Harmonized, high quality weather forecasts

Weather doesn’t know political borders

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Deutscher Wetterdienst

6 to 10 November 2017, Météo-France, Toulouse
Implementing Meteorological Information Exchange

→ Following EU Implementing regulation 716/2014, section 5.1.4

**Partners:** DWD, Met Office, Météo-France, Finnish Meteorological Institute (FMI), EUMETNET, EUROCONTROL,

**Time frame:** Dec 2020

**Co-funded:** by European Union

**Goal:** Deployment of the consolidation and translation of European adverse weather forecasts for aviation as part of 4DWxCube: Icing, turbulence, convection (nowcasting and ensemble) and winter weather (precipitation type, de-icing index, winter weather indices)

**Based on:** validated MET Prototypes developed in SESAR WP11.2
Consolidation & Translation means:

⇒ Combining several forecasts/analyses from NMSs to one single consistent vision of the present state of the atmosphere and its future evolution

⇒ Increasing geographical coverage with neither decreasing resolution nor increasing costs

⇒ Using the most suitable scientific approach for consolidation process to achieve the highest performance

⇒ Developing common protocols e.g. convection severity levels specific for ATM and airspace user needs
Icing / turbulence forecast: Blending of NWP data

- Each single product covers European domain
- Weighted blending method
- For execution and short term planning
- Verification and determination of weighting factors
- Collecting observation / measurement data
Nowcasting of Convection: domain increase, weighting

High horiz. & temp. resolution + update rate, severity levels, cloud top height,

References: Haussler, S., R. Müller, 2017; Moisselin, J.-M. and Jauffret, C., 2017
Super-ensemble forecast of convection: Merging

MOGREPS + AROME = 24 members

COSMO + AROME = 32 members

weight

w=1

w=0

Model 1 (black)

Model 2 (red)

Reference: Beck et al., 2016
Super-ensemble forecast: Merging

Mean RH2m(%) 2012080500+05

Mean RH2m(%) 2012080500+05

- Maximum reflectivity
- Cloud top height
- Output: severity and probability of convection / severity

- Long-term goal: one consistent product for convection (T0 – T+1d)

Reference: Raynaud, L., and F. Bouttier, 2017
### Winter Weather: De-Icing Weather Class (DIW)

- Defined meteorological thresholds of four different DIW classes
- Probabilities of DIW based on weather radar information and METAR

<table>
<thead>
<tr>
<th>Time</th>
<th>DIW=0</th>
<th>DIW=2</th>
<th>DIW=3</th>
</tr>
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<tbody>
<tr>
<td>9:15 UTC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>obs</td>
<td>0.00</td>
<td>0.54</td>
<td>0.46</td>
</tr>
<tr>
<td>+15 min</td>
<td>0.00</td>
<td>1.00</td>
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<tr>
<td>+30 min</td>
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<tr>
<td>+45 min</td>
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<td>0.05</td>
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<td>+120 min</td>
<td>0.02</td>
<td>0.97</td>
<td>0.01</td>
</tr>
<tr>
<td>+135 min</td>
<td>0.08</td>
<td>0.89</td>
<td>0.03</td>
</tr>
</tbody>
</table>
Winter Weather indices

- three severity classes
- Thresholds depending on aircraft category (commercial, rotorcraft)
- Based on NWP parameters

→ Considering using DWD, MO and MF models as input for European products (harmonisation to other products)

→ Considering blending output of several different input models (improving accuracy)

<table>
<thead>
<tr>
<th></th>
<th>LGT (1)</th>
<th>MOD (2)</th>
<th>HVY (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility</td>
<td>&lt; 5000 m</td>
<td>&lt; 1500 m</td>
<td>&lt; 600 m</td>
</tr>
<tr>
<td>Snowfall intensity</td>
<td>0.1– 0.5 mm/h</td>
<td>&gt; 0.5 – 2.5 mm/h</td>
<td>&gt; 2.5 mm/h</td>
</tr>
<tr>
<td>Freezing rain intensity</td>
<td>0.1– 0.7 mm/h</td>
<td>&gt; 0.7 mm/h</td>
<td></td>
</tr>
</tbody>
</table>

Precipitation types (prob.)

- probability of snow, sleet, freezing rain or freezing drizzle for advanced planning purposes
Objectives for operational MET products

The MET products shall be generated in the highest resolution (time, space) that allows the best quality.

- Accuracy (verification: obs./measurement to product statement)
- Scientific integrity
- Consistency (‘fit for customer needs‘)
- Latency / timeliness
- Robust production / delivery system
- ‘Keep it as simple as possible and as complex as necessary.‘
- Usable for different purposes
MET Products provided as SWIM compliant services

e.g.

→ MET Gridded Forecast Service
→ MET Hazard Enroute Forecast Service
→ Airport MET Nowcast Service

→ Provided by MET-GATE
  Implemented by Météo France, Met Office, Deutscher Wetterdienst
  (Project 2015_069_AF5)

→ Further information: poster presentation today (Thursday afternoon)
Radar composite for 3D convection

- 15min update over Europe
- 5min over hub areas (512 x 512 x 12 km³)
- 500m horizontal resol.
- 250m vertical resol.
- Large, central panel is a xy-cross-section at 2km constant altitude

→ SESAR deployment project:
   2015_067_AF5 (MO, MF, DWD)

MODE-S EHS deployment

Aircraft derived MET observations: wind, temperature

- Quality improved up to T+6h
- low cost receivers are being developed that can be simply and cheaply deployed around Europe. KNMI gather that information in their data hub

- SESAR deployment project 2015_137_AF5 (KNMI, MO)
  Contact: Jan Sondij, KNMI
In brief: Harmonised weather forecast implementation

- Implementing SESAR solution Meteorological Information Exchange
- MET products in the highest resolution (time, space) available
- „Best quality“ (accuracy and performance)
- Focus on adverse weather phenomena
  - Icing
  - Turbulence
  - Convection
  - Winter weather phenomena
- Provision via SWIM compliant MET-GATE services
Thanks to all project contributors
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Further information / references:


Raynaud, L., and F. Bouttier, 2017: The impact of horizontal resolution and ensemble size for convective-scale probabilistic forecasts, Quarterly Journal of the Royal Meteorological Society