Interactive Meteosat: Educational Platform for Meteorological Applications Entirely Developed with FLOSS Software

Vasile Craciunescu¹, Chris Stewart², Francesco Sarti², Florin Serban³

¹Meteo Romania & ASRC  ²European Space Agency Center  ³Advanced Studies & Research
The “Eduspace” website aims to provide students and educators of Europe and worldwide with an e-learning tool giving access and exposure to satellite image data of the Earth and in particular to a wide-spread visibility of Earth Observation applications for education and training. Eduspace is primarily aimed at secondary school students, but some material is more advanced and better suited towards university undergraduates.
Interactive Meteosat

• Teachers and students do explore and analyse the weather of the day in Europe

• Do their own weather observation which become visible on the corresponding Meteosat image

• Exercise: analyse and produce a forecast!
Web tool v.1

• Launched in November 2001

• Java based (closed source)
New Interactive Meteosat

• Will be officially launched in November 2010
• Developed by ASRC using open source software
• More complex and interactive
Tasks

• Download and process daily METEOSAT images

• Create a web interface for users to upload meteorological observations

• Integrate the images and the observations into a webmapping application
Batch image processing

METEOSAT channels:
- Visible 0.6 μm;
- Visible 0.8 μm;
- Infrared 1.6 μm;
- Infrared 10.8 μm;
- Water Vapour 6.2 μm;
- Natural Color RGB

Download .jpg

EUMETSAT

GDAL magic
- Georeference
- Merge
- Clip
- Reproject
- Tiles

Download .hdf

ESA EKU

GDAL magic
- Convert
- Clip
- Combine
- Reproject
- Tiles

Web client
Observation upload

Users
- Date & time;
- Latitude & longitude;
- Location;
- Elevation;
- Current conditions;
- Wind direction;
- Wind speed;
- Cloud cover;
- Temperature;
- Additional obs;
- Photo.

ExtJS Web client

Insert, Edit, Delete
Browse, Sort, Search

Linux
Apache
PHP
Python
Inkscape
ImageMagick
MySQL

Details
Photo Symbols

Webmapping client
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Latitude</th>
<th>Longitude</th>
<th>E/W</th>
<th>School</th>
<th>Location</th>
<th>Elevation</th>
<th>Current conditions</th>
<th>Wind direction</th>
<th>Wind speed</th>
<th>Wind units</th>
<th>Cloud cover</th>
<th>Temperature</th>
<th>Additional observations</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-09-2010</td>
<td>06:00 AM</td>
<td>51° 30' 30&quot;</td>
<td>North</td>
<td>-1° 52' 12&quot;</td>
<td>West</td>
<td>Yahoo London</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>90°</td>
<td>14.5 m/s</td>
<td></td>
<td>+13°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>06-09-2010</td>
<td>06:00 AM</td>
<td>64° 25' 45&quot;</td>
<td>North</td>
<td>26° 6' 0&quot;</td>
<td>East</td>
<td>Yahoo Bucharest</td>
<td>yahoo</td>
<td>100 m</td>
<td>Mist</td>
<td>130°</td>
<td>4.8 m/s</td>
<td></td>
<td>+17°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>06-09-2010</td>
<td>06:00 AM</td>
<td>52° 14' 24&quot;</td>
<td>North</td>
<td>21° 0' 35&quot;</td>
<td>East</td>
<td>Yahoo Warsaw</td>
<td>yahoo</td>
<td>100 m</td>
<td>Rain</td>
<td>320°</td>
<td>20.9 m/s</td>
<td></td>
<td>+9°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>06-09-2010</td>
<td>06:00 AM</td>
<td>52° 31' 36&quot;</td>
<td>North</td>
<td>-1° 52' 12&quot;</td>
<td>West</td>
<td>Yahoo London</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>90°</td>
<td>12.9 m/s</td>
<td></td>
<td>+14°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>06-09-2010</td>
<td>06:00 AM</td>
<td>44° 25' 48&quot;</td>
<td>North</td>
<td>26° 6' 0&quot;</td>
<td>East</td>
<td>Yahoo Bucharest</td>
<td>yahoo</td>
<td>100 m</td>
<td>Mist</td>
<td>0°</td>
<td>0 m/s</td>
<td></td>
<td>+10°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>05-09-2010</td>
<td>06:00 AM</td>
<td>52° 14' 24&quot;</td>
<td>North</td>
<td>21° 0' 35&quot;</td>
<td>East</td>
<td>Yahoo Warsaw</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>30°</td>
<td>9.7 m/s</td>
<td></td>
<td>+9°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>05-09-2010</td>
<td>06:00 AM</td>
<td>52° 31' 36&quot;</td>
<td>North</td>
<td>-1° 52' 12&quot;</td>
<td>West</td>
<td>Yahoo London</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>0°</td>
<td>0 m/s</td>
<td></td>
<td>+8°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>05-09-2010</td>
<td>06:00 AM</td>
<td>52° 14' 24&quot;</td>
<td>North</td>
<td>21° 0' 35&quot;</td>
<td>East</td>
<td>Yahoo Warsaw</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>0°</td>
<td>0 m/s</td>
<td></td>
<td>+6°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>04-09-2010</td>
<td>06:00 AM</td>
<td>52° 31' 36&quot;</td>
<td>North</td>
<td>-1° 52' 12&quot;</td>
<td>West</td>
<td>Yahoo London</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>350°</td>
<td>4.8 m/s</td>
<td></td>
<td>+11°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>04-09-2010</td>
<td>06:00 AM</td>
<td>52° 14' 24&quot;</td>
<td>North</td>
<td>21° 0' 35&quot;</td>
<td>East</td>
<td>Yahoo Warsaw</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>30°</td>
<td>1.6 m/s</td>
<td></td>
<td>+7°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>04-09-2010</td>
<td>06:00 AM</td>
<td>52° 31' 36&quot;</td>
<td>North</td>
<td>-1° 52' 12&quot;</td>
<td>West</td>
<td>Yahoo London</td>
<td>yahoo</td>
<td>100 m</td>
<td>Rain</td>
<td>30°</td>
<td>3.2 m/s</td>
<td></td>
<td>+10°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>04-09-2010</td>
<td>06:00 AM</td>
<td>52° 14' 24&quot;</td>
<td>North</td>
<td>21° 0' 35&quot;</td>
<td>East</td>
<td>Yahoo Warsaw</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>0°</td>
<td>0 m/s</td>
<td></td>
<td>+6°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>03-09-2010</td>
<td>06:00 AM</td>
<td>51° 30' 36&quot;</td>
<td>North</td>
<td>-1° 52' 12&quot;</td>
<td>West</td>
<td>Yahoo London</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>330°</td>
<td>14.5 m/s</td>
<td></td>
<td>+7°</td>
<td>Data from Yahoo Weather</td>
<td></td>
</tr>
<tr>
<td>03-09-2010</td>
<td>06:00 AM</td>
<td>49° 0' 0&quot;</td>
<td>North</td>
<td>25° 0' 5&quot;</td>
<td>East</td>
<td>ACME School</td>
<td>aha</td>
<td>111 m</td>
<td>Thunderstorm</td>
<td>135°</td>
<td>39 Knots</td>
<td></td>
<td>+5°</td>
<td>fig</td>
<td></td>
</tr>
</tbody>
</table>
Observation upload

Observations for various locations and dates:

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Latitude</th>
<th>Longitude</th>
<th>E/W</th>
<th>School</th>
<th>Location</th>
<th>Elevation</th>
<th>Current conditions</th>
<th>Wind direction</th>
<th>Wind speed</th>
<th>Wind units</th>
<th>Cloud cover</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-09-2010</td>
<td>08:00 AM</td>
<td>51° 30' 30&quot; N</td>
<td>-1° 52' 12&quot; W</td>
<td>West</td>
<td>Yahoo London</td>
<td>100 m</td>
<td>Good visibility</td>
<td>90°</td>
<td>14.5</td>
<td>m/s</td>
<td>Party cloudy</td>
<td>+13°</td>
<td></td>
</tr>
<tr>
<td>06-09-2010</td>
<td>08:00 AM</td>
<td>52° 14' 24&quot; N</td>
<td>21° 0' 35&quot; E</td>
<td>East</td>
<td>Yahoo Warsaw</td>
<td>100 m</td>
<td>Mint</td>
<td>320°</td>
<td>20.9</td>
<td>m/s</td>
<td>Data from Yahoo Weather</td>
<td>+8°</td>
<td></td>
</tr>
<tr>
<td>05-09-2010</td>
<td>08:00 AM</td>
<td>60° 10' 12&quot; N</td>
<td>24° 55' 48&quot; E</td>
<td>East</td>
<td>Yahoo Helsinki</td>
<td>100 m</td>
<td>Good visibility</td>
<td>350°</td>
<td>1.6</td>
<td>m/s</td>
<td>Data from Yahoo Weather</td>
<td>+11°</td>
<td></td>
</tr>
<tr>
<td>05-09-2010</td>
<td>08:00 AM</td>
<td>51° 30' 35&quot; N</td>
<td>-1° 52' 12&quot; W</td>
<td>West</td>
<td>Yahoo London</td>
<td>100 m</td>
<td>Good visibility</td>
<td>90°</td>
<td>12.9</td>
<td>m/s</td>
<td>Data from Yahoo Weather</td>
<td>+14°</td>
<td></td>
</tr>
</tbody>
</table>

Additional columns include: School, Location, Elevation, Current conditions, Wind direction, Wind speed, Wind units, Cloud cover, Temperature, and Additional observations.
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Latitude</th>
<th>Longitude</th>
<th>E/W</th>
<th>School</th>
<th>Location</th>
<th>Elevation</th>
<th>Current conditions</th>
<th>Wind direction</th>
<th>Wind speed</th>
<th>Wind units</th>
<th>Cloud cover</th>
<th>Temperature</th>
<th>Additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-09-2010</td>
<td>06:00 AM</td>
<td>51° 50' 30&quot; N</td>
<td>-1° 52' 12&quot; W</td>
<td>West</td>
<td>Yahoo London</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>90°</td>
<td>14.5</td>
<td>m/s</td>
<td>Green</td>
<td>+13°</td>
<td>Data from Yahoo Weather</td>
</tr>
<tr>
<td>06-09-2010</td>
<td>06:00 AM</td>
<td>44° 25' 45&quot; N</td>
<td>26° 8' 0&quot; E</td>
<td>East</td>
<td>Yahoo Bucharest</td>
<td>yahoo</td>
<td>100 m</td>
<td>Mist</td>
<td>130°</td>
<td>4.8</td>
<td>m/s</td>
<td>Green</td>
<td>+17°</td>
<td>Data from Yahoo Weather</td>
</tr>
<tr>
<td>06-09-2010</td>
<td>06:00 AM</td>
<td>52° 14' 24&quot; N</td>
<td>21° 0' 35&quot; E</td>
<td>East</td>
<td>Yahoo Warsaw</td>
<td>yahoo</td>
<td>100 m</td>
<td>Rain</td>
<td>320°</td>
<td>20.9</td>
<td>m/s</td>
<td>Green</td>
<td>+9°</td>
<td>Data from Yahoo Weather</td>
</tr>
<tr>
<td>05-09-2010</td>
<td>06:00 AM</td>
<td>52° 31' 35&quot; N</td>
<td>13° 22' 48&quot; E</td>
<td>East</td>
<td>Yahoo Berlin</td>
<td>yahoo</td>
<td>100 m</td>
<td>Good visibility</td>
<td>90°</td>
<td>12.9</td>
<td>m/s</td>
<td>Green</td>
<td>+14°</td>
<td>Data from Yahoo Weather</td>
</tr>
</tbody>
</table>

...
Mapping clients

• Geostationary view (+proj=geos +lon_0=0.0 +h=35785831 +x_0=0.0 +y_0=0.0)

• Map view (EPSG:3785 a.k.a. EPSG:900913)

• Google Earth
Geostationary View
Map View
Weather symbols
Get info
Archive
Archive
Archive
Archive
Channels: VIS
Channels: IR 10.8
Channels: IR 1.6
Channels: IR 1.6
Additional obs. sources
Conclusions

- Linux, Apache, PHP, Python, Wget, Textpattern, MySQL, GDAL, PROJ4, ImageMagick, Inkscape, OpenLayers, ExtJS, GeoExt, Proj4JS.

- Verdict: Easy, fun, effective.
• Integrate GLOBE temperature data

• Add Google Earth support

• Translate the application in all Eduspace official languages

• Eduspace portal
The end

Thanks for your attention. Questions?

www.asrc.ro/imeteosat_beta/