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The Use of Near-Real-Time Global ASCAT Soil Moisture Observations for Monitoring of Water Hazards

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Water hazards, as understood here, arise due to the excess or lack of water and may harm society in multiple ways. Excessive rainfall and/or rapid snowmelt may quickly saturate the soil in a catchment area, leading to water logging, surface runoff and flooding. If sustained for longer periods, water excess may affect plant growth and lead to the proliferation of water-borne diseases. A prolonged lack of rainfall depletes the soil water reservoir leading to drought conditions which may affect the productivity of agricultural areas and natural ecosystems, limit the availability of fresh water for humans and industry, and increase the risk of fires. Multi-year droughts may lead to land degradation and desertification. One of the most important indicators for identifying these extreme hydrological conditions is the moisture content of the soil. Unfortunately, soil moisture data were available only over a limited number of networks worldwide until recently. Therefore, hydrologist and other scientists interested in soil moisture resorted to modeling the soil moisture content, using precipitation and other weather and soil data as input into their models. In recent years two major developments paved the way for obtaining global soil moisture data much more readily. Firstly, the increasing number of in-situ networks and international efforts to bring all these data together in a common data hosting facility cumulated in the International Soil Moisture Network (ISMN). The ISMN currently comprises 27 networks with 835 stations and continues to grow thanks to the voluntary efforts and contributions of the network providers (Dorigo et al. 2011). The data are freely available for research purposes at http://www.ipf.tuwien.ac.at/insitu/. Secondly, polar-orbiting earth observation satellites are increasingly providing global soil moisture observations. Probably the most well-known satellite mission is the Soil Moisture and Ocean Salinity (SMOS) mission which was launched in November 2009 by the European Space Agency. SMOS was the first satellite designed exclusively to measure soil moisture over land (Kerr et al. 2010). But besides this experimental satellite mission, soil moisture can also be derived from operational microwave sensors, which has the important advantage to have guarantee data access beyond the lifetime of a single satellite (Wagner et al. 2007). For example, the first operational near-real-time soil moisture observations are provided by EUMETSAT based on C-band backscatter observations acquired by the Advanced Scatterometer (ASCAT) (Bartalis et al. 2007). The ASCAT instrument is flown onboard the series of three METOP satellites, METOP-A launched in 2006 and METOP-B planned for launch in summer 2012. Together these three satellites can be expected to cover the period until 2020. For the time beyond 2020 it is planned to fly a successor instrument on-board the METOP Second Generation (MSG) satellite series. In this presentation the ASCAT soil moisture data will be presented and results from international validation efforts summarized (e.g. Albergel et al. (2012) and Parrens et al. (2011)). Also an overview of successful application examples will be given, including for example the use of the ASCAT data in numerical weather prediction (Dharssi et al. 2011), runoff forecasting (Brocca et al. 2010), and epidemiological modeling.

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