A Met/Ocean Wish List for Feature & Coverage Portrayal using SLD/SE

Ilkka Rinne, Marko Pietarinen
Finnish Meteorological Institute

OGC SLDSE Standards Working Group Meeting
Frascati, Italy, 10th March 2010
Example Architectures

Component WMS model, Feature / Coverage Portrayal Service
Example Architectures
Meteorological Feature Data

• Typically complex Features.
• Rapidly changing, often incomplete information.
• Internationally agreed, legally mandated visualization rules, but not in machine-readable format.
• Examples:
  • weather observations from fixed or mobile observation stations,
  • Human-crafted weather forecasts or analyses,
  • (Semi-)Automatically extracted Features describing observed or predicted weather conditions or phenomena (like storms).
Features, (Relatively) Simple Cases

- Image symbols, decorated lines, areas with color and/or hatch fill.

- **BUT** lines (and decorations) have direction, arrow heads.

- Line and area geometries may be defined with spline curves and rings.
Features, (Relatively) Simple Cases

• Image symbols, decorated lines, areas with color and/or hatch fill.

• BUT lines (and decorations) have direction, arrow heads.

• Line and area geometries may be defined with spline curves and rings.
Symbology Is Mandated for WMO Members

3.2 Symbols

WMO Manual on the Global Data-Processing and Forecasting System, Part II, Appendix II-4

Term
1. Cold front at the surface
2. Cold front above the surface
3. Cold front frontogenesis
4. Cold front frontolysis
5. Warm front at the surface
6. Warm front above the surface
7. Warm front frontogenesis
8. Warm front frontolysis
9. Occluded front at the surface
10. Occluded front above the surface
11. Quasi-stationary front at the surface
12. Quasi-stationary front above the surface
13. Quasi-stationary front frontogenesis
14. Quasi-stationary front frontolysis
15. Convergence line
16. Intertropical convergence zone
17. Intertropical discontinuity
18. Axis of trough
19. Axis of ridge

Symbol

NOTE: The separation of the two lines gives a qualitative representation of the width of the zone, to indicate areas of activity.
Features, More Challenging(?) Cases

- Synop (ground weather observation) plots
- Several observation parameters combined in fixed positions around the observation position.
- Both graphical and text notation.
- Data probably some kind of O&M via an SOS/WFS interface.
**Symbology for Ground Weather Observations Mandated for WMO Members**

WMO Manual on the Global Data-Processing and Forecasting System, Part II, Appendix II-4

---

### APPENDIX II-4

**GRAPHICAL REPRESENTATION OF DATA, ANALYSES AND FORECASTS**

1. **THE SURFACE PLOTTING MODEL**

If it is required to plot the elements shown in the model, they should be placed in the relative positions shown. Any of the elements may be omitted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_0$</td>
<td>Temperature at ground level</td>
</tr>
<tr>
<td>$T_x$</td>
<td>Temperature at upper level</td>
</tr>
<tr>
<td>$C_H$</td>
<td>dewpoint temperature</td>
</tr>
<tr>
<td>$E$</td>
<td>Relative humidity or E°(dewpoint)</td>
</tr>
<tr>
<td>$PPP$</td>
<td>Pressure or P°(dewpoint)</td>
</tr>
<tr>
<td>$N$</td>
<td>Wind direction</td>
</tr>
<tr>
<td>$PPP$</td>
<td>Wind speed</td>
</tr>
<tr>
<td>$GG$</td>
<td>Ground temperature or G°(dewpoint)</td>
</tr>
<tr>
<td>$RRR$</td>
<td>Relative humidity ratio</td>
</tr>
<tr>
<td>$D_{G}$</td>
<td>Dewpoint</td>
</tr>
<tr>
<td>$d_1$</td>
<td>Surface pressure</td>
</tr>
<tr>
<td>$d_2$</td>
<td>Surface pressure at height 1</td>
</tr>
<tr>
<td>$d_3$</td>
<td>Surface pressure at height 2</td>
</tr>
</tbody>
</table>

![Typical station weather plot](image-url)
Symbology for Ground Weather Observations Mandated for WMO Members

APPENDIX II-4

GRAPhICAL REPRESENTATION OF DATA, ANALYSES AND FORECASTS

1. THE SURFACE PLOTTING MODEL

If it is required to plot the elements shown in the model, they should be placed in the relative positions shown. Any of the elements may be omitted.

Typical station weather plot
Symbology for Ground Weather Observations Mandated for WMO Members

WMO Manual on the Global Data-Processing and Forecasting System, Part II, Appendix II-4

1. THE SURFACE PLOTTING MODEL

If it is required to plot the elements shown in the model, they should be placed in the relative positions shown. Any of the elements may be omitted.
Symbology for Ground Weather Observations
Mandated for WMO Members

WMO Manual on the Global Data-Processing and Forecasting System, Part II, Appendix II-4

APPENDIX II-4

GRAPHICAL REPRESENTATION OF DATA, ANALYSES AND FORECASTS

1. THE SURFACE PLOTTING MODEL

If it is required to plot the elements shown in the model, they should be placed in the relative positions shown. Any of the elements may be omitted.
Symbology for Ground Weather Observations Mandated for WMO Members

WMO Manual on the Global Data-Processing and Forecasting System, Part II, Appendix II-4
Symbology for Ground Weather Observations Mandated for WMO Members

WMO Manual on the Global Data-Processing and Forecasting System, Part II, Appendix II-4

APPENDIX II-4

GRAPHICAL REPRESENTATION OF DATA, ANALYSES AND FORECASTS

1. THE SURFACE PLOTTING MODEL

If it is required to plot the elements shown in the model, they should be placed in the relative positions shown. Any of the elements may be omitted.

Wind direction and strength
Features, More Challenging(?) Cases

- **Significant Weather Charts (SigWx, SWC)**
- **Detached labeling**
- **Features may contain additional geospatial structure: wind speeds at specific points and heights along the jet lines.**
Features, More Challenging(?) Cases

• Significant Weather Charts (SigWx, SWC)
• Detached labeling
• Features may contain additional geospatial structure: wind speeds at specific points and heights along the jet lines.

Wind arrows indicate the maximum wind in jet and the flight level at which it occurs. Significant changes (speed of 20 knots or more, 3,000 ft (less if practicable) in flight level) are marked by the double bar. In the example, at the double bar the wind speed is 225 km/h (120 kt).

The heavy line delineating the jet axis begins/ends at the points where a wind speed of 150 km/h (80 kt) is forecast.
Legally Mandated Symbology, Aviation Met

WMO Technical Regulations, Volume II, Meteorological Service for International Air Navigation, Chapter 3.1, Appendix 1-16

Originates from the “Chicago Convention”, Annex 3

1. Symbols for significant weather

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Weather Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>☁️</td>
<td>Thunderstorms</td>
</tr>
<tr>
<td>☁️</td>
<td>Tropical cyclone</td>
</tr>
<tr>
<td>⛄</td>
<td>Severe squall line*</td>
</tr>
<tr>
<td>⬇️</td>
<td>Moderate turbulence</td>
</tr>
<tr>
<td>⬇️</td>
<td>Severe turbulence</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Weather Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>℃</td>
<td>Rain</td>
</tr>
<tr>
<td>✯</td>
<td>Snow</td>
</tr>
<tr>
<td>⬇️</td>
<td>Shower</td>
</tr>
<tr>
<td>⬇️</td>
<td>Hail</td>
</tr>
</tbody>
</table>

2. Fronts and convergence zones and other symbols used

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚔️</td>
<td>Cold front at the surface</td>
<td>FL 270</td>
</tr>
<tr>
<td>⚔️</td>
<td>Warm front at the surface</td>
<td></td>
</tr>
<tr>
<td>⚔️</td>
<td>Occluded front at the surface</td>
<td>9-100</td>
</tr>
<tr>
<td>⚔️</td>
<td>Quasi-stationary front at the surface</td>
<td></td>
</tr>
<tr>
<td>⚔️</td>
<td>Intertropical convergence zone</td>
<td></td>
</tr>
<tr>
<td>⚔️</td>
<td>Tropopause High</td>
<td>10</td>
</tr>
<tr>
<td>⚔️</td>
<td>Tropopause Low</td>
<td>18</td>
</tr>
<tr>
<td>⚔️</td>
<td>Tropopause Level</td>
<td>280</td>
</tr>
<tr>
<td>⚔️</td>
<td>Widespread Strong surface wind *</td>
<td>FL 340</td>
</tr>
</tbody>
</table>

Wind arrows indicate the maximum wind in knots and the flight level at which it occurs. Significant changes (speed of 20 knots or more, 3,000 ft [less if practicable] in flight level) are marked by the double bar. In the example, at the double bar the wind speed is 125 knots (225 kt). The heavy line delineating the jet axis begins/ends at the points where a wind speed of 150 knots (80 kt) is forecast.

*This symbol refers to widespread surface wind speeds exceeding 60 km/h (30 kt)
Coverage Portrayal Needs: Isolines

- Line density definable.
- Coloring depending on the data ranges.
- “Smart” labels positioning along the isolines.
- Highlight the major isolines by increased line weight.
Coverage Portrayal Needs: Contour Lines

- Color slides, several ranges depending on the data values.
- Possibly special ranges around the most interesting values (like temperature around zero)
- Some ranges may be transparent
Coverage Portrayal Needs: Wind Arrows

• Line properties (size, weight) may depend on the data values.

• The visualization may depend on several parameters (wind speed, direction, others)
Coverage Portrayal Needs: Wind Barbs

- Line properties (size, weight) may depend on the data values.
- The visualization may depend on several parameters (wind speed, direction, others).
- Different handedness depending on the hemisphere.
- Difficulties in tiling (WMTS).
Avoid Cluttering, Adjust The Level Of Detail

• Existing in SE: maxScaleDenominator and minScaleDenominator in se:RuleType.

• But we also need to be able to
  • visualize the coverage data with different sampling on different map (zoom) scales.
    • WCPS?
  • calculate the categorization (for isolines) based on the map scale.
Our Hopes for the SLD/SE

• Language for formalizing the existing internationally agreed symbology and data visualization rules.
  • Especially important for using the Met/Ocean data in non-met/ocean visualization software together with data from other domains.
  • Necessity for providing the data to non-experts in non-graphical formats (GML, binary grid formats).

• A clean separation of visualization from the data in format that can be shared and re-used.