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Possible KNMI contributions to EURRA

J. Onvlee, P. van Velthoven, B. van der Hurk



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Koninkrijk Nederlands Meteorologisch Instituut

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Questions and remarks



Koninkrijk Nederlands Meteorologisch Instituut

- Which scope? “Standard” NWP or include coupling with non-atmospheric systems (hydrology, atmospheric chemistry, ...)?
- Which models? One on every scale, or several?
- Mesoscale models+analysis still under development, however reliable downscaling techniques for regional models to km-scales already exist for some parameters. Use them in early phase?
- To study impact on forecast quality: do few years of reforecasting as well?
- Preparation phase requiring at least:
 - Diagnosis and where necessary removal of model biases before (majority of) reanalysis
 - Selection and validation of mesoscale model system(s) of choice
 - Selection and collection of high-density (local) observations for mesoscale analysis (beyond what is available on GTS)



Proposed contributions of KNMI

- Implement improved soil data assimilation schemes based on ELDAS, diagnose treatment of hydrological cycle
- Coupling of global and regional models with atmospheric chemistry models
- Use downscaling techniques for near-surface wind profiles and temperature to derive km-scale wind, temperature fields from regional models
- Participate in selection and collection of extensive high-resolution data suitable for meso-gamma scale assimilation



Proposed contributions to land data assimilation

- Experience: lead role in ELDAS project (vdHurk)
- ELDAS: improved soil data assimilation methods + recommendations on them
- Experience from ELDAS with ERA-40: model biases limit usefulness of reanalysis for study hydrological cycle. Diagnose analysis increments to improve land surface model, use model with and without land data assimilation
- KNMI contribution:
 - Implement ELDAS soil data assimilation in regional (HIRLAM) model
 - Diagnose land data increments to assess suitability of reanalysis model suite for hydrological cycle



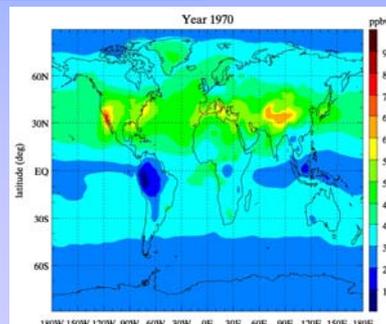
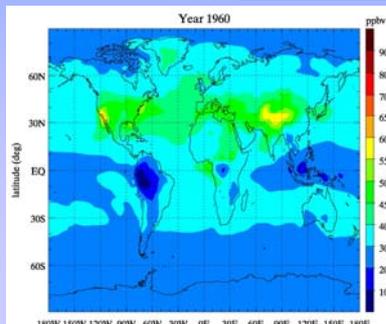
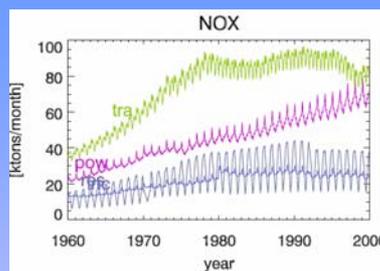
..... **Proposed contributions related to atmospheric chemistry/air quality**



- Chemical re-analysis with a coupled atmospheric chemistry model, building on EU-RETRO and GEMS. On scale of global model (ECMWF / TM5), and on regional scale (HIRLAM / Chimere)
- Provision of satellite observations of chemical composition (GOME, SCIAMACHY, OMI, GOME-2)
- Diagnosis of EURRA characteristics relevant to atm. chemistry modelling:
 - Brewer-Dobson circulation – age of air, ozone fluxes
 - Convective and turbulent mass fluxes
 - Precipitation formation (scavenging)

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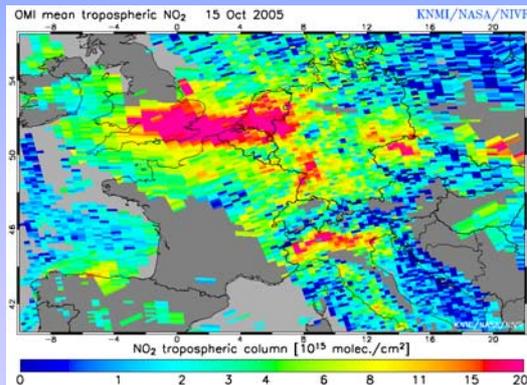
..... **Chemical re-analysis based on ERA-40**



Provision of satellite observations of chemical composition



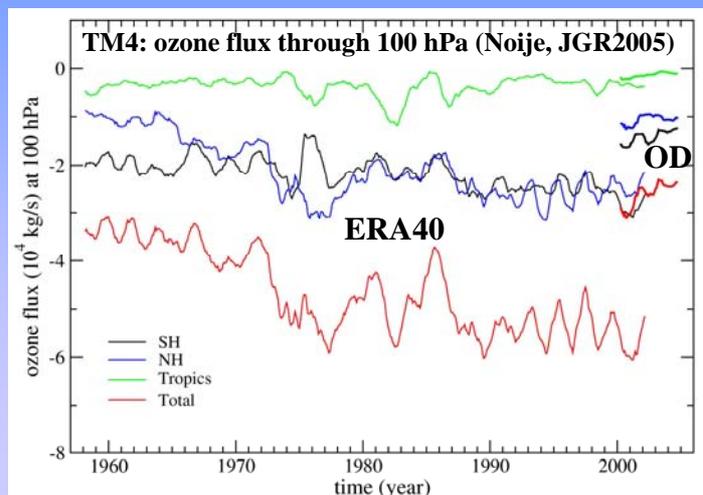
- Suite of instruments: GOME, SCIAMACHY, OMI, GOME-2
- OMI provides spatial resolution of 20 km and daily global coverage – of interest to high resolution re-analyses
- Main species: O₃, NO₂, HCHO



Diagnosis of quality of re-analysis for atmospheric chemistry applications



- Brewer-Dobson circulation & age of air





Downscaling methods

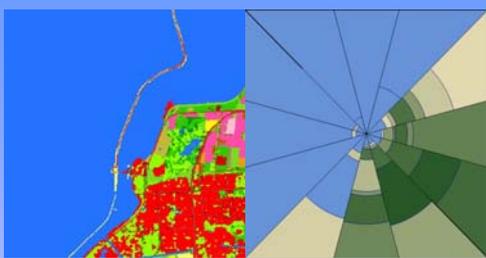
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- Downscaling methods to “translate” regional model (HIRLAM) output to km-scales, based on simple BL models; in operational use at KNMI since 1999
- Cheap, reliable, fast, physically consistent; available more quickly than full meso-gamma models
- Not for full set of model parameters, but significant improvements over regional model output for near-surface wind profiles (200-300m above surface)
- Requires high resolution land use datasets (30m)
- KNMI wishes to apply existing downscaling techniques for NL to reanalysis dataset of HIRLAM. **If** land use data sets on European scale are available, this could be extended to European scales.

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Downscaling:

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Methods:



- Wind: determine wind-direction dependent roughness from land use map, apply MO boundary layer model (Verkaik et al. 2003)
- Temperature: translate model T2m at central grid box location upwards using model roughness, then downwards to high-resolution grid using local roughness

Sample application: detailed wind behaviour at Schiphol airport

