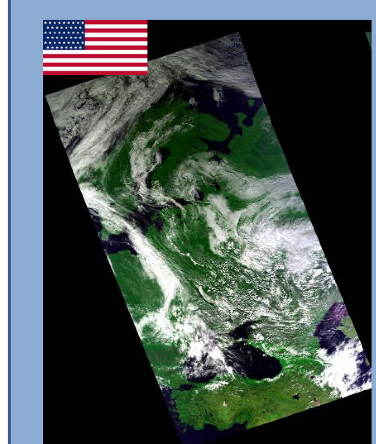
Using available DB satellite processing packages for case studies in Russia

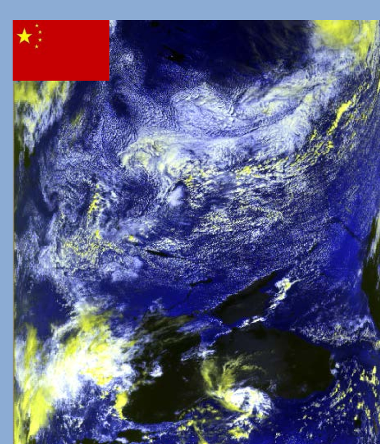
Katerina Melnik[1,2], [1]R&D center ScanEx
[2]Hydrometeorological Research Centre of Russian Federation

Meteorological satellites are a valuable source of information for synoptical analysis, severe weather event analysis and nowcasting, as well as natural hazards and air quality monitoring. In Russian Federation polar-orbiting satellites are used because ground observations are sparse and a large part of the territory is located in high latitudes. R&D center ScanEx has the technologies to receive and process the direct broadcast data from 11 meteorological polar-orbiting satellites (see below). RT-STPS, AAPP, MODIS L1 DB, IMAPP, IDEA-I, CSPP SDR and EDR, CLAVR-X, MIRS, HSRTV and OMPSNADIR_SPA are used to create atmosphere, ocean, land and polar products. Quicklooks packages, Polar2Grid, McIdas-V and PanOply are used for visualization.

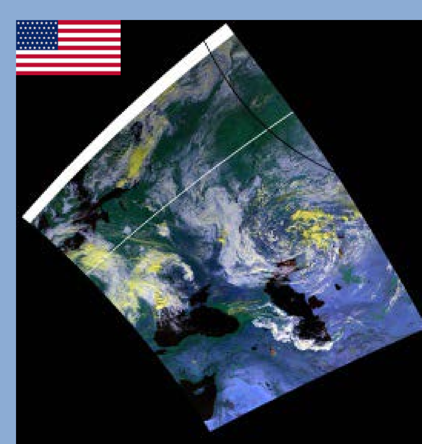
Receiving satellite data in real time



Aqua, Terra



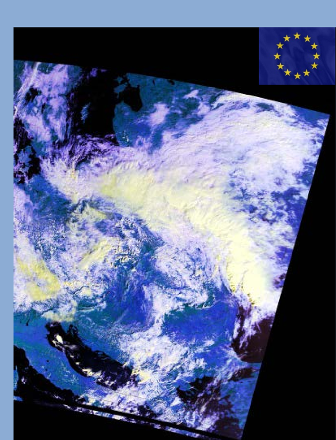
Feng-Yun 3A, 3B, 3C



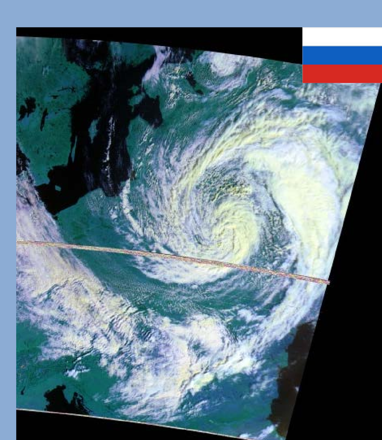
Suomi NPP

Sample images from X-band antenna UniScan

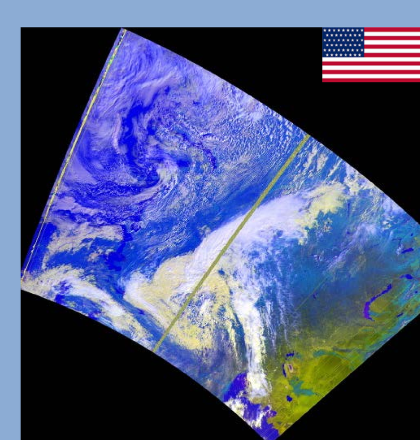
Each satellite overpasses a certain territory at least twice a day. More than 250 stations are installed around the world



MetOp-A,B



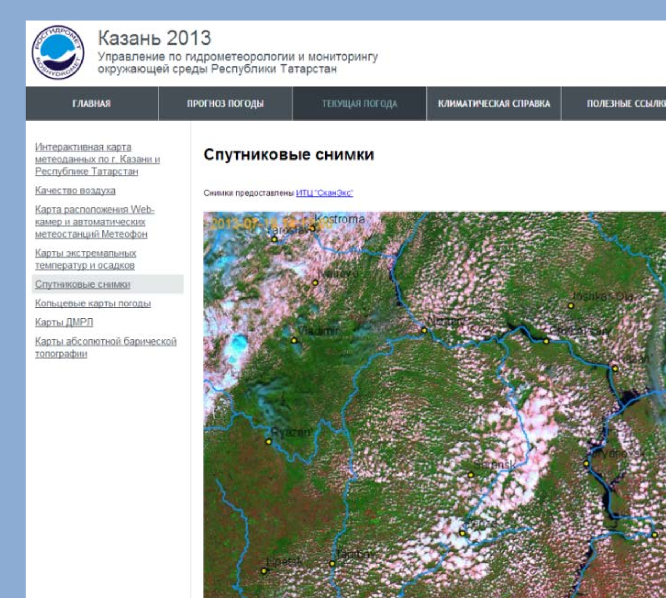
Meteor-M №2



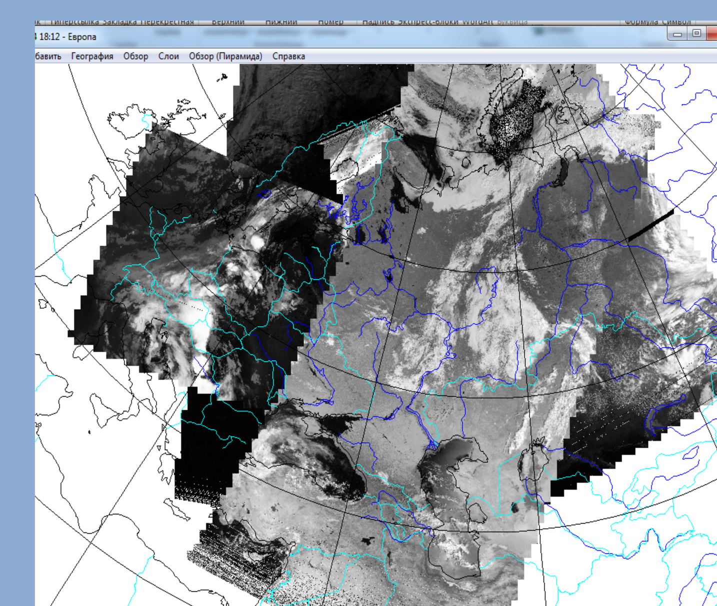
NOAA - 18,19

Sample images from L-band antenna Panda

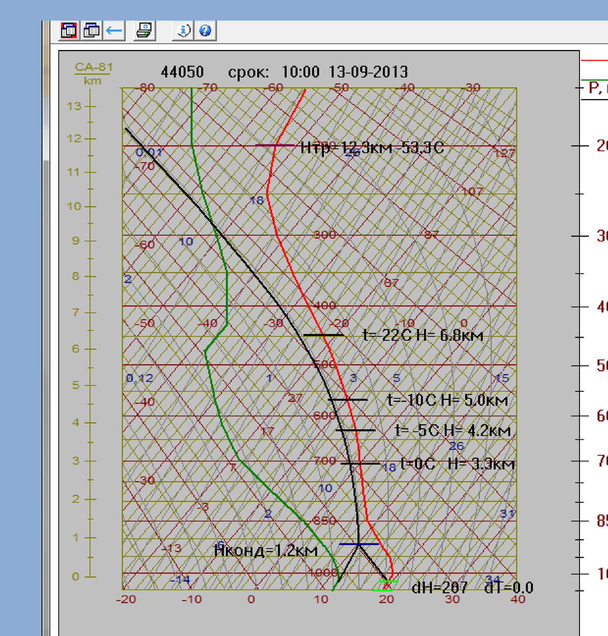
Processing satellite data and displaying the products (examples)



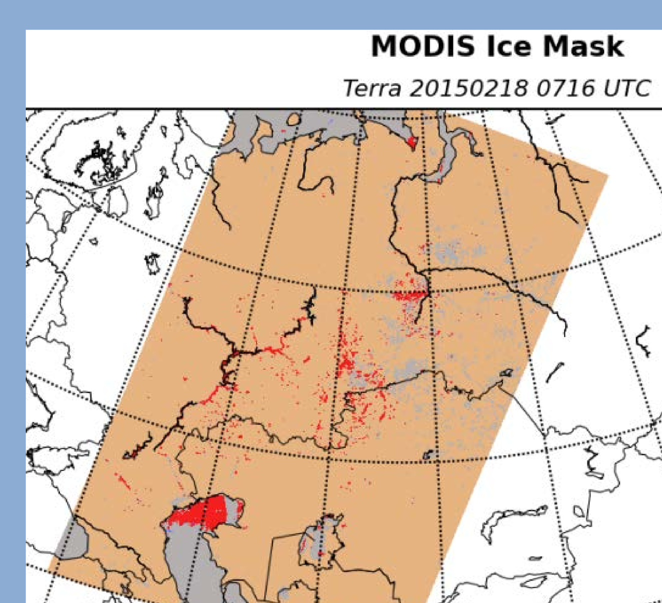
NRT Cloud cover monitoring for Kazan Universiade



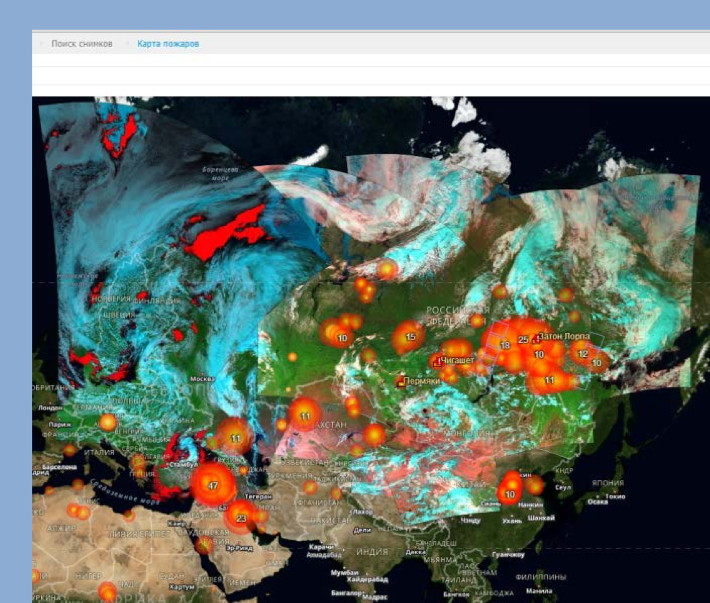
NOAA images display in GIS Meteo



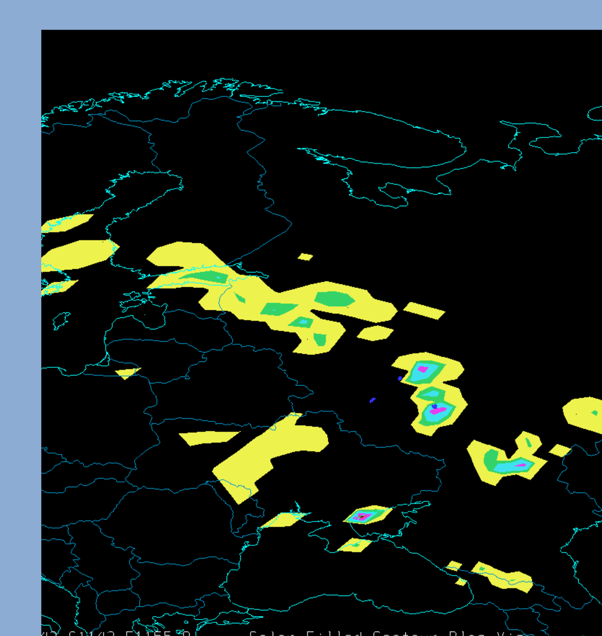
IAPP Skew-T display in MeteoExpert



IMAPP MODIS ice mask quicklook



IMAPP MODIS Fires detections

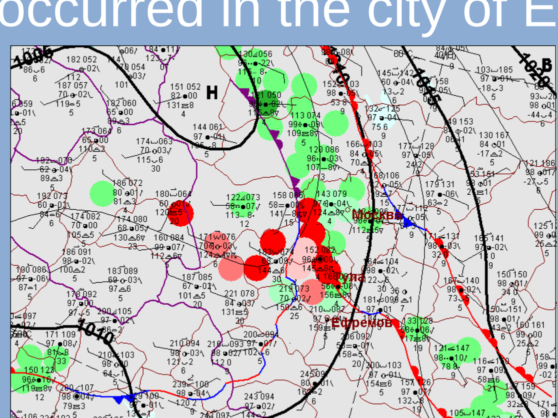


MIRS rain rate values in McIdas-V

Case studies of anomalous weather events reveal advantages and disadvantages of available meteorological information. Case studies of severe weather events also help to improve the accuracy of future forecasts and therefore prevent or mitigate damage caused by the severe weather event. In Russia most dangerous weather events are caused by severe convection – e.g. heavy rainfall, hail, strong winds, lightning. The next most dangerous category of weather events is represented by snowstorms, heavy snowfall, wet snow and riming. In the field of atmospheric chemistry an event of high ground ozone concentrations and thick smoke from forest fires could be viewed as a dangerous event due to the influence of smoke and ozone on human's health.

Severe storms

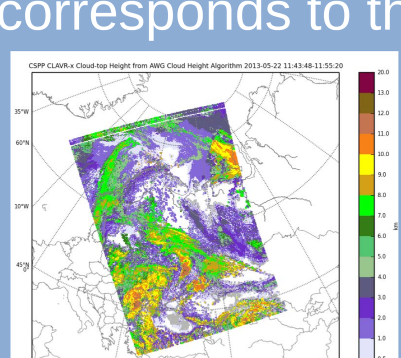
On 22rd of May 2013 an active atmospheric front was passing through the European territory of Russia. A small-scale tornado which is a very rare event occurred in the city of Efremov in Tula region.



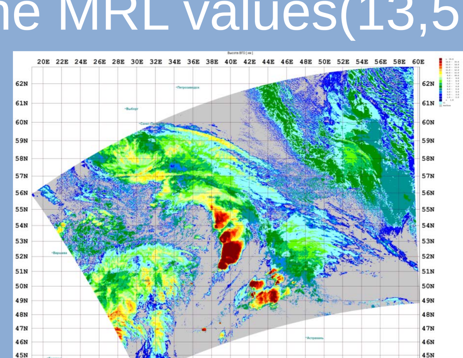
Synoptic al chart 22.05.2013, 10UTC

Efremov sky (Courtesy www.meteoinfo.ru/)

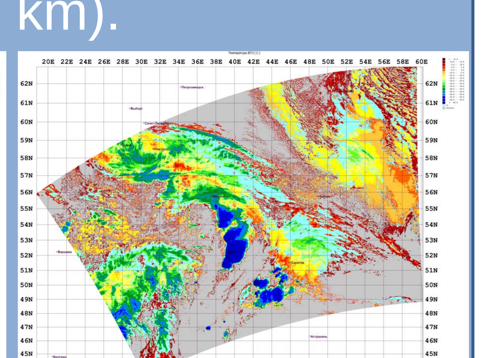
Satellite images show areas of severe convection. An AVHRR overpass has been processed with CLAVR-X and MeteoGamma software. The maximum CTH corresponds to the MRL values(13,5 km).



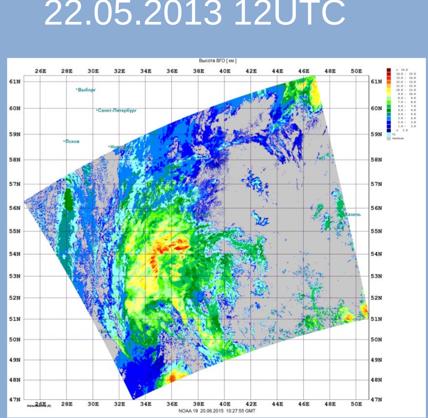
CLAVR-X CTH, 22.05.2013 12UTC



MeteoGamma CTH, 22.05.2013 12UTC



MeteoGamma CTT, 22.05.2013 12UTC

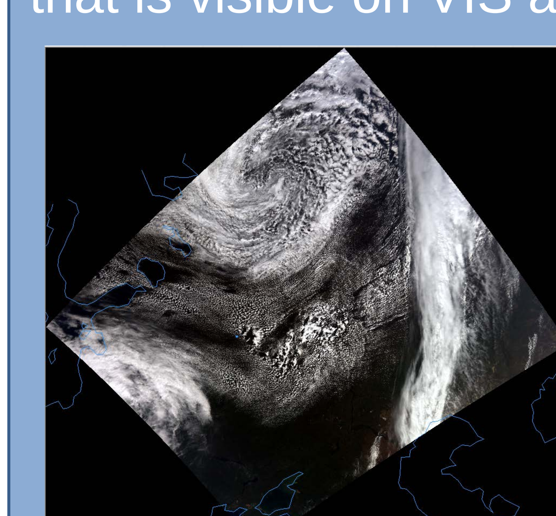


MeteoGamma CTH, 20.06.2015 10:30 UTC

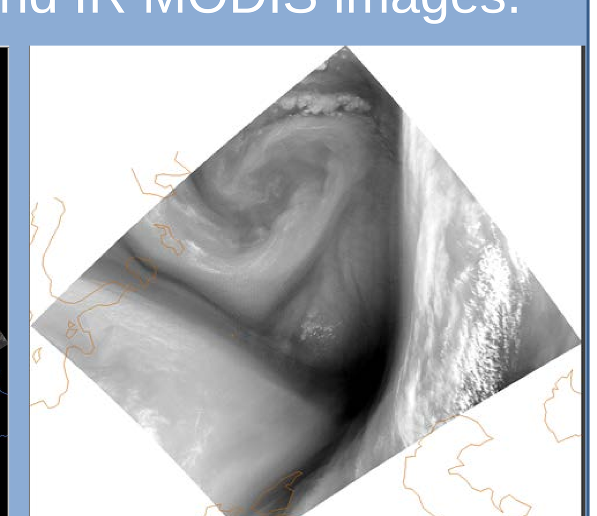
On 20th of June 2015 southern cyclone brought very heavy rainfall to Moscow (41 mm/24 hours, more than half of the monthly mean). Satellite data shows a "flower-like" pattern in the CTH structure.

Wet snow against a background of positive surface air temperatures

On 7th of May a cyclone from the Mediterranean region brought wet snow to Moscow. Wet snow was assosiated with a cloud structure in the rear part of the cyclone that is visible on VIS and IR MODIS images.



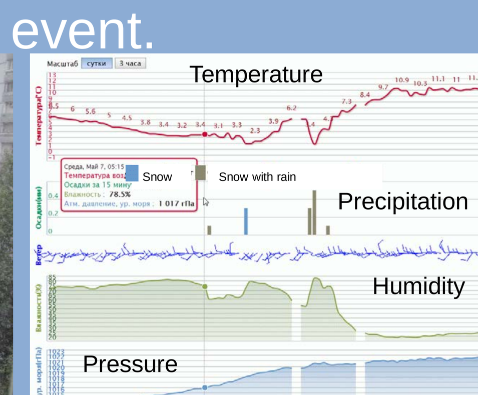
MODIS True color RGB, 07.05.2015, 09:50 UTC



MODIS Water Vapor channel, 07.05.2015, 09:50 UTC

Several Terra and Aqua overpasses were processed using CLAVR-X. For this cloud structure, the calculated CTH appeared to be 5-6 km, while CTT was found to be 250K and warmer. Relatively low CTH and warm CTT combined with positive air temperatures make it an anomalous weather event.

Wet snow, 07.05.2015



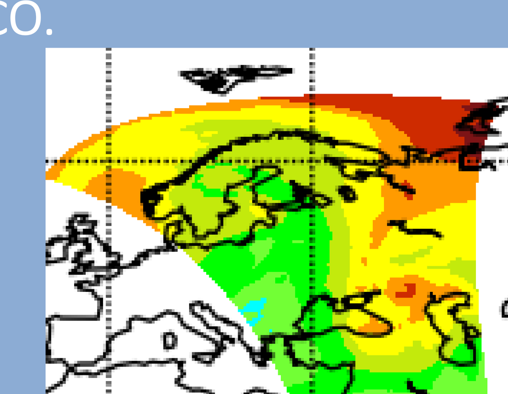
Diurnal variations 07.05.2015

High ground ozone concentrations and forest fire smoke

Ground level ozone concentrations in Moscow are measured by several automatic stations maintained by Mosecomonitoring. Observations show that from 5th of May to 14th of May 2015 the mean daily ozone concentrations were above 0,048 mg/m3 with maximum values up to 0,201 mg/m3. Several Suomi NPP overpasses were processed by OMPSNADIR_SPA software. The total column ozone (TCO) values were found to be above 400 DU. The cyclonic structure is clearly visible on the maps of TCO.

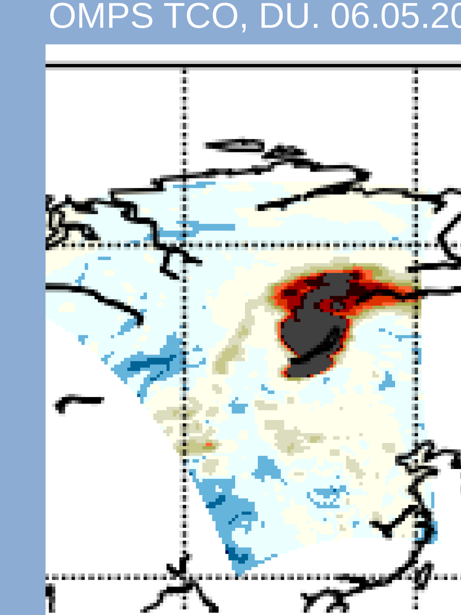
Date	Mean values (mg/m)	Maximum values (mg/m³)
05.05.15	0,048	0,149
06.05.15	0,049	0,148
07.05.15	0,049	0,156
08.05.15	0,046	0,167
09.05.15	0,059	0,183
10.05.15	0,073	0,161
11.05.15	0,054	0,166
12.05.15	0,052	0,170
13.05.15	0,060	0,201
14.05.15	0,053	0,141

Table 1. Ground level ozone concentration



OMPS TCO, DU. 06.05.2015

OMPS is also used for UV aerosol index calculation that helps to detect smoke from forest fires which is also an important issue for Russia. In August 2015 many forest fires took place near lake Baikal. The extent of forest fires smoke is clearly visible on the OMPS UV aerosol index product.



OMPS UV aerosol index 24.08.2015

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ITSC-20 · Lake Geneva, WI, USA

Contact me:
kmelnik@scanex.ru