AVIATION NOWCASTING

AT PULKOVO AIRPORT - LED (ST.PETERSBURG)
IN THE FRAMEWORKS OF AvRDP

World Meteorological Organisation

АВИАМЕТТЕЛЕКОМ РОСГИДРОМЕТА

HONG KONG, 10-12 OCTOBER 2018

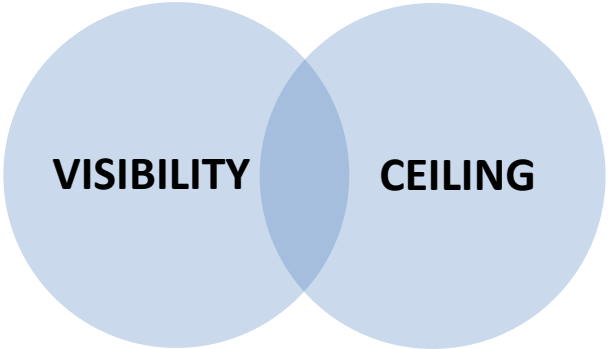
- **Pulkovo airport (St. Petersburg) - LED/ULLI**
- **Is one of the busiest airports in the Russian Federation**
- **150 000 flights / 16 M passengers (in 2017)**
- **Transitional zone from Sea Climate to Continental Climate**
- **Low visibility (including fogs) and ceiling are the main weather impacts on air traffic**

OBJECTIVES

(1st stage – since Feb 2018)

- To generate 0-4 hours nowcasts
- To deliver nowcasts in real time
- To improve forecasts accuracy at aerodrome
- To assess benefits of forecast improvement (verification)

According to climatic data, periods of reduced visibility combined with low ceiling are the most frequent high impact phenomena at LED within a year, while the convective phenomena are seasonal and rather rare phenomena. Fog and low ceiling significantly affect the work of aviation and flight safety.



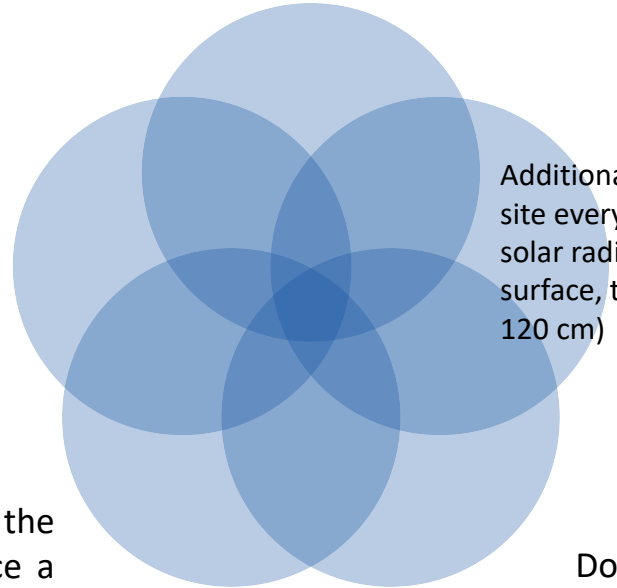
DATA SOURSE

AWOS «KRAMS-4»

Aviation weather observation station (AWOS, every 1 min) - 6 visibility sensors and 4 ceiling sensors, obtained with the help of the automated meteorological measuring system KRAMS-4

Temperature profiler MTP-5

Temperature profiler MTP-5 (every 5 min).



AMS «Saima»

Additional sensors of the AWS Saima installed on the MET site every 10 min (pyranometers for measuring the flux of solar radiation and thermal radiation from the underlying surface, the surface and the soil temperature at a depth of 120 cm)

AMDAR

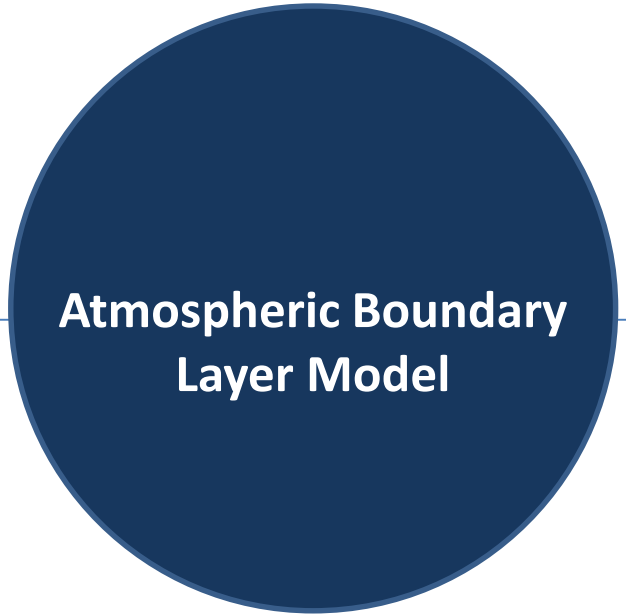
Atmosphere sounding data (by the aerological station Voyeikovo, twice a day) and AMDAR (if available);

RADAR

Doppler radar data and DMRL / MRL of Roshydromet network (every 10 min)

NWP model

It is 1-D model, based on the hydrodynamics prognostic equations system of horizontally homogeneous boundary layer of the atmosphere



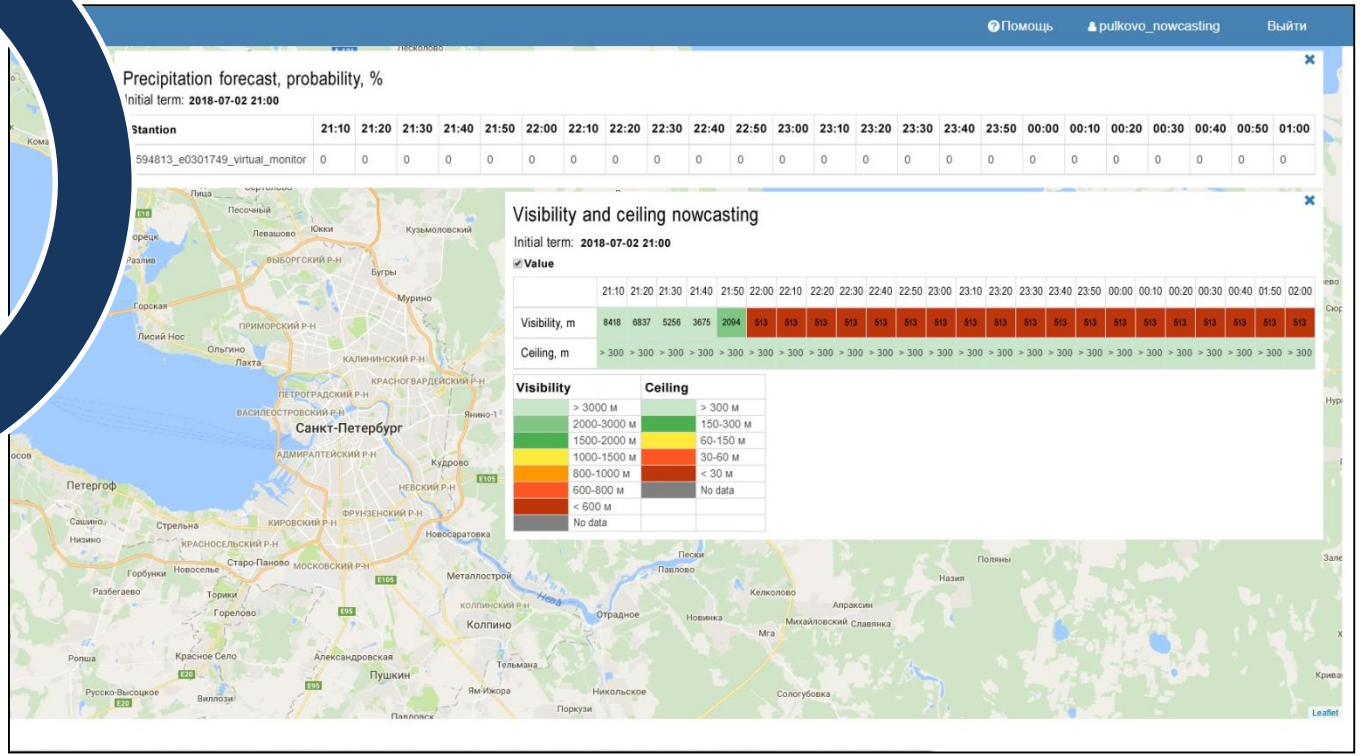
Satisfies the requirements for models for operational use: sufficient accuracy, stability and economy in calculations

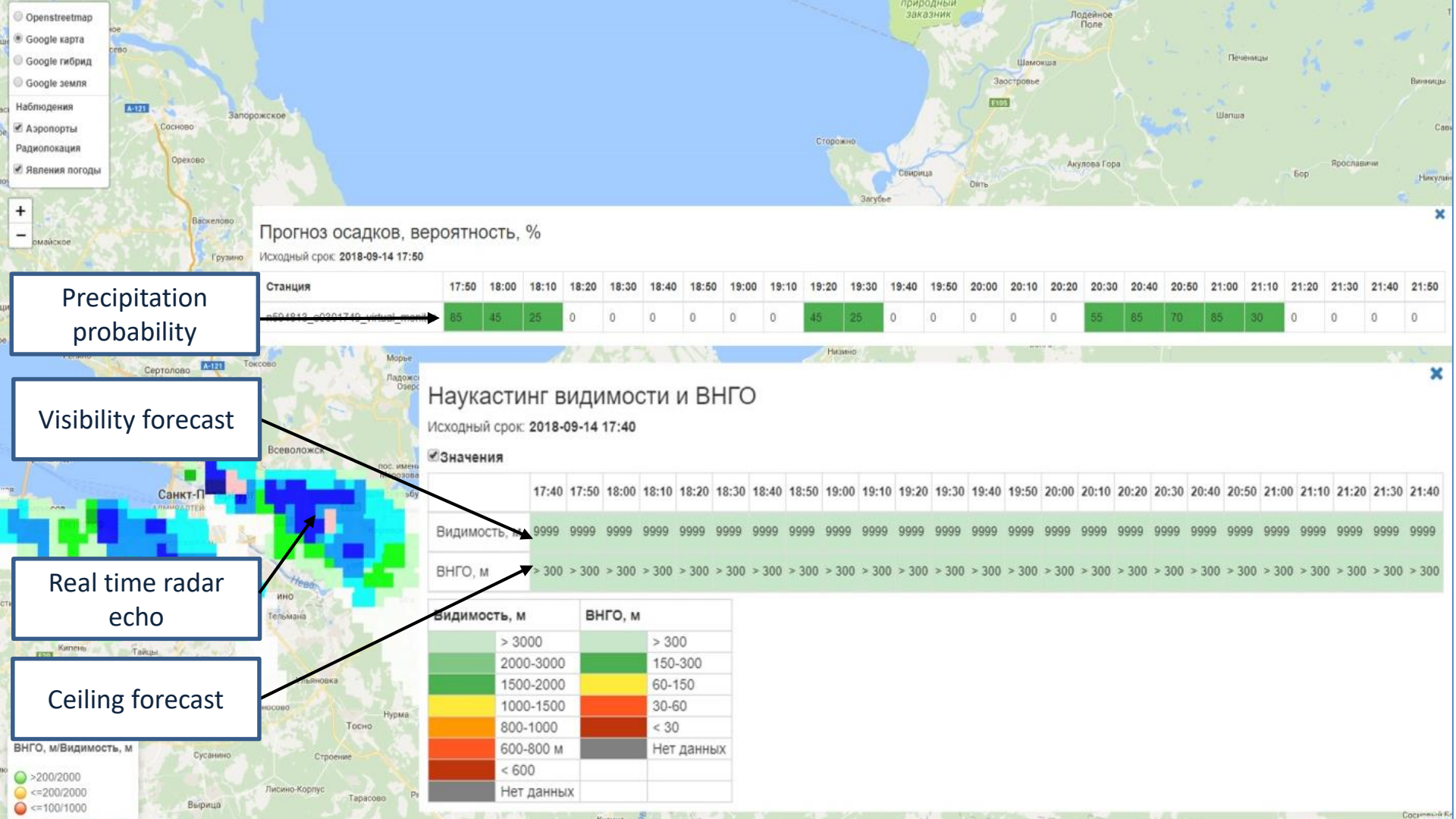
- The model description is presented in the publication: *T. A. Bazlova, N. V. Bocharnikov. Verification of the MeteoExpert Nowcasts. Universal Journal of Geoscience 2017, Vol. 5 (1), pp. 1 - 9, DOI: 10.13189 / ujg.2017.050101 and others*
- *Results of the nowcasting model usage were presented at conferences and meetings: 1st European Nowcasting Conference (ENC2014), EMS-ECAM-2015, ICAO METG PT EAST-2014, 2015, WMO CAeM-ET-CCP-1, WMO AMSC-2017 and others..*

Nowcasting issuing and visualization

Validity range: 4h
Refresh rate: 10min

Nowcasting visualization in a categorical tabular format on a WEB (4D METEO CUBE)



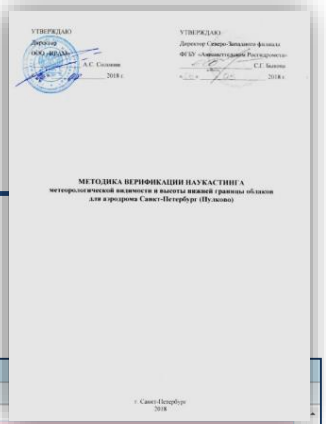

Openstreetmap
Google карта
Google гибрид
Google земля
Наблюдения
Аэропорты
Радиолокация
Явления погоды
Прогноз осадков, вероятность, %
Исходный срок: 2018-09-14 17:50
Станция
17:50 18:00 18:10 18:20 18:30 18:40 18:50 19:00 19:10 19:20 19:30 19:40 19:50 20:00 20:10 20:20 20:30 20:40 20:50 21:00 21:10 21:20 21:30 21:40 21:50
85 45 25 0 0 0 0 0 0 45 25 0 0 0 0 0 55 85 70 85 30 0 0 0 0
Precipitation probability
Visibility forecast
Real time radar echo
Ceiling forecast
Наукастинг видимости и ВНГО
Исходный срок: 2018-09-14 17:40
Значения
17:40 17:50 18:00 18:10 18:20 18:30 18:40 18:50 19:00 19:10 19:20 19:30 19:40 19:50 20:00 20:10 20:20 20:30 20:40 20:50 21:00 21:10 21:20 21:30 21:40
Видимость, м
9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
ВНГО, м
> 300 > 300
Видимость, м
> 3000
2000-3000
1500-2000
1000-1500
800-1000
600-800 м
< 600
Нет данных
ВНГО, м
> 300
150-300
60-150
30-60
< 30
Нет данных
ВНГО, м/Видимость, м
>200/2000
<=200/2000
<=100/1000

Verification

Verification scheme is customer-oriented and takes into account thresholds that are relevant to different users (meteorological and aviation) and in compliance with forecasts accuracy desirable in terms of operation (ICAO Annex 3, Attachment B — “Operationally Desirable Accuracy of Forecasts)

Visibility: ±200 m up to 800 m and ±30% between 800 m and 3000 m

Ceiling : ±30 m up to 300 m



МЕТОДИКА ВЕРИФИКАЦИИ НАУКАСТИНГА
метеорологической видимости и высоты нижней границы облаков
для аэродрома Санкт-Петербург (Пулково)

Verification is

- developed and put into force in September 2018
- conducted on the WEB site

Метеоэксперт: верификация прогнозов

n594813_e0301749 | Видимость: 3000м | 01.06.2018 | 31.08.2018 | Считать

Станция	Параметр	a	b	c	d	n	PC(%)	PC+(%)	PC-(%)	P+(%)	P-(%)
n594813_e0301749	Видимость: 3000м	1167	33632	569	271267	306635	89	3	100	67	89

Условные обозначения

a	число случаев, когда явление прогнозировалось и наблюдалось
b	число случаев, когда явление прогнозировалось, но не наблюдалось
c	число случаев, когда явление не прогнозировалось, но наблюдалось
d	число случаев, когда явление не прогнозировалось и не наблюдалось
n = a+b+c+d	общее число прогнозов за заданный период
PC =(a+d)*100/n	оправдываемость прогнозов
PC+ = a*100/(a+b)	оправдываемость прогнозов наличия явления
PC- = d*100/(c+d)	оправдываемость прогнозов отсутствия явления
P+ = a*100/(a+c)	предупрежденность прогнозов наличия явления
P- = d*100/(b+d)	предупрежденность прогнозов отсутствия явлени

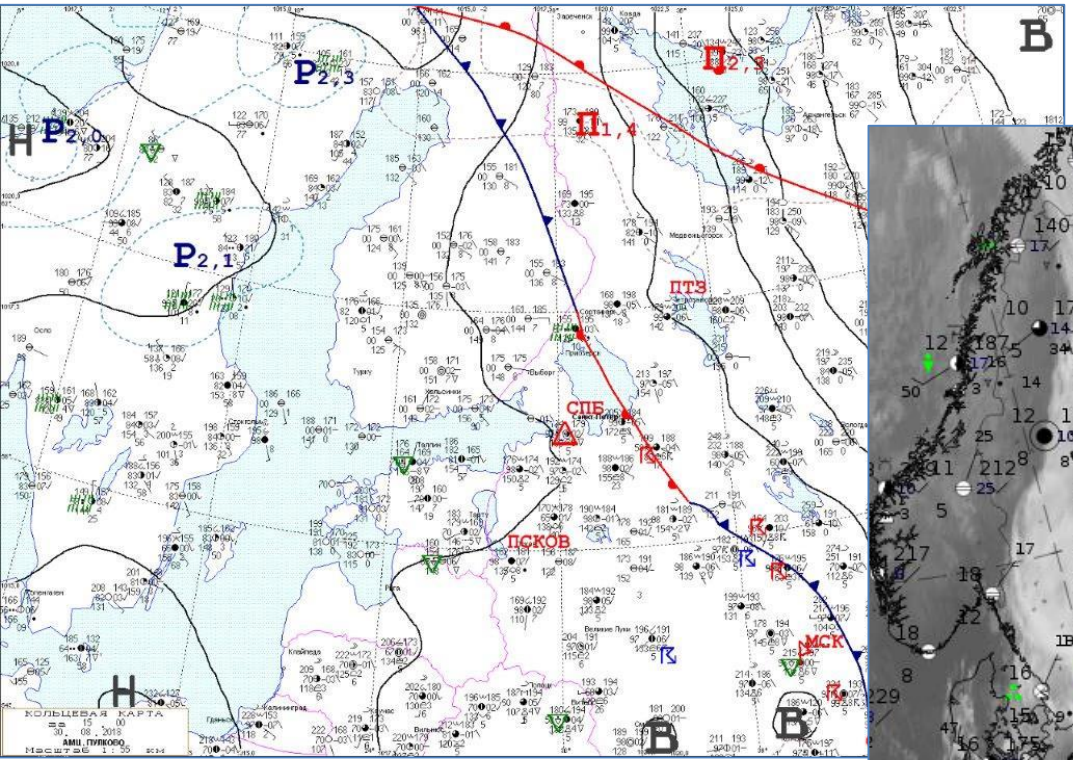
Станция	Параметр	H	F	FAR	Miss	ORSS	EDI	SEDI	p(e)	prec_fcst(мин)	lead_time(мин)
n594813_e0301749	Видимость: 3000м	0.67	0.11	0.97	0.0	0.89	0.69	0.73	0.01	149	181

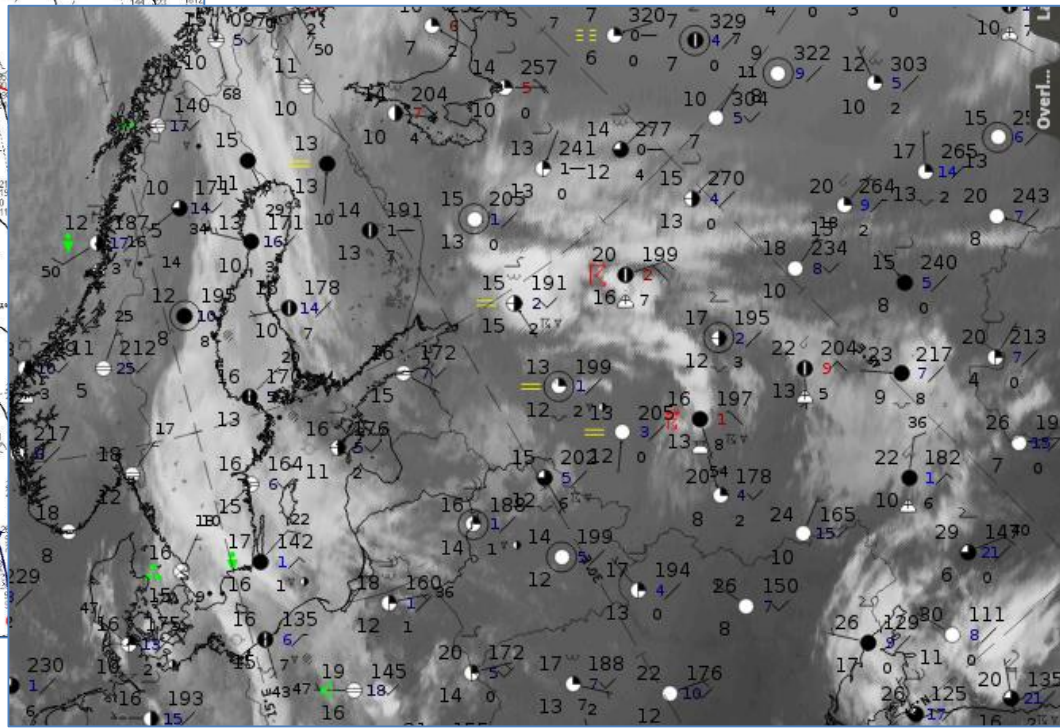
Условные обозначения

		Интервал значений	Идеальное значение
H = a/(a+c)	коэффициент попаданий	[0,1]	1
F = b/(b+d)	коэффициент ложных тревог	[0,1]	0
FAR = b/(a+b)	отношение ложных тревог	[0,1]	0
Miss = c/(c+d)	коэффициент пропусков	[0,1]	0
ORSS = (a*d-b*c)/(a*d+b*c)	показатель Юля	[-1,1]	1 (если b>0 и c>0)
EDI = (log(F)-log(H)) / (log(F)+log(H))	показатель EDI	[-1,1]	1
SEDI = (log(F)-log(H)-log(1-F)+log(1-H)) / (log(F)+log(H)+log(1-F)+log(1-H))	показатель SEDI	[-1,1]	1
p(e) = (a+c)/n	вероятность явления (видимость ниже порогового значения)		
prec_fcst	точность прогноза времени начала ухудшения видимости ниже порогового значения		
lead_time	заблаговременность прогноза ухудшения видимости ниже порогового значения		

Case study

August 30th : FG 0500m from 19:08 UTC





NOWCASTING

16:20 UTC
Forecast of fog
from 18:20
VIS = 723м

elaboration

18:00 UTC
Nowcasting had
adjusted the
forecast.
Forecast of fog
from 19:00
VIS = 529м

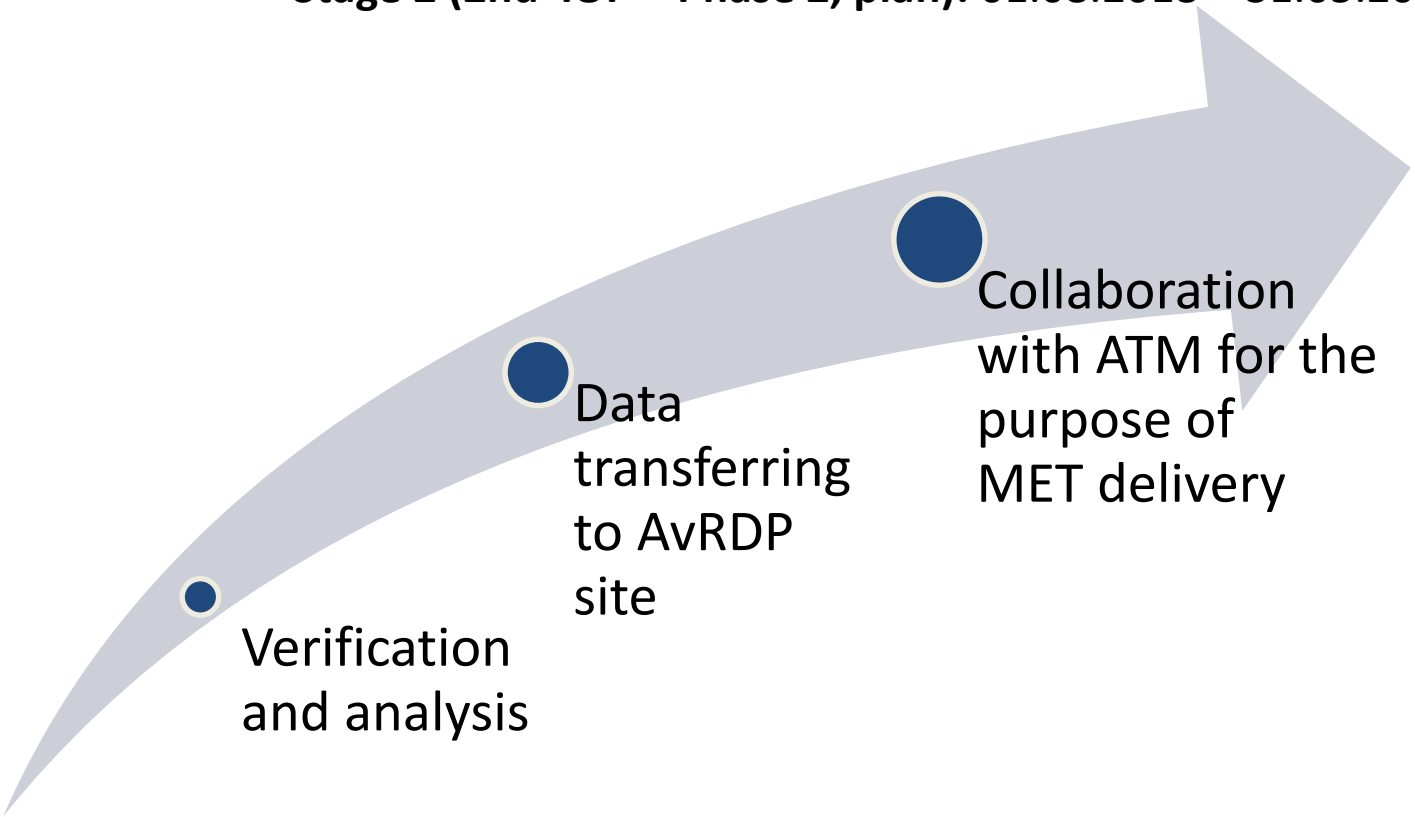
OBSERVATION

19:08 UTC
MIFG

19:50 UTC
FG
VIS = 500м

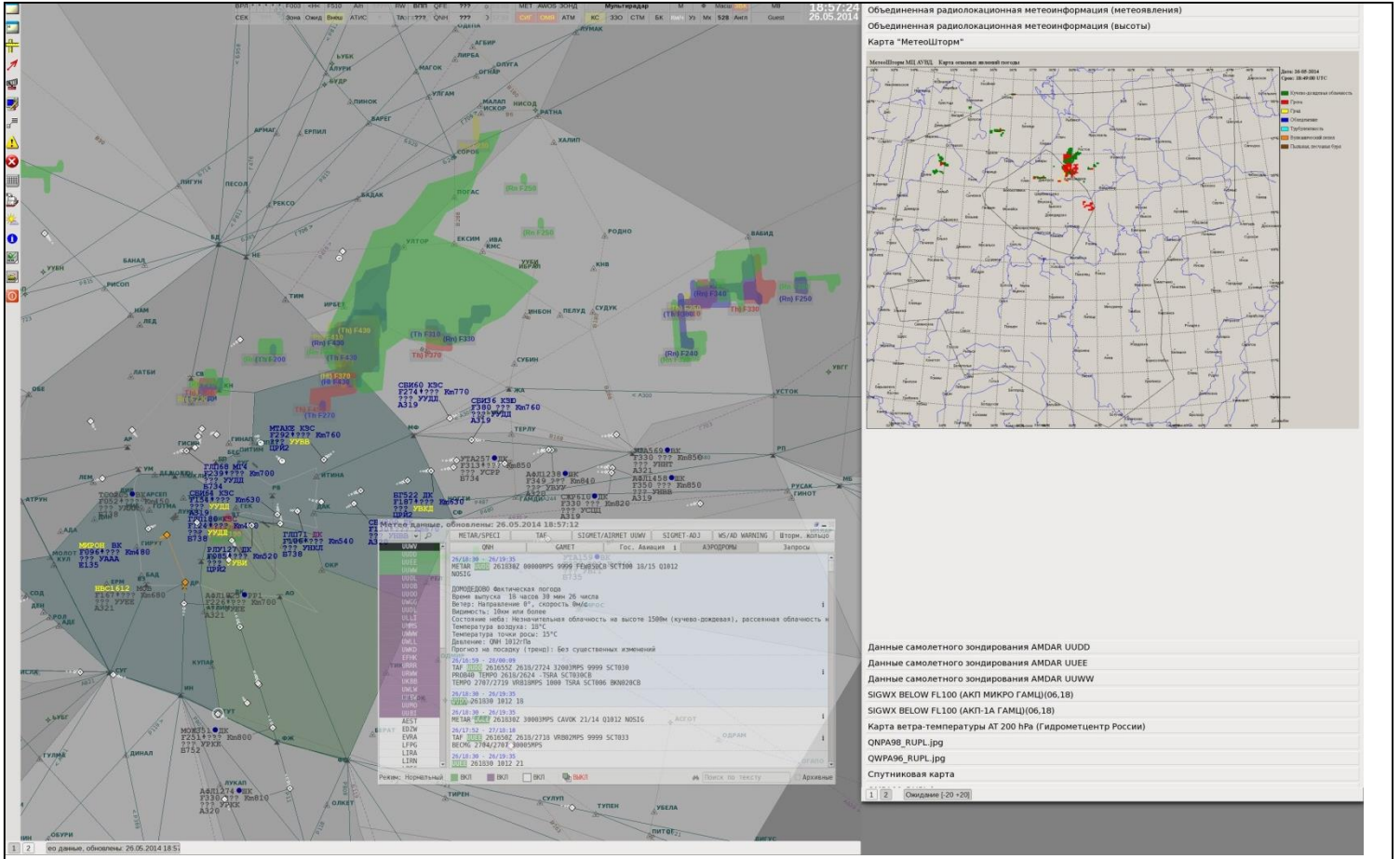
Future Plans

Stage 2 (2nd IOP + Phase 2, plan): 01.08.2018 – 31.05.2019

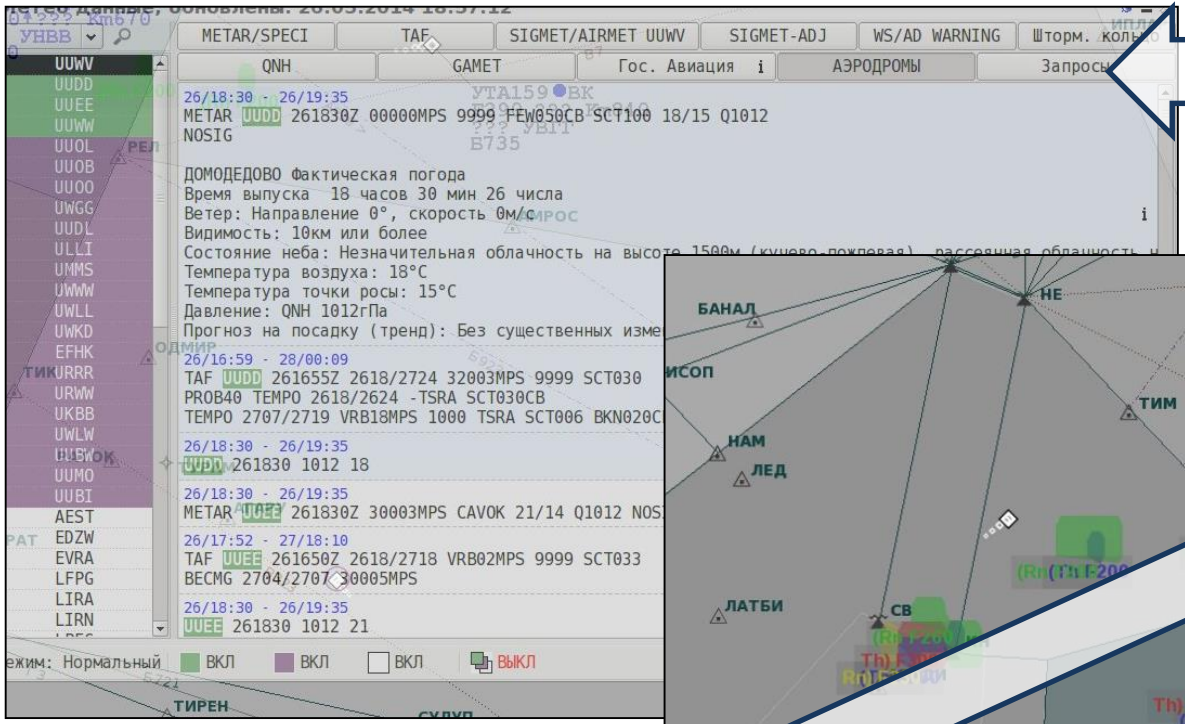


ATM System "Alpha"

The ATC system "Alpha" (produced by the LLC "NITA", Russia) provides visualization of the data at the screens. The MeteoServer system (produced by IRAM, Russia) provides the ATC system (the "Alpha" and a few others produced in different countries) with all needed information in consistent formats



ATM System "Alpha"

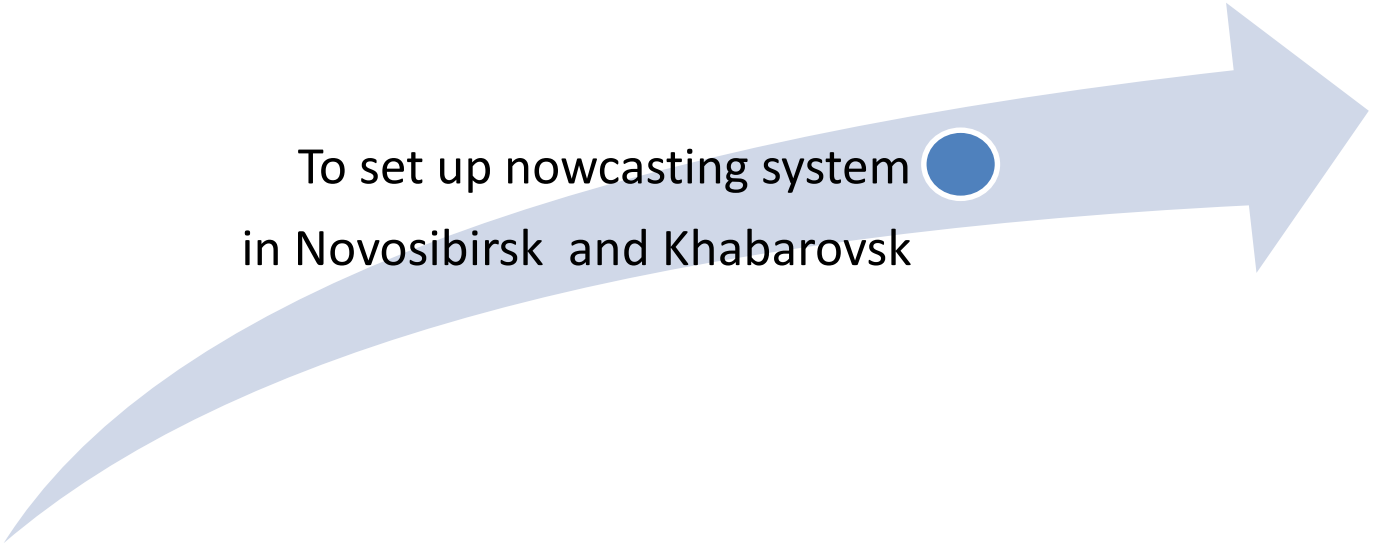


A possible future nowcasting position

Real Time Convection Areas: radar contours (in light green, dark green, purple, red ...) with corresponding indication

Future Plans

Outside AvRDP



MeteoExpert was one of the six nowcasting systems of the FROST-2014 (WMO WWRP) and was operational at the Main Operations Center of Sochi-2014 Olympic Games.

MeteoExpert nowcasting systems is operated 24/7 at 2 airports now – Pulkovo and Irkutsk (near Baikal lake)

Thanks for your attention!