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Parametrising nearest neighbor interaction in a convection scheme: an idealized squall line test case.

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Most convection schemes in operational models for numerical weather prediction operate in a single column that is connected to other columns only via the large scale dynamics. In particular the triggering of convection is usually independent of the convective activity in the surrounding of the grid cell. This is not realistic since convective activity is able to trigger convection nearby [1,2].
Here, the intention is to work toward an implementation of nearest neighbor interaction (NNI) within the framework of a parametrization of deep convection within the global ICON model [3].
The main research question is whether a convection scheme equipped with NNI is able to interact with the large scale dynamics in a constructive way.
In particular the focus is laid on an idealized squall line case in which the standard convection scheme fails. It is shown how a propagating squall line can be recovered either in the large scale dynamics, the pure NNI or the coupled dynamic.

Observations of tropical convection suggest continous phase

transition between precipitating and non-precipitating phases [4] similar

to what is observed in simple two-dimensional lattice models.

Thus, using simple two-dimensional presciptions to descibe horizontal correlations

in convection schemes might be suitable to introduce a scale-consistent behavior.

Percolation models are good canditates to describe spatio-temporal

correlations, critical scaling or cloud size distributions [5].

This motivates the current work, which investigates, how a given NNI might

interact with the dynamic of the host model and to establisch a proof of principle

that such a mechanism might be beneficial.

[1]: Tompkins (2001), JAS 58 (13), 1650.

[2]: Seifert & Heus (2013), ACP 13 (11), 5631.

[3]: Zängl et.al. (2015), QJRMS 141 (687), 563.

[4]: Peters & Neelin (2006), Nature Physics 2 (6), 393.

[5]: Windmiller (2017), PhD Thesis, LMU Munich, https://edoc.ub.uni-muenchen.de/21245/