MeteoVIAS: Web Application for winter road weather forecasting

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Motivation

- Severe winter weather conditions such as ice or snow on the road are potential risks to the safety and operation of national transport systems.
- Keeping roads clear and open can be a challenge in certain places, especially in winter.
- The region of Castilla y Leon is greatly affected by winter weather since its main road network has sections over 1000 m of altitude.
- The optimization of human and material resources for this purpose requires specific and updated meteorological information.
Objectives of MeteoVIAS

• Oriented to traffic/road maintenance managers:
  • Decision-making tool for winter road operations: Short and very short range

• Application desired characteristics:
  • Provide a specific road forecast.
  • Allow visual identification of severe weather forecasted and its location.
  • Show an overall view of the weather forecasted for the country.
  • Include a time evolution chart of variables like temperature, rain or snow.
  • Possibility of filtering the information to visualize.
Specific road forecast

- Model chosen: **METRo** (Model of the Environment and Temperature of Roads)
  - 0D model (predictions in points)
  - Relatively easy to implement
  - Few configuration options
  - Requires as inputs:
    - Atmospheric forecast
    - Observation data
    - Location characteristics

Source: www.vaisala.com

DGT RWIS network

HARMONIE-AROME
DGT road weather station network

Source: www.vaisala.com
METRo verification: Surface Temperature

- A **test campaign** was performed, with >12000 cases, aimed to:
  - Find METRo **configuration** that results in best skill
  - Evaluate skill **improvement with respect to HARMONIE-AROME**
METRo verification: Surface Temperature

- **Abs. error and STD** compared to HARMONIE-AROME

  **Lower** Abs. error and STD for **shorter ranges** (<6h)

  Average abs. error is \(~-1^\circ\text{C}\) (HARM \(~-2^\circ\text{C}\)
METRo verification: Surface Temperature

- Forecast-Obs. dispersion

METRo improves skill (reduces BIAS)
Narrower spread for lower temperatures
METRo verification: Surface Temperature

- Dichotomous verification
  
  **Hit Rate:**
  - similar to HARMONIE-AROME

  **False Alarm Rate** and **Equitable Threat Score:**
  - better for METRo, specially for shorter ranges

METRo improves skill for road weather forecast, compared to HARMONIE
MeteoVIAS: Features

- Forecast **range**: 36 hours
- **Automatic update** every 6 hours
- Provides information about:
  - **Specific** road forecast (METRo)
  - **Atmospheric** forecast (HARMONIE-AROME)
- Allows to visualize **severe weather, intensity** and **location**:
  - **Snow** accumulation
  - **Ice** presence
  - **Water film** on road
  - **Surface temperature** below certain value
- Includes a **time evolution chart** and **most characteristic values** for each point
- Possibility of **filtering** the information to visualize
- **Multi-device** access.
MeteoVIAS

Estaciones DGT

Añadir límites:
- Temp. mínima:
  - 2.0 °C
- Película de agua:
  - 0.5 mm
- Acum. de nieve:
  - 0.1 cm

Previsión en carretera para la estación

Estación: 70394 - CL-601 pk:24 - Ceredilla, SEGOVIA

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<tr>
<th>Rango</th>
<th>Temp. mín.</th>
<th>Max. lluvia</th>
<th>Max. nieve</th>
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<tbody>
<tr>
<td>De: 059 27/02</td>
<td>-2.8 °C</td>
<td>0 mm</td>
<td>0 cm</td>
</tr>
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<td>-0.6 °C</td>
<td>2.6 mm</td>
<td>0.5 cm</td>
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<td>-1.0 °C</td>
<td>- mm</td>
<td>- mm</td>
</tr>
<tr>
<td>A: -</td>
<td>- °C</td>
<td>- mm</td>
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</tr>
</tbody>
</table>

Iconos
- Temp. mínima (°C)
- Película de agua [mm]
- Placa de hielo [mm]
- Capa de nieve [cm]
Web App structure

- Interactive map
- Summary table
- Time evolution chart
- Filtering options
Interactive map

Information shown:
- METRo forecast (icons)
- HARMONIE (other)
Interactive map

Layer selector
Interactive map

Severe winter weather conditions according to METRo

Locations: Points with observation (weather stations)

Severe weather:
- Accum. snow
- Ice presence
- Water film on road
- Min. surf. temp. <2ºC

Point with METRo forecast

Point with HARMONIE forecast (no observation available)
Interactive map

Severe weather condition on road according to HARMONIE-AROME

Most severe, no matter which

+ severity
Interactive map

Minimum surface temperature according to HARMONIE-AROME

Full temp. range

Only for ST < 4ºC
Interactive map

Total accumulated precipitation according to HARMONIE-AROME

Rain

Snow

Rain + Snow
Interactive map

Visibility < 1km according to HARMONIE-AROME
Filtering options

- Allow to filter the information shown in the interactive map, by:
  - Time range
  - METRo forecast variable and/or severity
Time evolution chart

For each point selected on map, it shows time evolution of:

- Surface temperature
- Water film thickness
- Accumulation of snow
- 1 hour snow precipitation
- 1 hour rain precipitation
Summary table

For each point selected on map, it shows characteristic values of:

- Surface temperature
- Water film thickness
- Accumulation of snow
- 1 hour snow precipitation
- 1 hour rain precipitation
Responsive Web design

Same features, different structure when accessing from smartphone
Future work

• Structure and content modifications according to feedback from test users.
• Increase number of METRo forecast points, adding other road weather station networks.
• Increase METRo forecast updating frequency.
• Include an observation verification system for data from road weather stations
Thank you for your attention