model for runoff, evapotranspiration,

and antecedent soil moisture simulation. Adv. Geosci. 2, 31–39.
Mattia F., G. Satalino, A. Balenzano, G. D'Urso, F. Capodici, V. Iacobellis, A. Gioia, P. Milella, M. Rinaldi, S. Ruggieri, and L, Dini"Time series of COSMO-SkyMed data for landcover classification and surface parameter retrieval over agricultural sites", submitted to the 2012 IEEE International Geoscience and Remote Sensing Symposium, Munich, Germany, 22-27 July, 2012.
MattiaF., G. Satalino, A. Balenzano, V. Pauwels, E. DeLathauwer, "GMES Sentinel-1 soil moisture retrieval algorithm development," European Space Agency contract n. 4000101352/10/NL/MP/ef, Final Report, November, 2011.
Satalino G., A. Balenzano, R. Panciera and F. Mattia, "Soil moisture retrieval from temporal series of PALSAR ScanSAR data", presented tothe 4th Joint PI Symposium of ALOS Data Nodes for ALOS Science, Tokyo, Japan, 15-17 November, 2010.
Simunek, J., Sejna, M., Saito, H., Sakai, M., van Genuchten, M. T., 2009. The Hydrus-1D Software Package for simulating the one-dimensional movement of water, heat, and multiple solutes in variably-saturated media. Version 4.08. Department of Environmental SciencesUniversity of CaliforniaRiverside. Riverside, California. P. 332.