Application of Latent Heat Nudging in ALADIN Model

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Motivation

- Need to assimilate local observations in a LAM,
- Improvement of precipitation scores,
- Nowcasting with ALADIN on demand,
- Is nudging nothing?
Model Domain Properties

- Old SI operational domain
- 80x80 grid points,
- 11km resolution,
- 450s time step,
- 365 runs for entire year 2002 with 12 hours of nudging process,
Radar Data

- Radar data from 3 radars: Lisca - SLO, Zirbitzkogel - A and Fossalon - I
- Interpolation into 1/8 model resolution using nearest neighbour method
- Aggregation to model grid
- Using hourly accumulations
Latent Heat Nudging

- Using 2D RR fields from radar (hourly accumulations)
- Combining radar and model precipitation,
- Adjusting vertical profiles of latent heat part of temperature tendency

precipitation analysis

adjustment of latent heat profiles
LHN Procedure

- Radar and model precipitation case:

\[ RR_{\text{analysis}} = wRR_{\text{radar}} + \left( \frac{\partial T}{\partial t} \right)_{\text{LHN}} = \left( \frac{\partial T}{\partial t} \right)_{\text{model}}. \]

- No model precipitation case: a climatological profile is rescaled and applied
Climatological Profiles

Derived from model control run

Average Monthly Profiles of Temperature Tendency Normalized With Precipitation Flux \( (K/h)/(kg/h/m^3) \)
Results – whole year 2002

Contingency tables scores (rain/norain)
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Contingency tables scores (rain/norain)

Equitable Threat Score (precip. threshold=0.1mm/h)

Hour of Forecast

< end of LHN
Results – Oct. 24, 2002 (1)

October 24, 2002 at 06 UTC (within nudging period)

Radar prec. [mm]  no lhn model prec. at +06 hrs [mm]  lhn (till +12hrs) model prec. at +06 hrs [mm]
Results – Oct. 24, 2002 (2)

October 24, 2002 at 06 UTC (one hour after end of nudging)

Radar prec. [mm]

no lhn model prec. at +06 hrs [mm]

lhn (till +05hrs) model prec. at +06 hrs [mm]
Results – Sep. 22, 2002 (1)

September 22, 2002 at 17 UTC (two hours after end of nudging)

Radar prec. [mm]

no lhν model prec. at +17 hrs [mm]

lhν (till +15hrs) model prec. at +17 hrs [mm]

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Results – Sep. 22, 2002 (2)

September 22, 2002 at 17 UTC (within nudging period)

Radar prec. [mm]  
no_lhn model prec. at +17 hrs [mm]  
lhn (till +18hrs) model prec. at +17 hrs [mm]
Conclusions

- Nudging is a poor man’s solution for radar assimilation in LAM
- Repositioning precipitation
- Effect only a few hours ahead – usage in nowcasting
- Powerless in reducing amount
- Small radar nudging area in the domain (in comparison to DWD)