A Simple Dynamical Model of Cumulus Convection for Data Assimilation Research

Michael Wuersch[a,b], George C. Craig[a,b]

[a] *Hans-Ertel-Centre for Weather Research, Data Assimilation Branch, Ludwig-Maximilians-Universitaet, Muenchen, Germany michael.wuersch@lmu.de,* [b] *Meteorologisches Institut, Ludwig-Maximilians-Universitaet, Muenchen, Germany,*

A simplified model for cumulus convection has been developed, with the aim of providing a computationally inexpensive, but physically plausible, environment for developing methods for convective-scale data assimilation. This model is part of a hierarchy of models, where a stochastic toy model [1] already exists and is the first in a series of models. The model presented here is an intermediate model. An idealised convection resolving model is the last step of the hierarchy.

Key processes, including gravity waves, conditional instability and precipitation formation, are represented, and parameter values are chosen to reproduce the most important space and time scales of cumulus clouds. The model is shown to reproduce the classic life cycle of an isolated convective storm. When provided with a low amplitude noise source to trigger convection, the model produces a statistically steady state with cloud size and cloud spacing distributions similar to those found in radiative-convective equilibrium simulations using a cloud resolving model.Results are also shown for convection triggered by flow over an orgraphic obstacle, where depending on the wind speed two regimes are found with convection trapped over the mountain, or propagating downstream.

The model features prognostic variables for wind and rain that can be used to compute synthetic observations for data assimilation experiments. These observation can mimic radar and radial wind observations. An LETKF is used for the data assimilation experiments which will also be presented.

References
[1]George C. Craig, Michael Würsch. "The impact of localization and observationaveraging for convective-scale data assimilation in a simple stochastic model," Q. J. R. Meteorol. Soc., vol. 139, no. 671, pp. 515-523, January 2013.