I.

Development, testing and verification of the suitable classification and visualisation of the multi-spectral rain rate intensities as well as ranges. The microwave algorithms adequately define the areas of the high humidity values, which sometimes are ignored. It is calculated according to the regression algorithm -

\[ \text{TPW} = -26.94 + 0.59 \times \text{TB}(50) + 1.02 \times \text{TB}(89) - 0.40 \times \text{TB}(150) - 0.79 \times \text{TB}(183\pm7) \]  


The regression analysis is shown in Table 3.

2.

Precipitation is a highly variable parameter with time and space therefore the use of satellite data allows obtaining the global information. Satellite observations, ground measurements and numerical weather prediction (NWP) models provide the continuous information on the state of the atmosphere which is used for weather analysis and forecast. Combining these data into one system encounters problems due to the data various range as well as temporal and spatial resolution, however, GIS can provide the useful tool for the data analysis and presentation. Table 1 has been assembled in order to visualise the variety data used and potential problems caused by different spatial resolution, frequency - temporal resolution and scale.

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Range</th>
<th>Frequency</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>AERIAL</td>
<td>Temporal</td>
<td>Absolute</td>
<td>1 day</td>
</tr>
<tr>
<td>DATA</td>
<td>Spatial</td>
<td>Multi-spectral</td>
<td>1 km</td>
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<tr>
<td>AERIAL</td>
<td>Time</td>
<td>Precipitation</td>
<td>RR</td>
</tr>
<tr>
<td>DATA</td>
<td>Frequency</td>
<td>Radar</td>
<td>10 GHz</td>
</tr>
<tr>
<td>AERIAL</td>
<td>Resolution</td>
<td>High resolution</td>
<td>0.5 m</td>
</tr>
</tbody>
</table>

The figure above shows a good example of combining different information. In the background there is a False Colour Composite FCC (channels 371) from the Very High resolution Radiometer (AVHRR) on board the polar orbiting meteorological satellite - NOAA 16. The clouds appear in white to blue colours, sea in black and land in shades of green and brown.

Several different thematic layers are laid on top of the FCC; the locations of the SYNOP stations in Europe and Poland are shown as blue and green dots, respectively. Yellow dots show the marked SYNOP stations with the recorded precipitation over 1 mm. The labels show the recorded precipitation. The recorded lightnings from S5E system are shown in red.

3.

The satellite observations, ground measurements and numerical weather prediction (NWP) models provide the continuous information on the state of the atmosphere which is used for weather analysis and forecast. Combining these data into one system encounters problems due to the data various range as well as temporal and spatial resolution, however, GIS can provide the useful tool for the data analysis and presentation. Table 1 has been assembled in order to visualise the variety data used and potential problems caused by different spatial resolution, frequency - temporal resolution and scale.

The temporal and spatial characteristics of NOAA satellites data are summarised in Table 1. There has been significant progress in developing methods using the satellite information over the sea and oceans. However, the methods of sounding in microwave spectrum over land are still inadequate and these problems are researched in the Satellite Research Department, IMWM, Poland. Vertical profiles of temperature, dew point as well as geopotential height from TEMP, at standard pressure levels (925, 850, 700, 500, 300, 200 hPa) were used to calculate air relative humidity and cloud water content. Micro wave sounding (MSS) allows to retrieve relative humidity, air temperature, cloud water path (CWP) and precipitation range (based on Scattering Index – RR, SI; and potential precipitation forecast on 12.08.2002, 12.00 GMT + 3 h.}

4.

Precipitation intensity range from AMSU data:

- RR: 12.08.2002, 12.24 GMT. Intensity is broken into 2 classes – high, medium and low.

Microwave data NOAA/AMSU are valuable for the recognition of extreme situations such as convective cloud systems or extended storms. Clouding and verification of the precipitation detection versus ground measurements for the summer-autumn season in 2002 is shown in Table 3.

5.

Temperature and precipitation forecast fields are created from the NWP model Aladin analysis. Thematic layers are imported from ASEA format and rectified by topographic (ER Mapper).