Geophysical Research Abstracts, Vol. 9, 07716, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07716

Process-oriented statistic dynamical evaluation of LM precipitation forecasts

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In the last years of the development of numerical weather prediction (NWP)models there has been great progress in the short-term and middle-term forecast of temperature, wind speed or direction and cloud coverage, but only little success in the quantitative precipitation forecast. To improve the NWP models, it is necessary to understand the precipitation processes.

A central goal is the statistical evaluation of precipitation forecasts with dynamical parameters. Here, the newly designed Dynamic State Index (DSI) is used as dynamical threshold parameter. The DSI theoretically describes the change of atmospheric flow fields as deviations from a stationary adiabatic solution of the primitive equations (Nèvir, 2004). In the synoptic scale the DSI constitutes ageostrophic and in the mesoscale diabatic and non–stationary processes.

These processes are particularly aligned with extreme events. For successive Januaries and Julies the DSI shows a remarkably high correlation with the precipitation analyses of the Lokal–Modell (LM) of the German Weather Service, even without regarding the specific humidity fields. Furthermore, two case studies, representing a ‘‘normal” passage of a cold front and a cold front with severe precipitation, show, that the DSI features the frontal structure and convective cells. Especially, the DSI reflects the precipitation pattern.

Another objective is, to show a relationship between the DSI and different cloud types. Therefore, an improved independent precipitation data set with cloud types from Meteosat data in the horizontal resolution of the 7 km LM grid over Germany was therefore generated. For scale dependent evaluation of the LM, the data were separated into convective and stratiform clouds. Due to the responsibility of cloud types for con-

vective and stratiform precipitation, different combinations of into cloud classes were used for our precipitation analyses.

The cloud classes for convective and stratiform rainfall are as follows: the cumulus class contains the cloud types cumulus mediocris, cumulus congestus and ’cumulus and stratocumulus’, the cumulonimbus class consists of cumulonimbus calvus and cumulonimbus capillatus, the stratus class contains stratocumulus, stratus nebulosus, stratus fractus and ’cumulus and stratocumulus’, the nimbostratus class contains altostratus opacus or nimbostratus, altocumulus translucidus or altocumulus together with altostratus or nimbostratus

A combination of DSI and cloud types derived from Meteosat show a good correlation, particularly convective cloud types.

These convective clouds are associate with heavy rainfall events, which can be seen in the DSI pattern.

Thus, the DSI opens the possibility as a new dynamical forecast tool for severe precipitation events.