Hazardous Weather Phenomena Forecast In GIS Meteo Technology.

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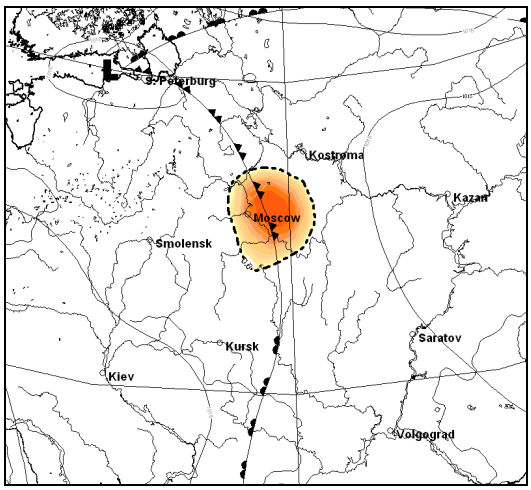
The GIS Meteo technology was developed in MapMakers Group Ltd. for use in meteorologist's operational work [1]. In this paper a new tool for hazardous weather phenomena forecast based on a model of explosive cyclogenesis is represented.

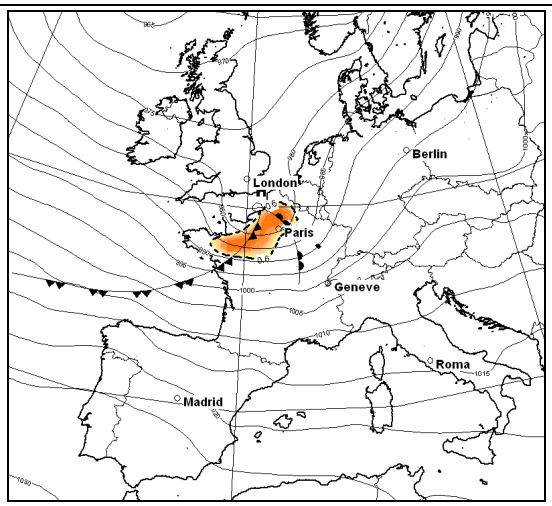
The concept of isentropic potential vorticity (IPV) [3] is increasingly being applied in theoretical and synoptic studies of explosive cyclogenesis [2]. When positive (in Northern hemisphere) PV anomalies move over low-mid tropospheric front (baroclinic band), and in case of low stability in troposphere, explosive cyclogenesis may be occurred. Extensive positive upper level PV anomaly should produce a cyclonic rotation at the earth's surface, in this case in a low-level baroclinic band. The low-level circulation begins to produce and enhance regions of warm and cold advection in the lower levels. A low-level PV anomaly is now present due to the warming and the low-level vorticity. This circulation associated with this low-level PV anomaly is felt through the entire troposphere and into the stratosphere. The upper portion of this effect helps to amplify the upper level PV anomaly. This strengthening upper PV anomaly, in turn, strengthens the surface anomaly and so on (mutual amplification). This results in a fast fall of pressure on a surface, with accompanying storm winds, heavy precipitation etc. Our software can fully automatically calculate the locations, where explosive cyclogenesis may be predicted. The finding possible explosive cyclogenesis zones algorithm is shown below:

1. Calculate IPV anomalies.
   $$PV = g\,(f + \zeta_\theta) \bullet (-\partial\theta / \partial P)$$
2. Determine the frontal zones in troposphere using the Huber-Pock and Kress method [4].
3. Define the stability in troposphere by calculation of the Total Totals index.

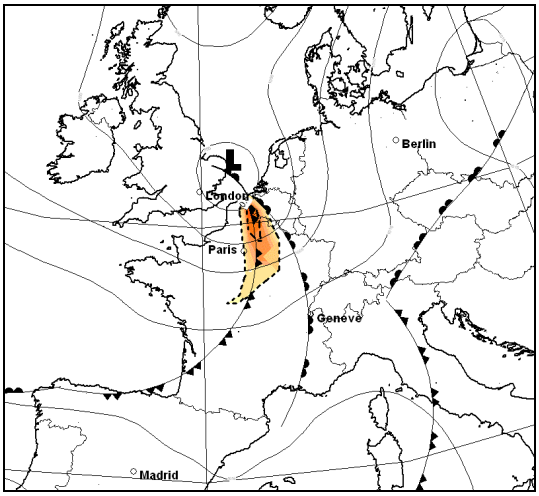
When all these conditions are met the software determines a hazardous weather zone at this location. We have investigated 40 cases of hazardous weather phenomena since June 1998 to Febriary 2002, and in 38 cases the result was successful. There were cases of Moscow storm (21 June 1998 and July 2001), Paris storm (26-27 of December 1999), S. Petersburg (July, 15, 2000, July 16, 2001), Strasbourg (July 7, 2001) and many others. It should be noted, that meteorological offices didn't predict some of these cases at the time. As input data we used GRIB data distributed by WMO. Below you can see some meteorological maps prepared by GIS Meteo technology.



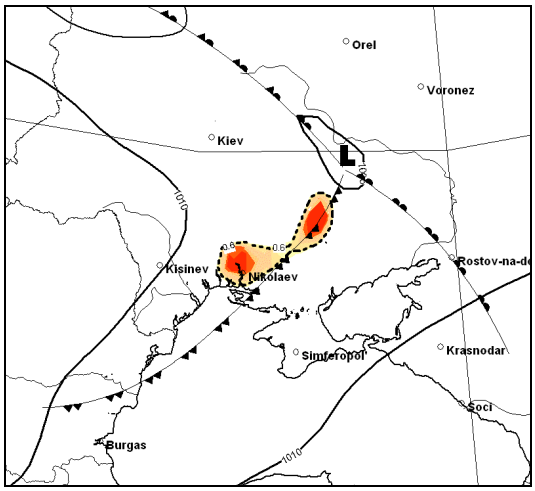
1998 / 06 / 21 00 UTC



1999 / 12 / 26 06 UTC



2000 / 05 / 28 12 UTC



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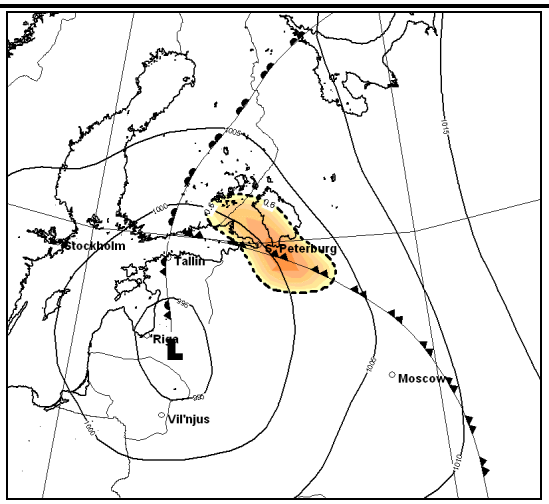
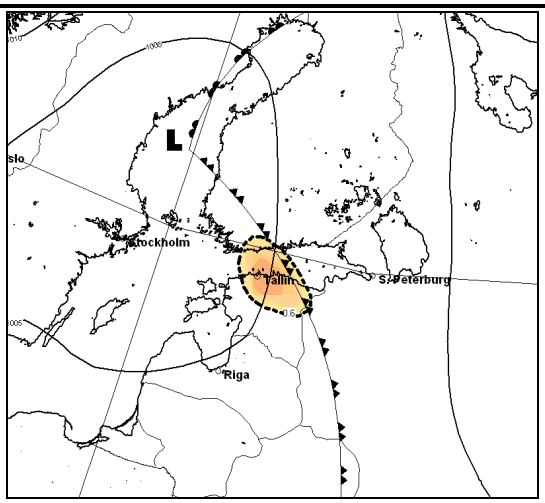
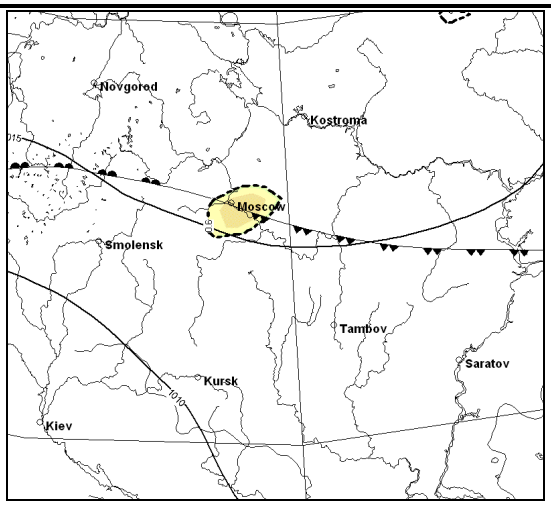


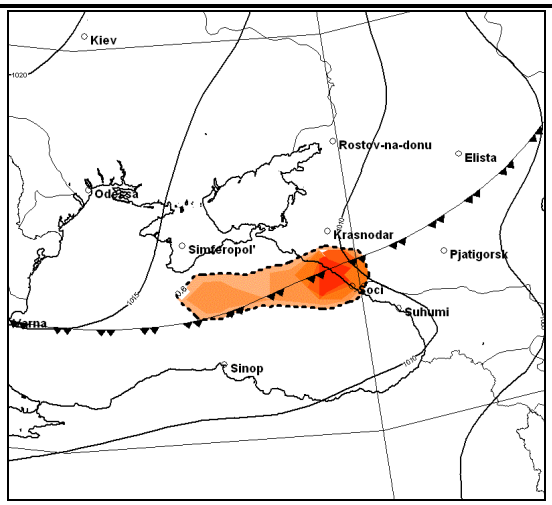
2000 / 07 / 15 18 UTC



2001 / 07 / 19 06 UTC



2001 / 07 / 24 12 UTC



2001 / 09 / 26 12 UTC

References.

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