The observations
IMPACT experiment

HIRLAM-ALADIN meeting
4-7 April 2016
Lisbon, Portugal

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Experiment IMPACT

- Cycle 38h1.2
- NL area 800x800 grid points
- 3DVAR and 4DVAR
- Analysis cycle 1 and 3 hours
- Period: 15 Nov.– 31 Dec. 2013 (includes Mandela storm)
- NOBS (3dvar, but no obs; surface analysis)
- CONV (3dvar, only conventional obs)
- SCAT (CONV + SCATTEROMETER)
- MODES (CONV + MODE-S EHS)
- 4DVAR (CONV + MODE-S EHS, 2 hour obs window with 7 sub-windows)
- RADAR (Reflectivity and Radial wind)
- HARATU (CONV + Harmonie-Racmo turbulence scheme)
- GNSS
- MSG (Cloudmasking)
NOBS not suitable as o-suite 4dvar modes
MODE-S EHS: improved 3DVAR timing of a passing front
10 m height validation De Bilt

- **Wind Direction [deg]**
  - obs
  - conv
  - Mode-s EHS 05km
  - Mode-s EHS 15km

- **Wind Speed [m/s]**

UTC times:
- 17:00
- 17:30
- 18:00
- 18:30
- 19:00
- 19:30
- 20:00
Mandela STORM: 5 Dec 2013

CONV

HA-U10; CONV; verification time: 2013120512UTC

CONV+SCAT

HA-U10; CONV+SCAT-NOTHINN-3h; verification time: 2013120512UTC

~ ECMWF
(o-f) u-10m over sea for scat

![Graph](image)
(o−f) v−10m over sea for scat

![Graph showing wind speed over time]

- IMPACT_NOBS
- IMPACT_CONV
- IMPACT_CONV_SCAT
- IMPACT_CONV_SCAT_THINN

number of obs

fc (hour)
• Harmonie exaggerates strong wind (over sea)
• Better match (closer to diagonal/less broad) for HARATU (over sea)
• Performance for wind speed >18m/s probably related to drag relation

Promising combi:
Harmonie (ASCAT) data assimilation + HARATU
IMPACT on cloud cover

Selection: Netherlands using 67 stations
Cloud cover Period: 20131116-20131231
Used {00} + 03 06 09 12 15 18 21 24

[Graph showing cloud cover data over different stations and periods]
bias and std specific humidity

4DVAR

3DVAR's
FOG or no FOG: 5 March 2014 12UTC +12h
o-f behaviour of 3dvar vs. 4dvar (10 sets o-f)
Humidity analysis increment and its evolution

**3Dvar Harmonie increment (FC+0)**

**3Dvar Harmonie evolved increment (FC+1)**

ML 51; q (g/kg) analysis increment at 2013112001UTC; exp. IMPACT_CONV

ML 51; q (g/kg) evolved analysis increment at 2013112006UTC; exp. IMPACT_CONV

Low correlation between increment and 1-hour evolved increment for humidity

Strong growth on small-scales, but is it correct?
Humidity analysis increment and its evolution

4Dvar Harmonie increment (FC+0)

Good correlation between increment and 1-hour evolved increment for humidity
Conclusions-Outlook

- Observations definitely contribute to an improved forecast performance, but impact
  
  i) is usually short-lived ( ~3h for 3dvar)
  ii) for different obs sets generally quite similar
- Wind DA (scat and mode-s) and Haratu seem a promising match.
- 3dvar suffers from the climatological B?
- 4dvar results (increment evolution, q-profile) warrant further exploration and obs set will be extended with Radar, Scatterometer and GNSS (possibly with 1-h analysis cycle)
- KNMI has started a CY38 3DVAR e-suite (Haratu, Mode-s EHS, Scatterometer, and soon Radar (F, B, Ire, DK))