Use of AMVs in the regional mesoscale model HARMONIE in AEMET

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Outline

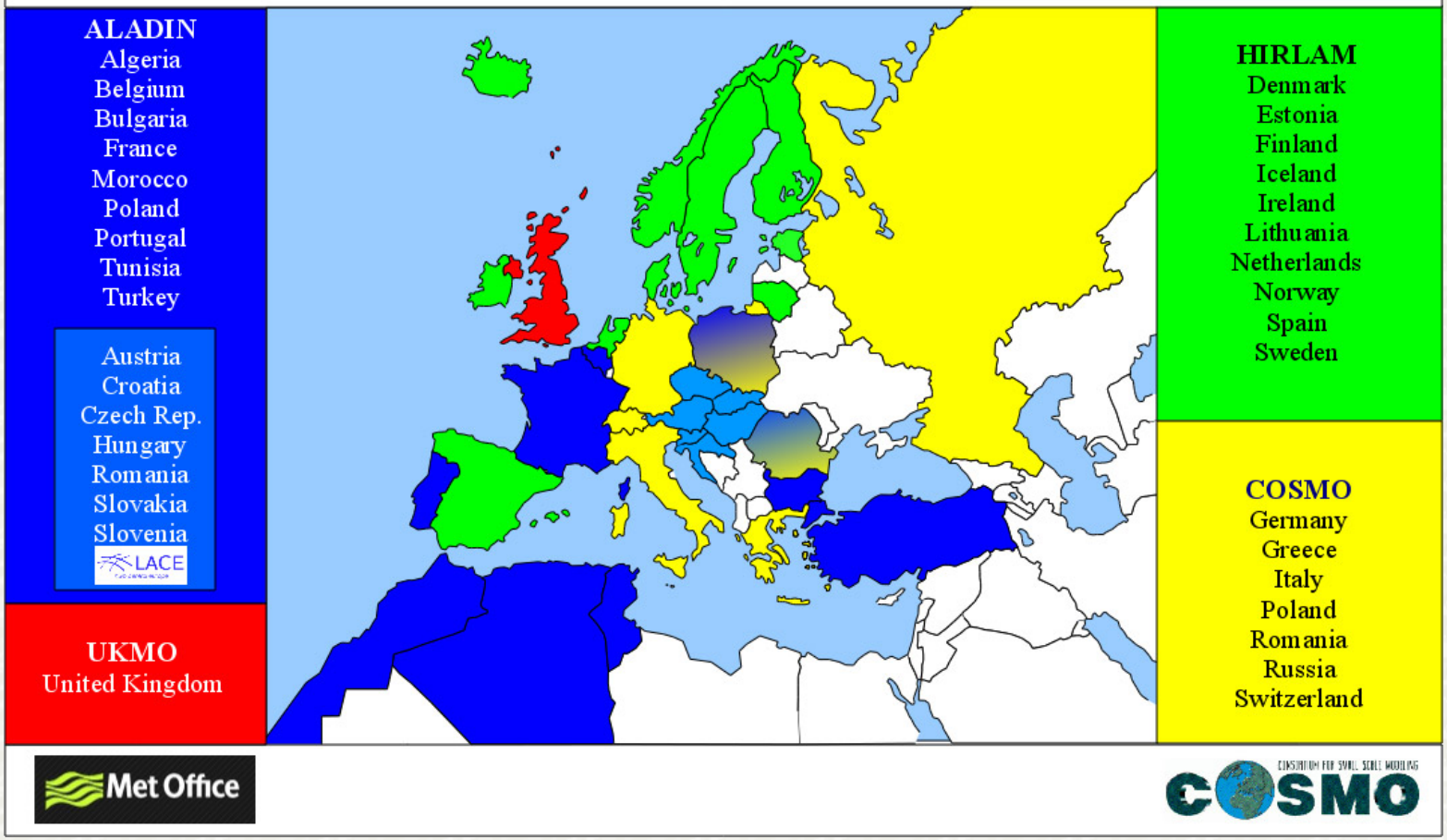
1. Background - HARMONIE in AEMET.
2. Mesoscale NWP and AMVs: problems / issues / challenges.
3. Directions of work.
4. Wishes.

1. BACKGROUND - HARMONIE in AEMET

HARMONIE and HIRLAM

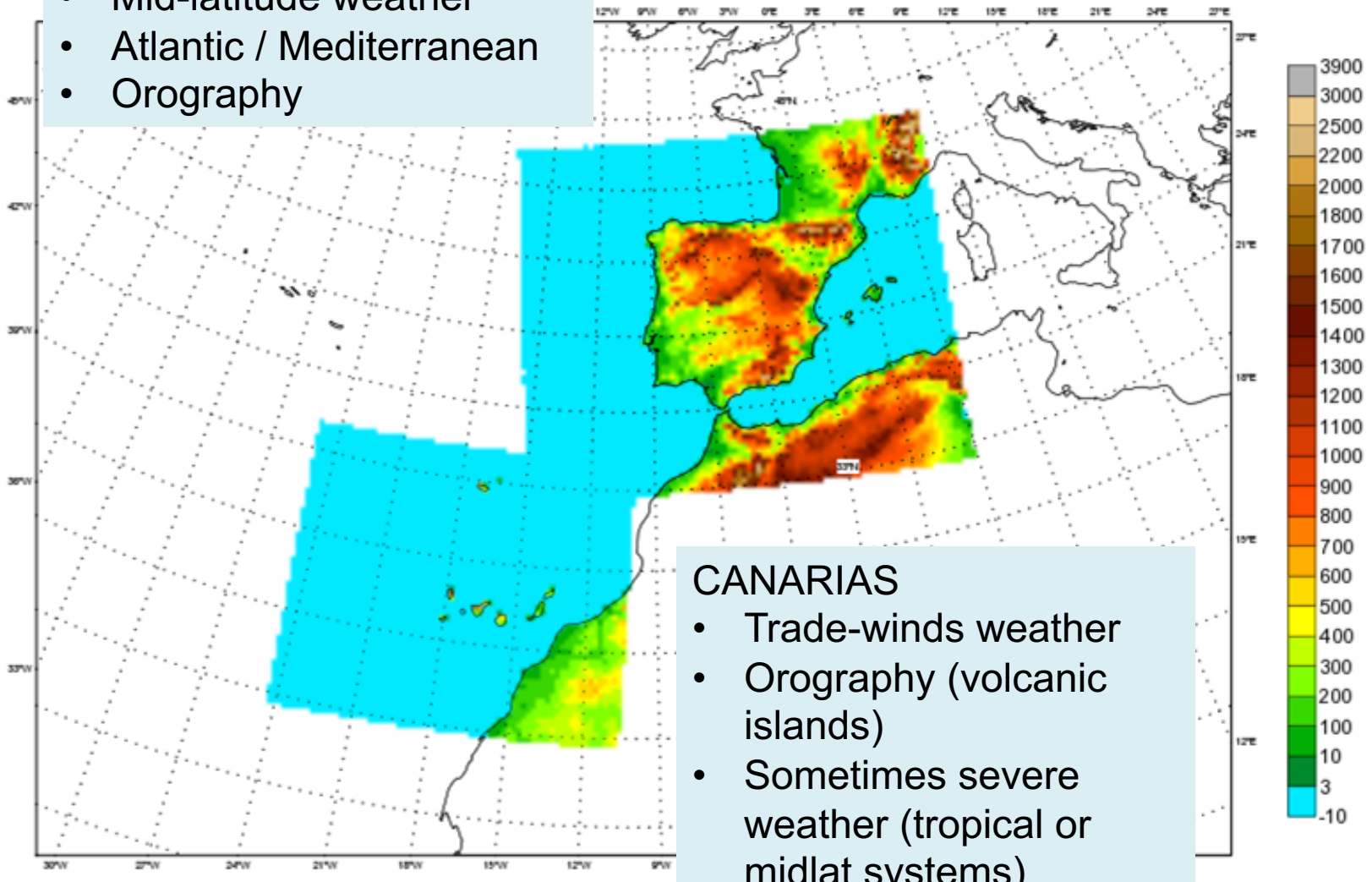
- HIRLAM - a consortium of National Met. Institutes in Europe.
- HARMONIE is a regional mesoscale NWP atmos. model
  - HIRLAM implementation of the LAM version of ARPEGE/IFS.
  - Non-hydrostatic, convection-permitting.
  - Horizontal resolution: 2.5 km (default).
  - Vertical resolution: 65 levels (default).
  - Flexible geographical area.
- HARMONIE = Hirlam-Aladin Research Mesoscale Operational NWP In Europe.

SRNWP Consortia in Europe



Source: EUMETNET C-SRNWP website (http://srnwp.met.hu)

IBERIA
- Mid-latitude weather
- Atlantic / Mediterranean
- Orography



CANARIAS
- Trade-winds weather
- Orography (volcanic islands)
- Sometimes severe weather (tropical or midlat systems)

1. BACKGROUND - HARMONIE in AEMET

- E-suite (= next in operations if everything OK):
  - HARMONIE, 3D-VAR (cycle 40h1b5).
  - DA/FC cycle: 3 hours, cut-off time: 1h 10 mins.
  - Conventional observations, AMSU, GNNS (no AMVs).
  - On new supercomputer.
- Plans for short-term future:
  - Obs = Obs + AMVs (+ others).
  - 3D-VAR with 1-hour Rapid Update Cycling.
  - Need for observations at hours other than 00-06-12-18.
  - Shorter cut-off time (40 mins?): good observation latency is essential.

1. BACKGROUND - HARMONIE in AEMET

- AMVs from Meteosat-10 a promising obs. system:
  - Available hourly.
  - Good observation latency.
  - Lat/Lon OK for both domains (Iberia, Canarias).
    - Unlike for most HIRLAM NMSs – several in the AMV Gap.
- Can AMVs be truly useful?
  - AMVs come with their problems / issues / challenges…
    - Some particularly relevant to mesoscale, others more general.
  - Is there anything we can do to get more than "neutral / marginally positive" impact?

2. Mesoscale NWP and AMVs – issues

- Time of Meteosat-10 AMV retrievals is hh30
  - One-year dataset of Met-10 AMVs (Jun 2015 to Apr 2016) downloaded from EUMETSAT EO Portal.
- Do we want to assimilate 30-min old observations in hourly DA cycles?
  - If it makes sense to have hourly DA cycles, surely it makes sense that the time of the observations / retrievals is the time of the analysis.
- It would be good if AMVs at hh00 were available.
- Also more appropriate in comparisons of AMVs with model FG.

2. Mesoscale NWP and AMVs – issues

- AMV horizontal resolution is low, even if derived from the HRVIS channel (day, low level).
  - HRVIS: tracer boxes are 12x12, resolution at SSP is 1km.
  - Other channels - tracer boxes: 24x24 pixels, 3km at SSP.
  - We would also like AMVs at high levels / night time.
- In addition, QI is essentially a measure of spatial and temporal consistency. From a mesoscale perspective,
  - Aren't we throwing the baby with the water?
- Could we get a priori estimates of quality not based on consistency?
- How could we get good quality AMVs from smaller tracers?

2. (Mesoscale) NWP and AMVs – issues

- Height assignment – in the last few years, several studies have given consistent evidence that AMVs are more representative of a level below the cloud top than of the cloud top.

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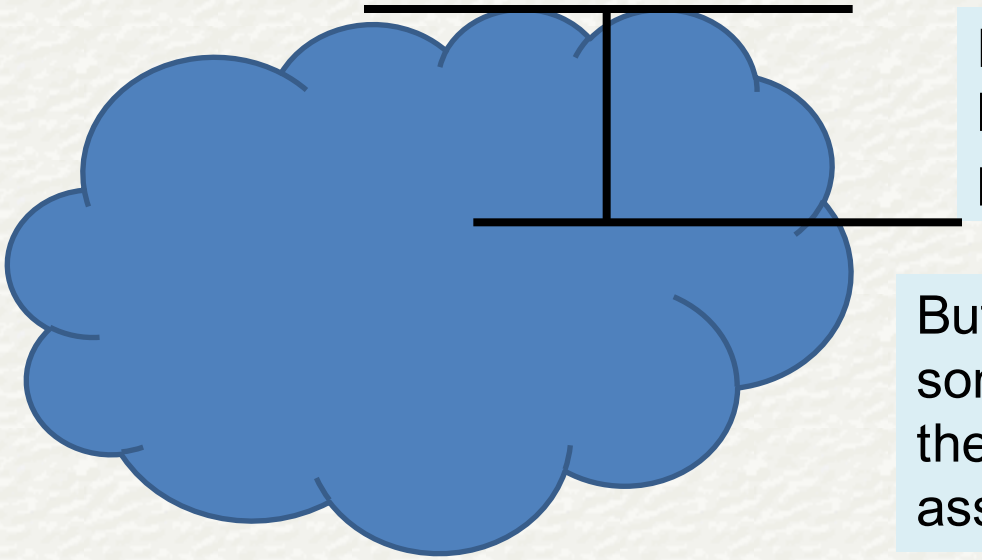

How deep in the cloud, below the top should we place AMVs?

But first, can we improve somehow the estimate of the cloud top height assigned during derivation?

BTW, what do we mean exactly with cloud top?

2. (Mesoscale) NWP and AMVs – issues

- Q1 - Several studies show that lidar-based corrections is a promising approach:
  - Folger and Weissmann (2014),
  - Poster presentation by Salonen et al.
- Q2 -

2. (Mesoscale) NWP and AMVs – issues

- Q1 - Several studies show that lidar-based corrections is a promising approach:
  - Folger and Weissmann (2014), poster Salonen et al.
- Q2 - How deep in the cloud should we place AMVs?
  - Perhaps cloud products can be of help?
    - Cloud type, optical depth ?
    - Perhaps cloud liquid/ice water path (Garcia-Pereda presentation)?
  - NWC/GEO v2016 will include a Cloud Product (Le Gleau, MF component of the NWC SAF).
    - New to users, but "mature" product.
    - Microphysics: Roebeling et al. 2006.

2. (Mesoscale) NWP and AMVs – issues

- Information communication – BUFR is a table driven, self-descriptive code.
  - Often it does not look like that.
  - E.g. Code Table 01032 used in AMV template.
- BUFR is OK, but it is not simple.
- We are aware that we need to invest effort to get it right.

3. Directions of work.

- When fighting technical problems allow…
- Explore AMVs generated locally with NWC SAF software (customize derivation, HRW).
- Explore alternative QI based on properties of the correlation surfaces.
- Explore HA corrections based on lidar and/or cloud physical properties.
- Explore rapid-scan AMVs.

4. Wishes

- It would be great to get AMVs from Meteosat-10 at hh00.
- It would be great if BUFR AMV messages contain cloud info (cloud type, optical depth?) that helps with the studies.
  - Beforehand we don't know what is going to help.
  - We may have an educated guess.
- It would be great if BUFR AMV messages could be understood just with a BUFR decoder and BUFR tables (WMO tables if possible).

Thank you. Any questions?

1. BACKGROUND - HARMONIE in AEMET

- Operations:
  - 6 hour DA/FC cycle, cycle 38h1.2, 3D-VAR.
  - Only conventional observations.
  - ECMWF supercomputer.
- E-suite:
  - 3 hour DA/FC cycle, cycle 40h1b5, 3D-VAR
  - Conventional observations, GNNS, ATOVS.
  - On new supercomputer Bull.

HIRLAM community - now

- AMVs assimilated operationally in HIRLAM NMSs?
  - Only in Danish Met Institute - HIRLAM model, not HARMONIE.
  - To the best of my knowledge…
- Why not?
  - **The gap** – for many NMS in HIRLAM, the model area overlaps the gap (lat. band not covered by either GEO or Polar AMVs).
  - **Polar AMVs** – timeliness is a problem for regional NWP:
    - Observation latency typically 2 to 4 hours.
    - DA cut-off time typically below 2h – can be as early as 20 mins!
  - **GEO AMVs** - poor cover and low quality at high latitudes.
    - Observation latency OK
  - **Staff resources** – limited, priority given to other obs. types (e.g. radar, GPS-R0, Mode-S).

HIRLAM community - plans

- Short-term plans to do AMVs impact studies, perhaps assimilate AMVs operationally, in some HIRLAM NMSs.
- Re GEO AMVs (Met. Norway and FMI)
  - AMVs generated locally using NWC SAF HRW software.
  - AMV studies, e.g. investigate quality of AMVs north of 65 N.
  - Latency of GEO AMVs from EUMETSAT not a problem.
  - But expected improvements in cover and quality.
- Re Polar AMVs (Met. Norway)
  - Assimilation of Polar AMVs generated locally using software provided by EUMETSAT – would improve latency.
- Other NMS also have interest, may do AMV experiments.