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Operational rainfall retrieval for the monitoring of severe events in mid-latitudes

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The reliable knowledge about the spatio-temporal dynamics of rainfall is indispensable. Sensors onboard of geostationary satellites can provide the spatial and temporal resolution necessary for nowcasting, monitoring of extreme events and high-resolution modelling. The straightforward convective schemes which normally identify potential precipitating clouds by means of their infrared brightness temperature usually perform well in the tropics but cannot simply be applied to the complex situation of mid-latitude frontal precipitation. Hence, a new modular retrieval scheme, the Advective-Convective-Technique (ACT) that is also applicable to advective precipitation in the midlatitudes has been developed. It consist of three modules. The first deals with precipitation from convective core areas which are identified by analysing the infrared and water vapour channel temperature distribution (Reudenbach et al. 2001). The second uses a k-means cluster analysis of the same channels for the identification of advective/stratiforme cloud regions. While these two schemes are applicable for the investigation of long time series, the third module (CP-ACT) needs the increased spectral resolution of the latest geostationary satellite sensors (Meteosat-8 SEVIRI). It represents an enhanced classification scheme especially useful for stratiform precipitating clouds using information of the cloud optical thickness and the effective droplet radius. The cloud properties are retrieved using a semi-analytical approach (Kokhanovsky et al. 2003) which is as accurate (Nauss et al. forthcoming) but much less time consuming than the usual look-up table based retrievals (Kawamoto et al. 2001). Based on the concept model that precipitating clouds need medium to large values of optical thickness and/or effective cloud droplet radius (see Lensky und Rosenfeld 2003) the retrieval identifies potential raining cloud areas on a pixel basis with an accuracy comparable to ground based radar networks. Moreover, the cloud physics based retrieval allows an adapted assignment

of precipitation rates with respect to cloud formation processes and life cycle stages. The rainfall rates itself are based on 3-D cloud model simulations using the Advanced Mesoscale Prediction System ARPS (Xue et al. 2003).

Within the framework of the GLOWA-Danube project (Ludwig et al. 2003) the ACT has been applied to half-hourly Meteosat VISSR data of the upper Danube catchment region covering the alpine forelands of southern Germany as well as the Austrian alps for a 5 years period from 1995 to 2000. Resulting datasets have been used to run a high resolution (1km, 1h) hydrological model. Evaluations against data from 45x45km MM5 model outputs as well as against interpolated point measurements from about 140 stations in this area show good agreement. The improvement caused by the additional consideration of cloud properties in the CP-ACT module was investigated during the severe summer flooding in central Europe in August 2002 and the comparison against ground based radar network data from the German weather service shows very good agreement. The presentation will cover the concept model and implementation of the ACT retrieval and discuss the evaluation results.

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