Hans-Ertel-Centre for Weather Research  
Climate Monitoring and Diagnostics

A high-resolution reanalysis  
for the European CORDEX region

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16-21 August 2014 – WWSC Montreal, Canada
Motivation

- Global reanalyses are established as reference data sets
  - Used in many applications
  - Consistent representation of the atmospheric state
    - spatio-temporally
    - physically, inter-parameter

- More and more applications need data at high spatio-temporal resolutions
  - E.g., assess climate and its variability on regional and local scales

→ Regional reanalysis for Europe
Reanalysis model setup

- COSMO model
  - Operational NWP model in
    Germany, Greece, Poland, Romania, Russia and Switzerland
  - Non-hydrostatic, rotated LatLon grid
  - Multi-layer soil and vegetation model TERRA

- Model setup
  - 6km horizontal resolution (2x horizontal resolution of CORDEX-EUR11)
  - 848 x 824 grid points in the horizontal
  - 40 vertical levels
Reanalysis domain

- CORDEX-EUR11 domain
Regional Reanalysis System

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High-resolution regional reanalysis, WWOFS, Montreal, 16-21 August 2014

SYNOP, SHIP, PILOT, TEMP, AIREP, AMDAR, ACARS,…
Reanalysis output

- 3D atmospheric state - 60 minutes interval
  - U, V, W, T, QV, QC, QI, QS, QR, TKE, QH

- 2D parameters - 15 minutes interval
  - sfc / 2m / 10m variables (also max/min, 850 mb)
  - Column integrated values (e.g., TCLC, TDLT)
  - Soil variables
  - Fluxes, radiation

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High-resolution regional reanalysis, WWO3C, Montreal, 16-21 August 2014
Reanalysis output

- 3D atmospheric state - 60 minutes interval
  - U, V, W, T, QV, QC, QI, QS, QR, TKE, CLC, DQVDT

- 2D parameters - 15 minutes interval
  - sfc / 2m / 10m variables (also max/min, gusts)
  - Column integrated values (e.g., TCLC, TQV)
  - Soil variables
  - Fluxes, radiation

- approx. 40GB per reanalysis day, 14TB per reanalysis year

- Distribution through ECMWF’s MARS archive in preparation
Reanalysis production


- 2 production streams running
  - Estimated to be finished by end of fall

- 1 stream in preparation for 1979-1984

- Intended coverage of final reanalysis: 35 years by end of 2015
Evaluation - Precipitation

High-resolution regional reanalysis, WWOSC, Montreal, 16-21 August 2014

DAS? Koeppen geiger
Evaluation - Precipitation

Bias from contingency table for 6-hourly precipitation

\[
BIAS = \frac{H + FA}{H + M}
\]

COSMO-REA6
Threshold 0.10 mm/6h

ERA-INTERIM

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High-resolution regional reanalysis, WWRFC, Montreal, 16-21 August 2014
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High-resolution regional reanalysis, VWOSC, Montreal, 16-21 August 2014
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Evaluation - Pure Downscaling

High-resolution regional reanalysis, WWOSC, Montreal, 16-21 August 2014

DAS? Koeppen geiger
Evaluation - Pure Downscaling

Bias from contingency table
for 6-hourly precipitation
Threshold 1mm

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Evaluation - Pure Downscaling

High-resolution regional reanalysis, WMO/CC, Montreal, 16-21 August 2014
Evaluation - Pure Downscaling

Log-Odds ratio for 3-hourly precipitation
Threshold 1mm

\[ LOR = \frac{H \cdot CN}{FA \cdot M} \]

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DAS? Koeppen geiger
Evaluation - Temperature

DAS? Koeppen geiger
Evaluation

- Further evaluation using independent observations
  - Integrated water vapor
  - Spatial cloud structure (MSG)
  - Cloud ceiling
  - Spatial distribution of precipitation
Applications

- Climate monitoring on regional and local scales
- Climate change detection
- Risk assessment
- Reference for forecast verification
- Energy production / usage
- Agro-meteorology
- Boundary conditions for downstream simulations, e.g. higher resolution runs, hydrological and land-surface models
Conclusions

- A high resolution reanalysis using COSMO in production
  (8 years of data available, more to come soon)
- Large variety of parameters available
- Evaluation shows added value compared to ERA-Interim
  and gridded data sets

  Bollmeye et al., QJRMS, in revision

Future plans

- Framework for the evaluation of (regional) reanalysis
- Regional ensemble reanalysis (FP7 funded project UERRA)
- Investigate higher resolution (convection permitting)
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