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DWD

ON THE LIMITS OF PREDICTABILITY OF CONVECTIVE PRECIPITATION: IMPACT OF OROGRAPHY

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1. BACKGROUND

Lorenz (1969) stated two aspects of predictability:

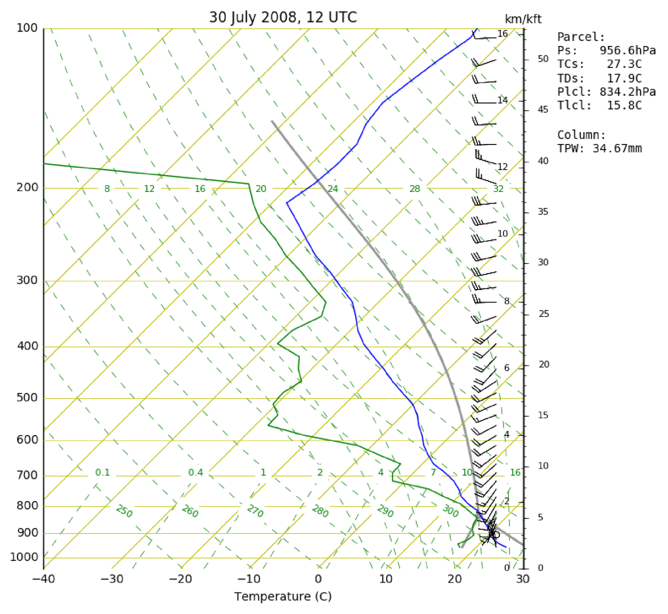
Intrinsic predictability: *'the extent to which prediction is possible if an optimum procedure is used'*
Practical predictability: *'the ability to predict based on procedures and various model error representations currently available'*

- Predictability of convective weather lies in the range of tens of minutes to one hour (Lilly, 1990)
- Surface inhomogeneities (e.g. orography) and weather regime influence predictability (Anthes, 1986)

Investigation of the impact of various forcing elements on the limit of predictability of convective precipitation

2. IDEALIZED COSMO-KENDA

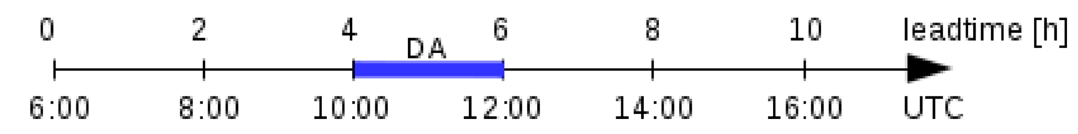
COSMO:
Convection-permitting 50 member EPS (Δx = Δy = 2km)
Domain 400 x 400km with periodic boundaries
Radiation
Surface friction
Horizontal homogeneous conditions:
sounding of Payerne allowing
for organized convection (CAPE=2200 J/kg)
Initial condition perturbations:
temperature: 0.02 K
vertical velocity: 0.02 m/s



Orography:
Gaussian mountain: Δz = 500m, 10.000m half width at (50km, 50km)

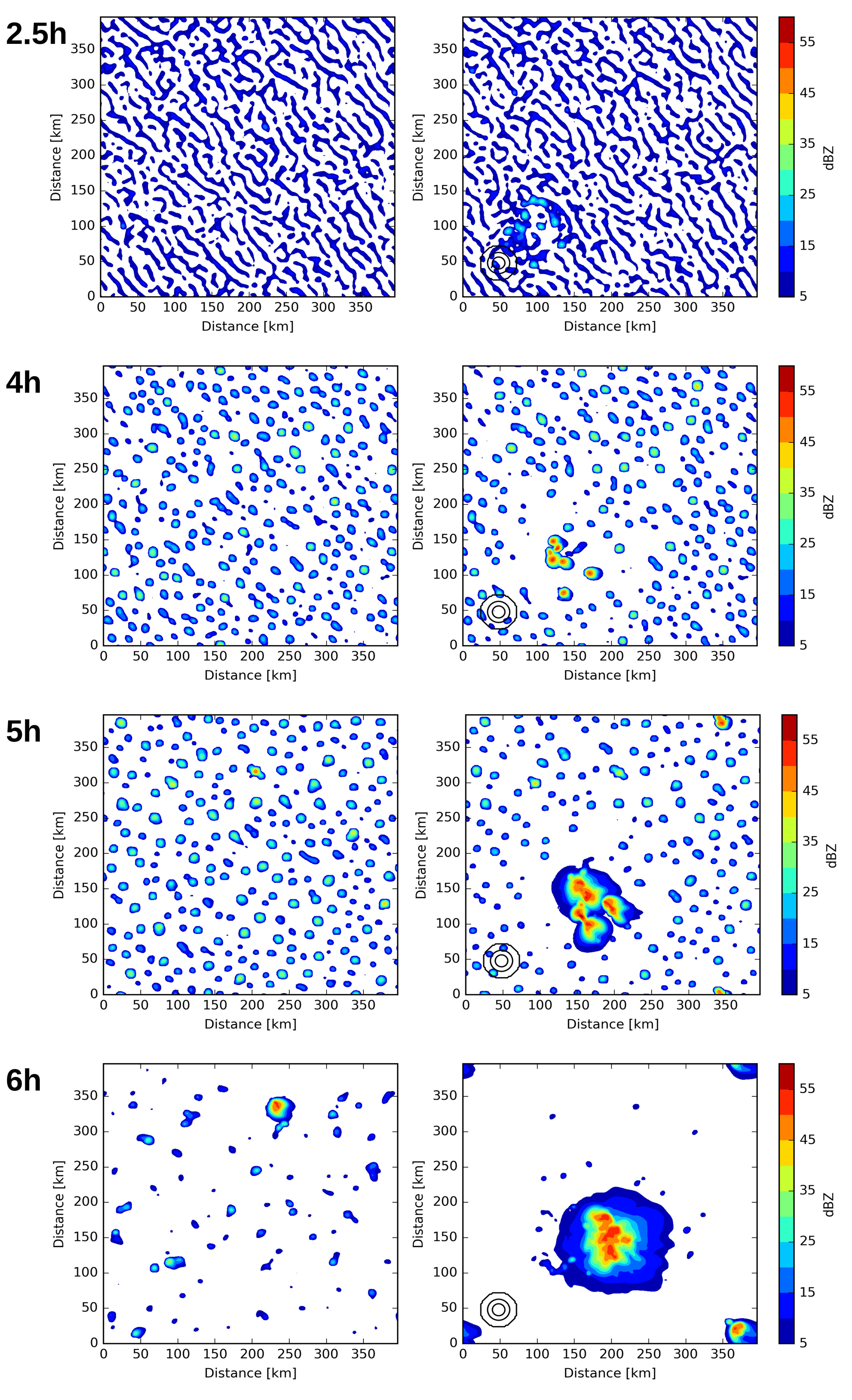
KENDA:
Kilometer-scale ensemble data assimilation based on a
Local Ensemble Transform Kalman Filter (LETKF)

Assimilation of synthetic radar observations (REFL and u) masked with a threshold of 5dBz



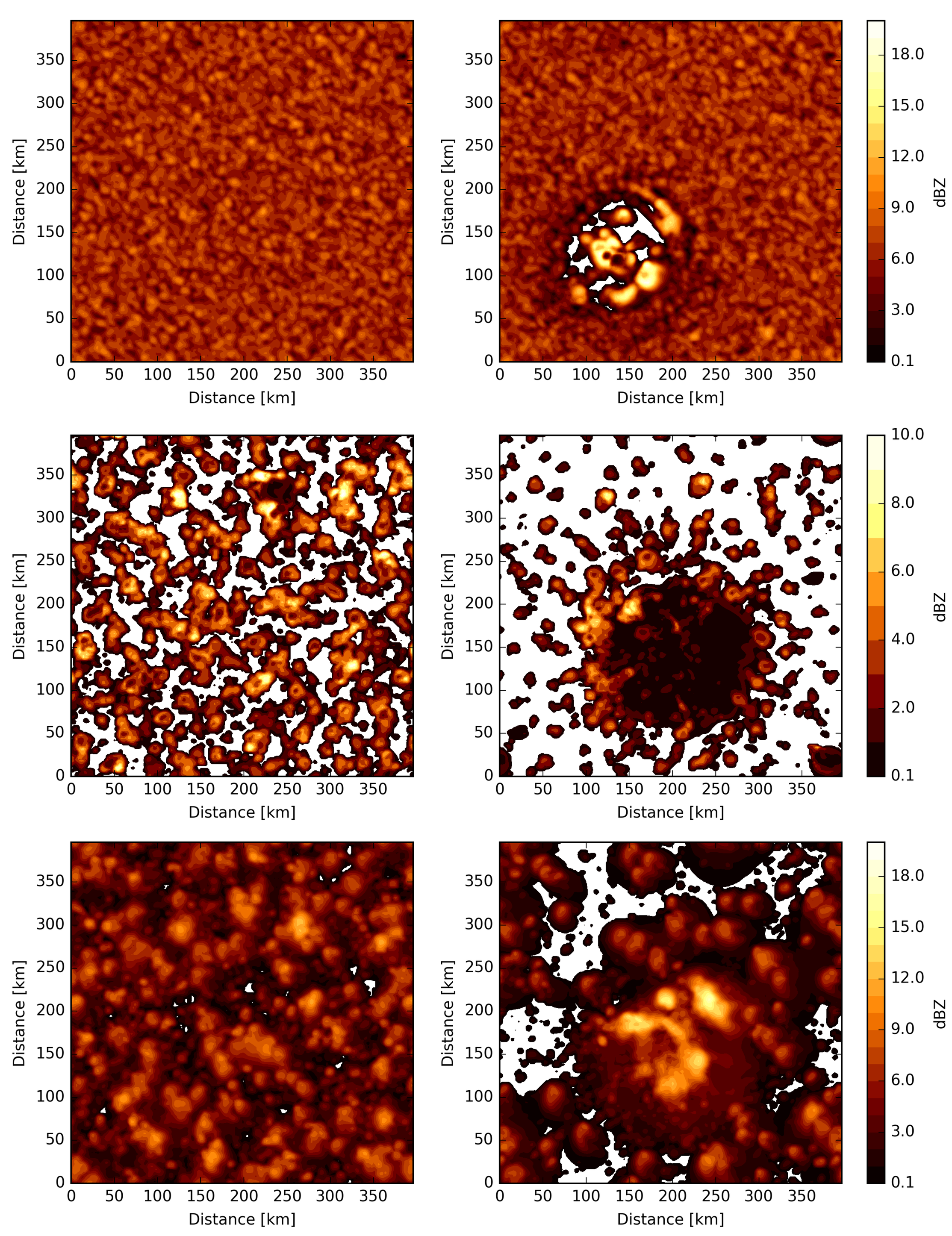
3. NATURE EXPERIMENTS W AND W/O OROGRAPHY

Comparison of the maximum reflectivity in the domain with and without orography depicts significant diferences:



The orography initiates convection about two hours earlier and increases strength and organization of the cell.

4. ENSEMBLE SPREAD OF REFLECTIVITY



4h leadtime: begin of DA

Homogeneous spread increased in the lee of the orography due to earlier onset of convection

6h leadtime: end of DA

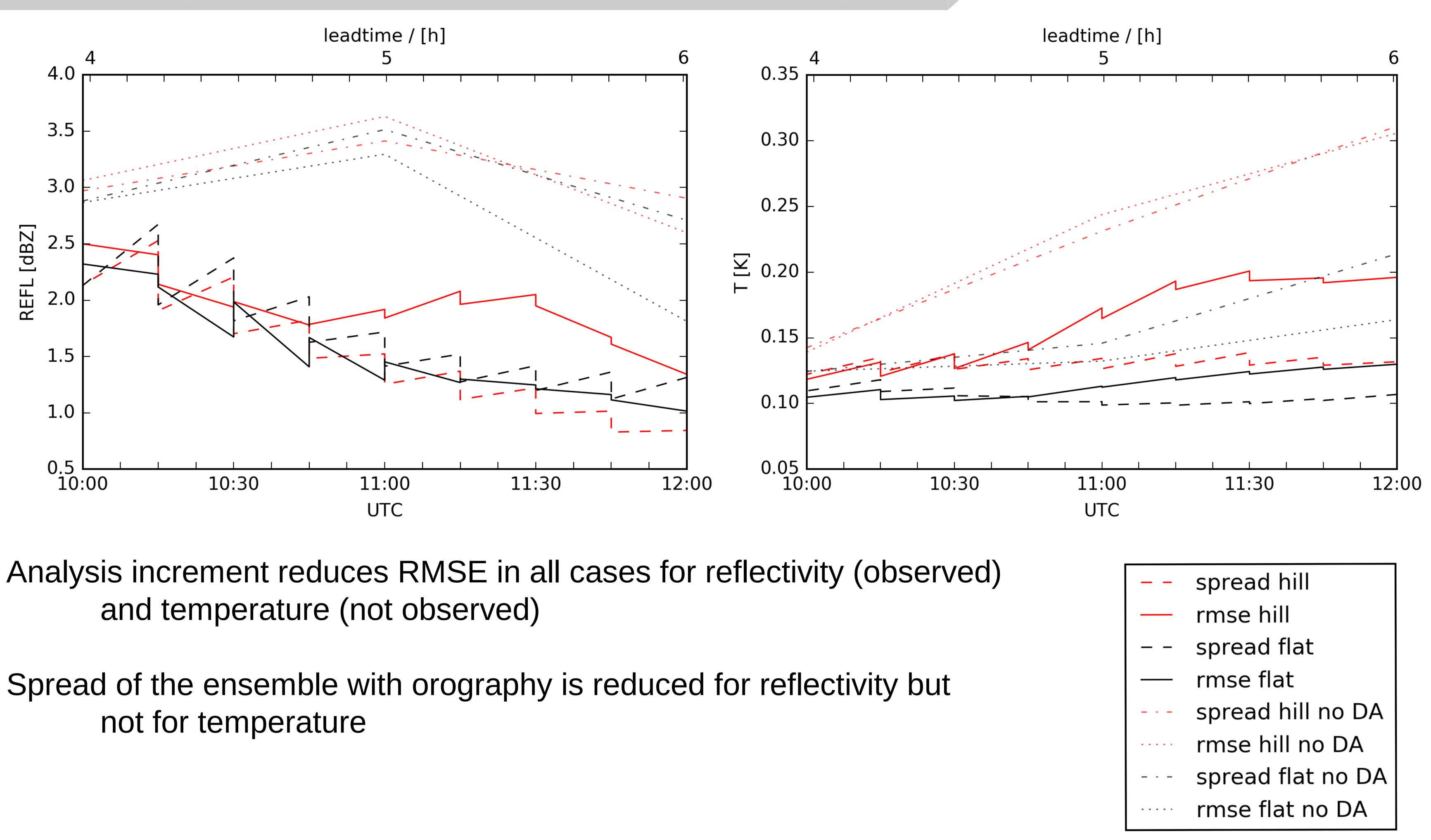
Drastically reduced spread

Different stages of development of convection visible

6h leadtime: no DA, free fct

Larger spread especially in the lee of the mountain

5. TIME SERIES OF SPREAD AND RMSE



Analysis increment reduces RMSE in all cases for reflectivity (observed) and temperature (not observed)

Spread of the ensemble with orography is reduced for reflectivity but not for temperature

6. OUTLOOK

- Sensitivity studies with different soundings representing different convective environments
- Analysis of the impact of orography on location and amplitude of precipitation using spatial measurements (FSS, DAS)
- Influence of height and shape of the orography on predictability
- Impact of synoptic forcing (convective vs. baroclinic instability)
- Account for model error to address limits of practical and intrinsic predictability

7. REFERENCES

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