Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07693, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07693
EGU General Assembly 2008

Investigating the Impact of Lightning Data Assimilation on Flash Flood Forecasting

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Lightning is maybe the only atmospheric parameter that can be recorded and measured at very high resolution (5 Km in location and 1 micro-second in time frequency) with a large regional coverage. A newly developed technique assimilating regional lightning measurements into a meteorological model is presented in this study. The technique relies on near real-time data from a long-range lightning detection network to indicate areas of deep, moist convection within the model domain. Model-generated humidity profiles are then nudged to empirical profiles as function of the observed lightning intensity. The empirical humidity profiles are assumed to be representative of convective regimes since they have been produced on the basis of atmospheric soundings obtained during thunderstorm days. Making use of these adjusted humidity profiles the model can compute the heating rate profiles more compatible with the local scale convective environment.

For the numerical experiments the POSEIDON weather forecasting system was used, incorporating observed data from the Romanian regional network of ground-based receivers covering Romania and surrounding countries. The performance of the technique was verified on the basis of major thunderstorm activities in a warm-season environment that occurred in the Mediterranean region and lead to flash flood. The assessment was performed using as reference hourly rain measurements available from the network of Romanian meteorological stations. The results indicate that assimilation of lightning data can improve the model's convective precipitation analysis and

short-range (e.g. up to 12 hours) forecasts.