On reproducing rescued U/A data for the 50's of last century and IGRA dataset by reanalyses

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With main contributions from: D. Nikolaev, A. Lavrov, A. Timofeev, A.Khohlova, V. Veselov and others

WP4 - Quantifying and reducing uncertainties

T4.1 - Quality control, bias adjustment and homogenisation of input observations [Months: 1-36]
RIHMI: Improved QC for upper-air, surface, and snow observations

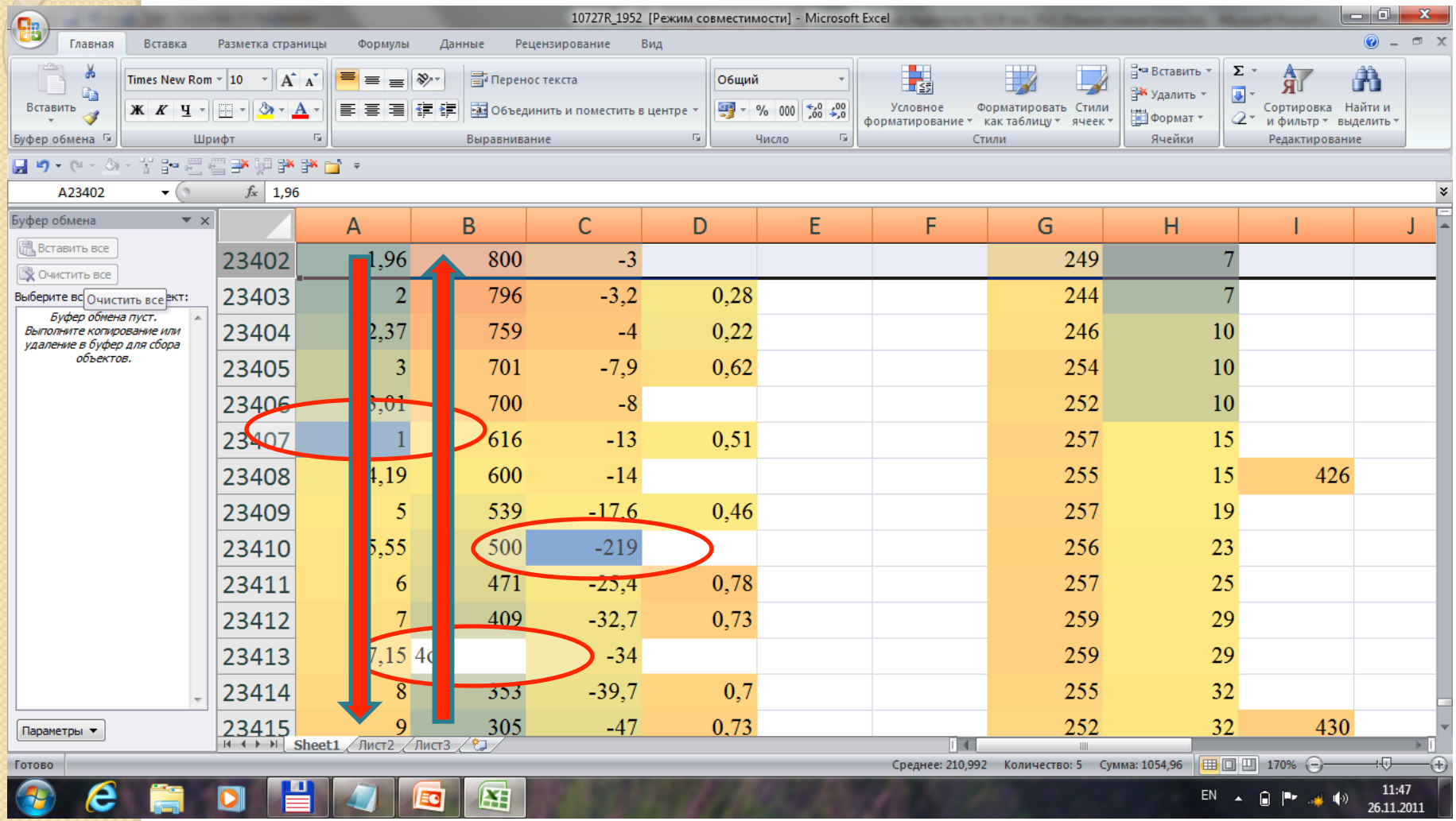
In ALL QC efforts, correct time of observation processing is vital!!!

Task 4.2: Diagnostics and uncertainty assessments of reanalysis output
RIHMI: Assessments of reanalysis uncertainty for upper-air temperature and humidity against radiosondes at selected station locations

Connected to output from WP3: Earth system observations:

Task 3.1: Data rescue for in-situ observations, quality control, and metadata
RIHMI: Early Russian upper-air data; gap filling; early Russian snow data;

STEPS OF THE TECHNOLOGY: PRE-QC OF DATA – CONDITIONAL FORMATTING ENABLES TO DETECT TYPICAL ERRORS



STEPS OF THE TECHNOLOGY: GENERAL PROCESS FOR MANUAL DIGITIZING

CONSTUCTING TABLE IN MS ACCESS AND MANUAL DIGITIZING

MS ACCESS TABLE OF DATA

IMPORT of MDB TABLE to SAS

PROCESSING BY SAS

- Data variables transformed and generated if needed

PROCESSING BY SAS

- **Data management operations**

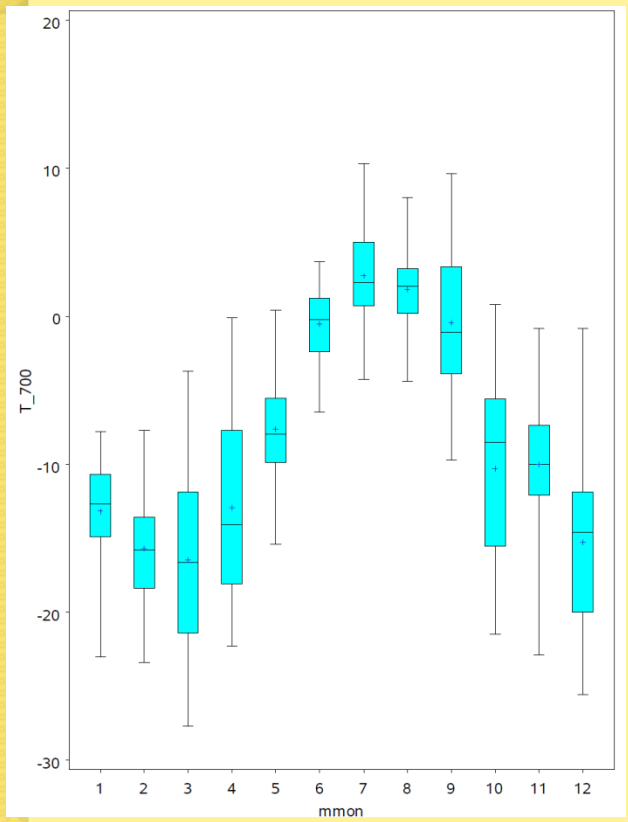
PROCESSING BY SAS

- Tables of statistics and statistical graphs (boxplots)

Export of tables to ORACLE

PROCESSING BY SAS:OUTPUT OF DATA TO TXT FORMAT

Pre-QC of U/A data



STATISTICS FOR F,T AND U ON STANDARD PRESSURE LEVELS FOR R CAO

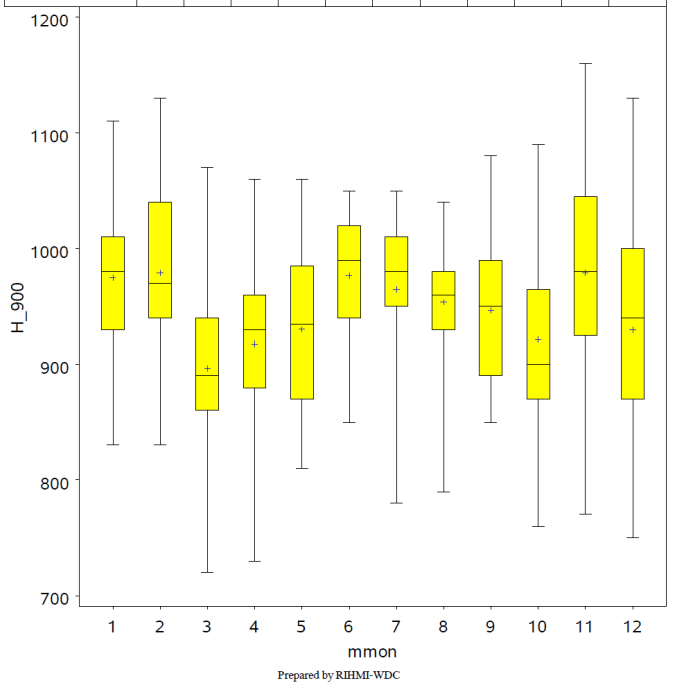
STATISTICS FOR F,T AND U ON STANDARD PRESSURE LEVELS FOR BIG TABLES
STATISTICS FOR F YEAR=1945

Overall Statistics

Min	720	Mean	947.6622	Max	1160
Pooled Std Dev	71.58791				

Extremes and means by month

	1	2	3	4	5	6	7	8	9	10	11	12
Min	830	830	720	730	810	850	780	790	850	760	770	750
Mean	974.898	979.0741	896.2903	917.6667	930.3125	976.6234	964.9254	953.8462	946.7241	921.6667	979.0625	929.8889
Max	1110	1130	1070	1060	1060	1050	1050	1040	1080	1090	1160	1130



Prepared by RIHMI-WDC

Reproducing rescued U/A data for the 50's of last century and IGRA dataset by reanalyses

To be more exact, rescued UA data for the 1950's and back (!)

We produced comparisons of temperature values for standard pressure levels for 1960 and back in:

- Rescued u/a data for 41 stations of the fUSSR within ERA CLIM2
- ERA -20C reanalysis data from ECMWF (surely ERA CLIM2 inputs not used)
- 20CR v2c reanalysis from NOAA-CIRES
- IGRA and IGRA v.2 beta from NCDC NOAA for the same stations (if available!)

For each station of 41, we selected synchronous values of T on standard pressure levels from all sources

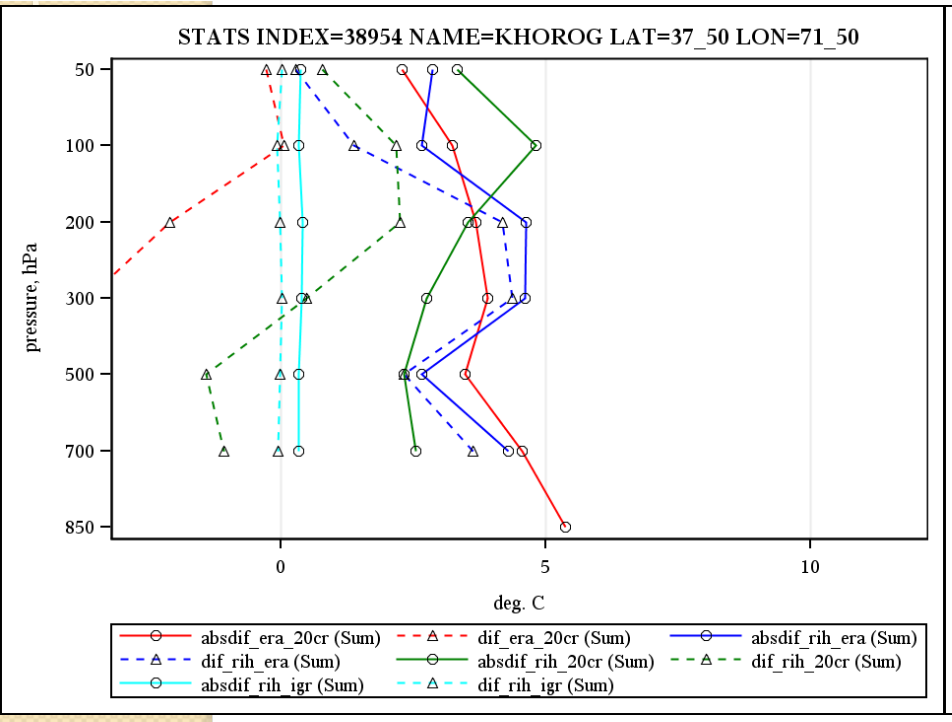
From reanalyses, we downloaded 2*2 degree values, then for certain station interpolated within cell to 1*1 degree values

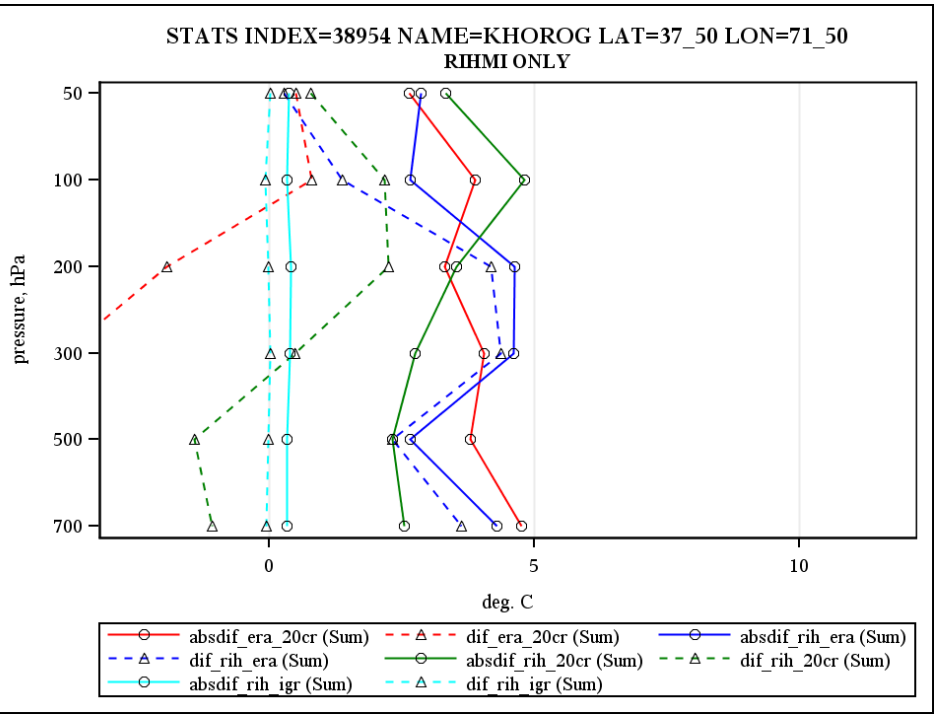
Finally, from reanalysis data, we took most possible synchronous values at nearest 1*1 degree grid points

We calculated a lot of comparison statistics and produced a lot of statistical tables and plots,

Here are some of them

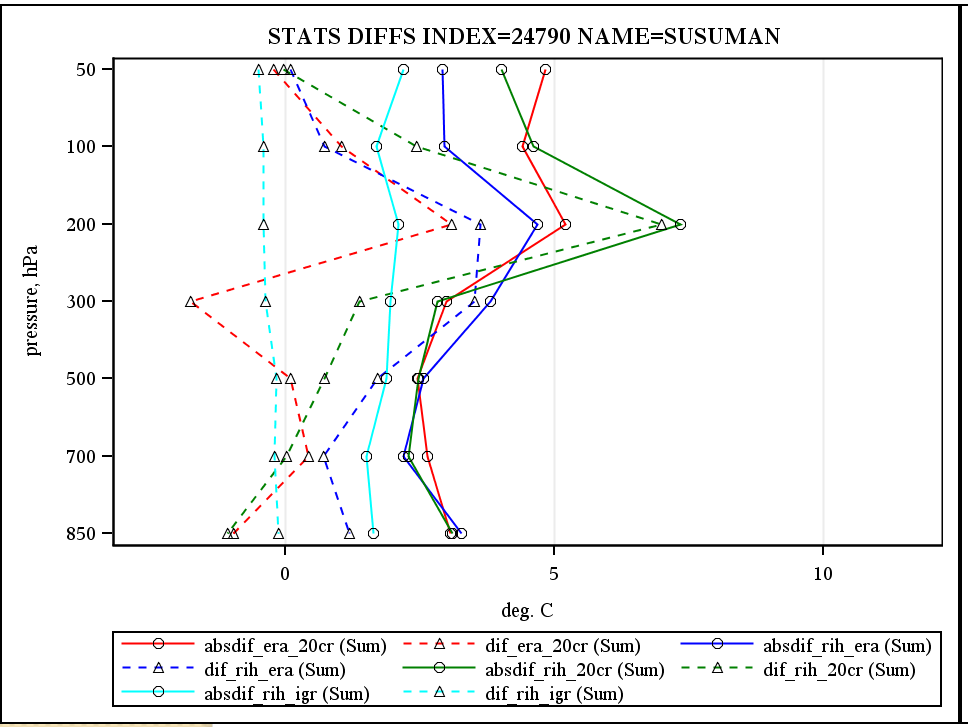
VERTICAL PROFILES: LEFT "ALL" RIGHT "RIHMI ONLY"

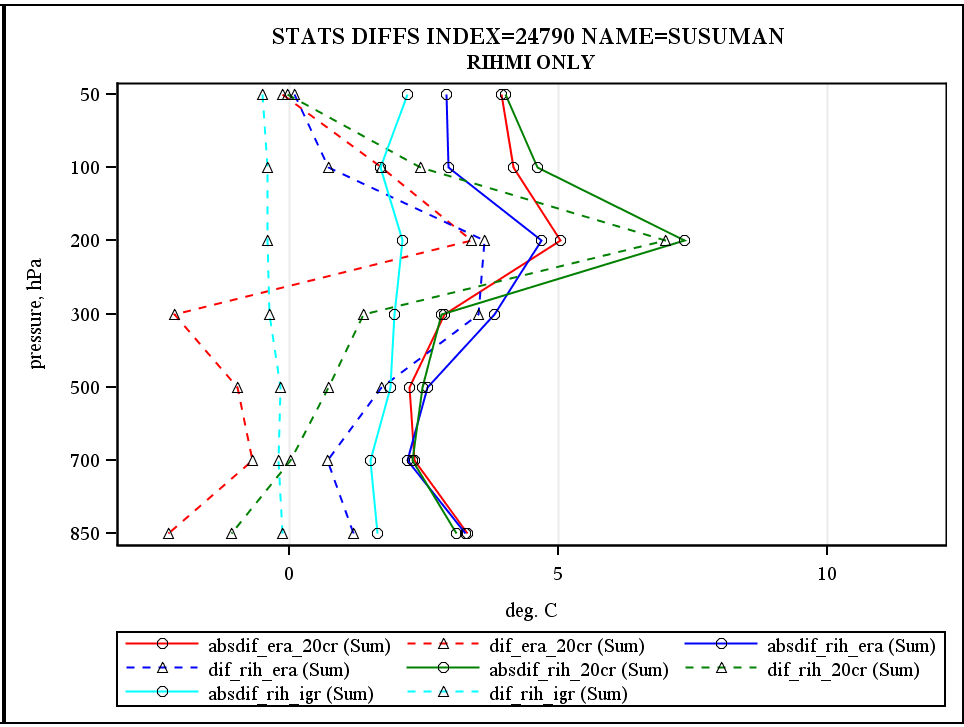




RED SOLID – MEAN OF ABSOLUTE DIFFERENCE ERA-20CR
RED DOTTED - MEAN OF DIFFERENCE ERA-20CR
BLUE SOLID – MEAN OF ABSOLUTE DIFFERENCE RIHMI -ERA
BLUE DOTTED - MEAN OF DIFFERENCE RIHMI – ERA
GREEN SOLID – MEAN OF ABSOLUTE DIFFERENCE RIHMI -20CR
GREEN DOTTED - MEAN OF DIFFERENCE RIHMI -20CR
CYAN SOLID – MEAN OF ABSOLUTE DIFFERENCE RIHMI - IGRA
CYAN DOTTED - MEAN OF DIFFERENCE RIHMI – IGRA

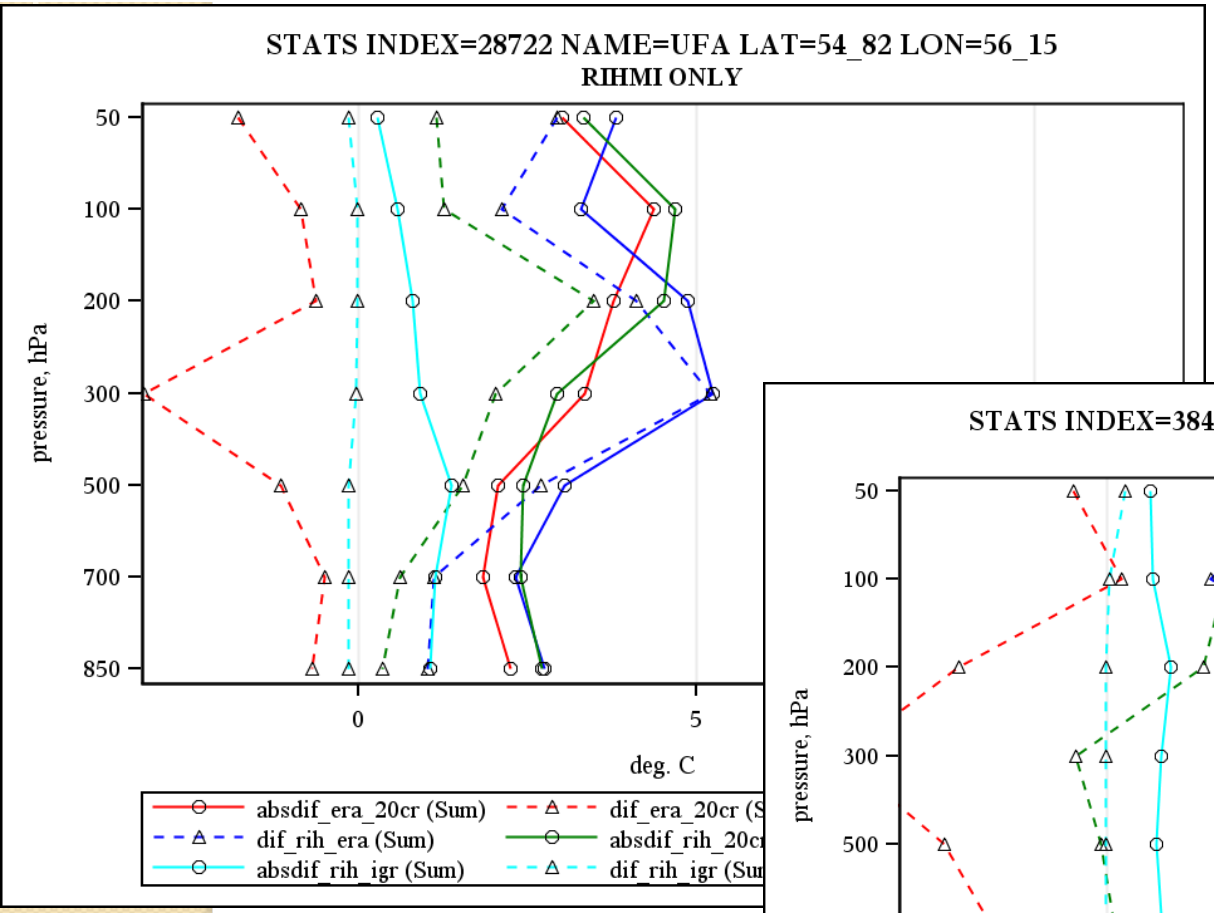
VERTICAL PROFILES: LEFT "ALL" RIGHT "RIHMI ONLY"

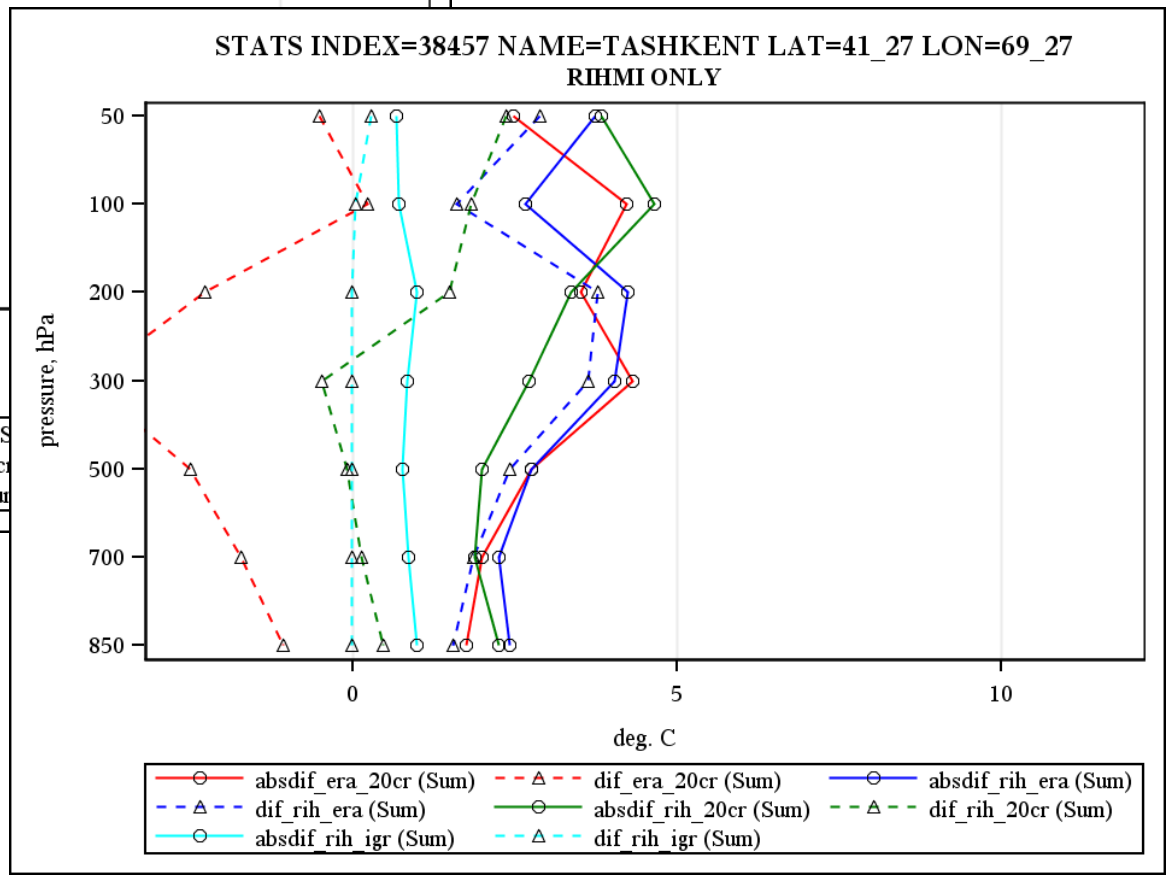




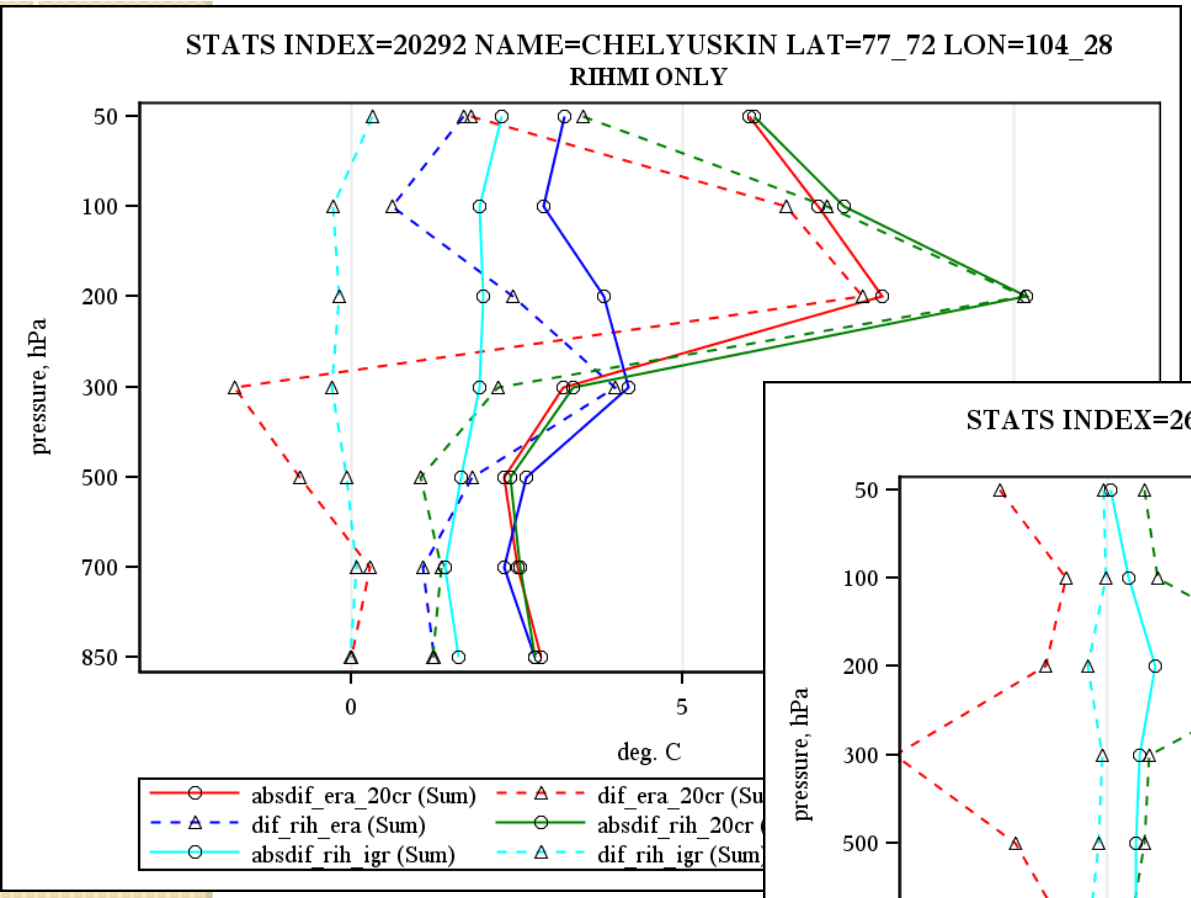
RED SOLID – MEAN OF ABSOLUTE DIFFERENCE ERA-20CR
RED DOTTED - MEAN OF DIFFERENCE ERA-20CR
BLUE SOLID – MEAN OF ABSOLUTE DIFFERENCE RIHMI -ERA
BLUE DOTTED - MEAN OF DIFFERENCE RIHMI – ERA
GREEN SOLID – MEAN OF ABSOLUTE DIFFERENCE RIHMI -20CR
GREEN DOTTED - MEAN OF DIFFERENCE RIHMI -20CR
CYAN SOLID – MEAN OF ABSOLUTE DIFFERENCE RIHMI - IGRA
CYAN DOTTED - MEAN OF DIFFERENCE RIHMI – IGRA

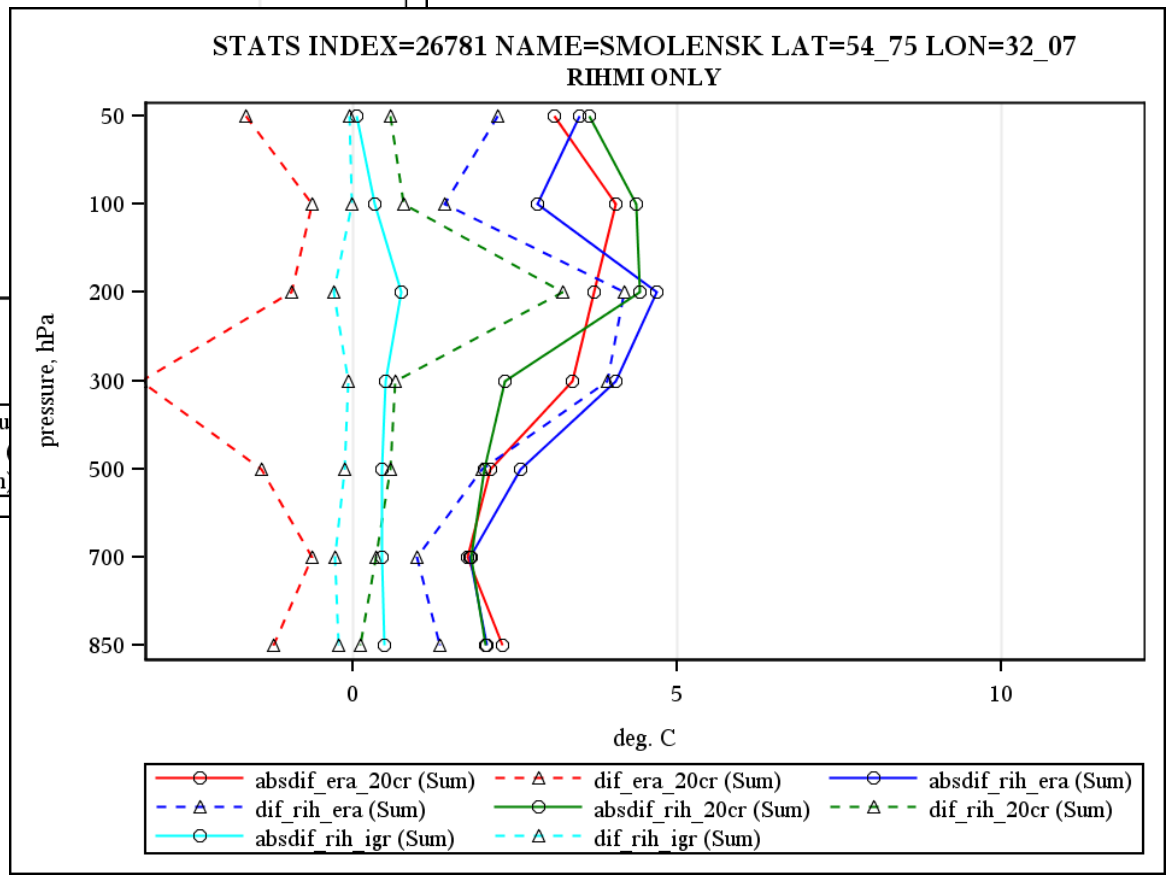
ВНИИГМИ-МЦД


STATS INDEX=28722 NAME=UFA LAT=54_82 LON=56_15
RIHMI ONLY
pressure, hPa
50
100
200
300
500
700
850
0
5
deg. C
absdif_era_20cr (Sum)
dif_era_20cr (S
dif_rih_era (Sum)
absdif_rih_20cr
absdif_rih_igr (Sum)
dif_rih_igr (Sum

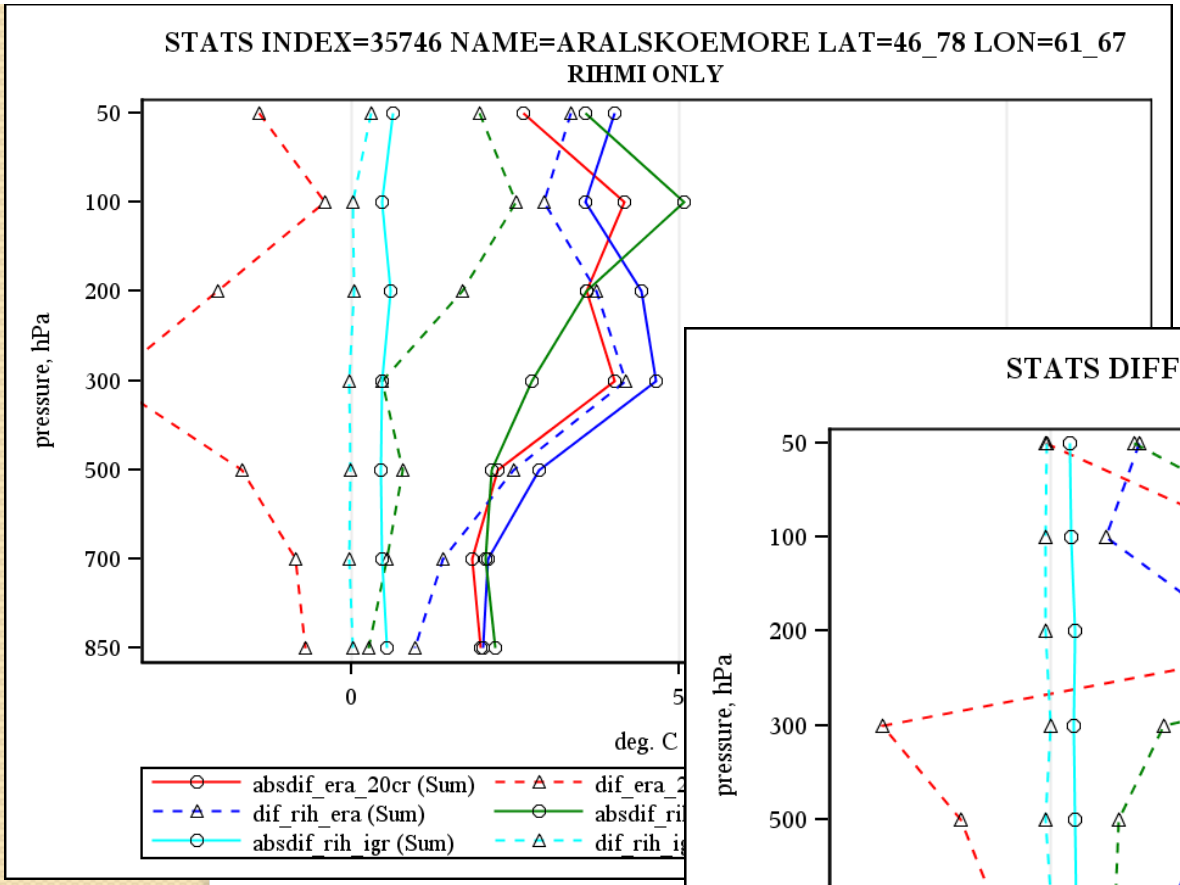

STATS INDEX=38457 NAME=TASHKENT LAT=41_27 LON=69_27
RIHMI ONLY
pressure, hPa
50
100
200
300
500
700
850
0
5
10
deg. C
absdif_era_20cr (Sum)
dif_era_20cr (Sum)
absdif_rih_era (Sum)
dif_rih_era (Sum)
absdif_rih_20cr (Sum)
dif_rih_20cr (Sum)
absdif_rih_igr (Sum)
dif_rih_igr (Sum)

ВНИИГМИ-МЦД

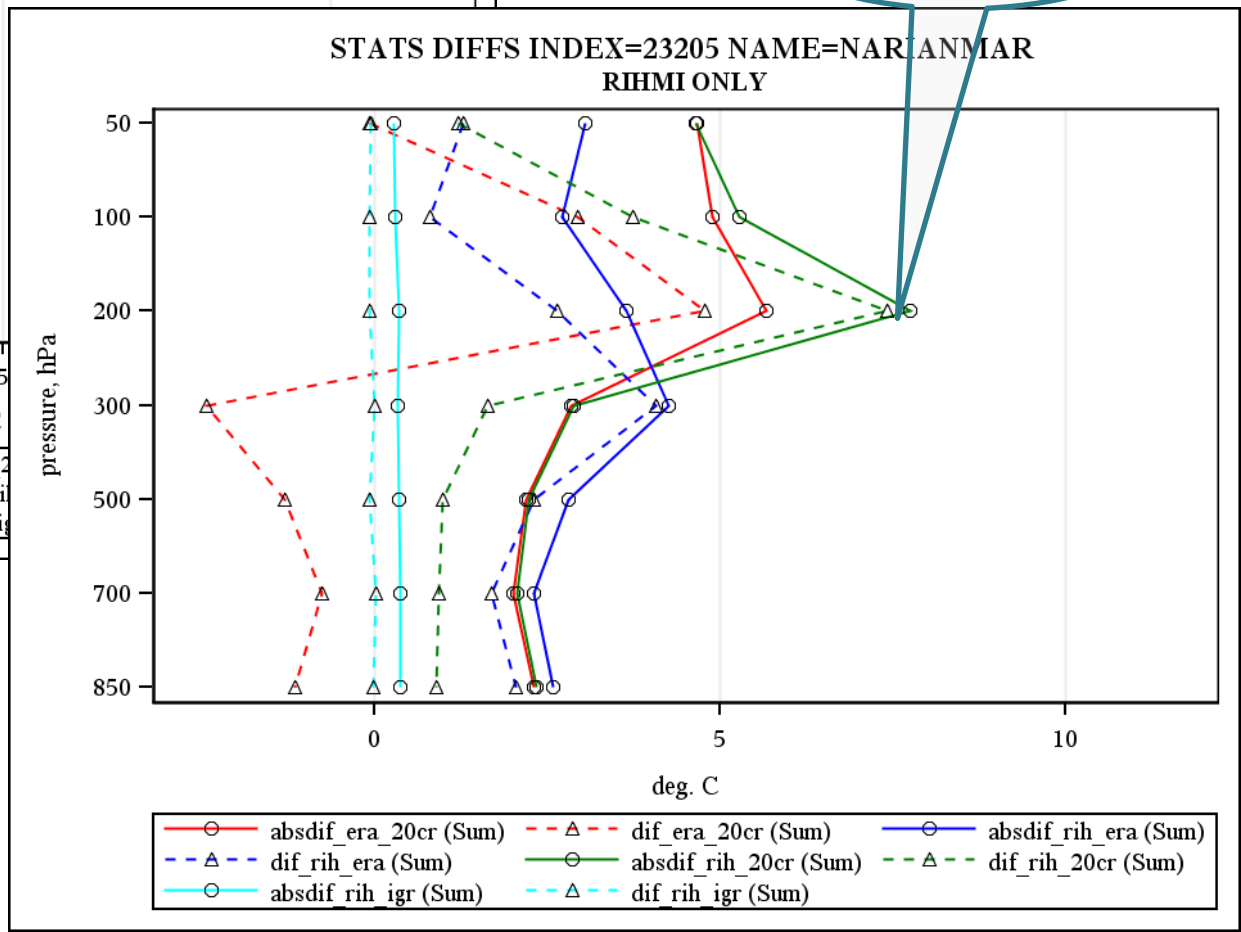

STATS INDEX=20292 NAME=CHELYUSKIN LAT=77_72 LON=104_28
RIHMI ONLY
pressure, hPa
50
100
200
300
500
700
850
0
5
deg. C
absdif_era_20cr (Sum)
dif_era_20cr (Su
dif_rih_era (Sum)
absdif_rih_20cr
absdif_rih_igr (Sum)
dif_rih_igr (Sum)


STATS INDEX=26781 NAME=SMOLENSK LAT=54_75 LON=32_07
RIHMI ONLY
pressure, hPa
50
100
200
300
500
700
850
0
5
10
deg. C
absdif_era_20cr (Sum)
dif_era_20cr (Sum)
absdif_rih_era (Sum)
dif_rih_era (Sum)
absdif_rih_20cr (Sum)
dif_rih_20cr (Sum)
absdif_rih_igr (Sum)
dif_rih_igr (Sum)

ВНИИГМИ-МЦД

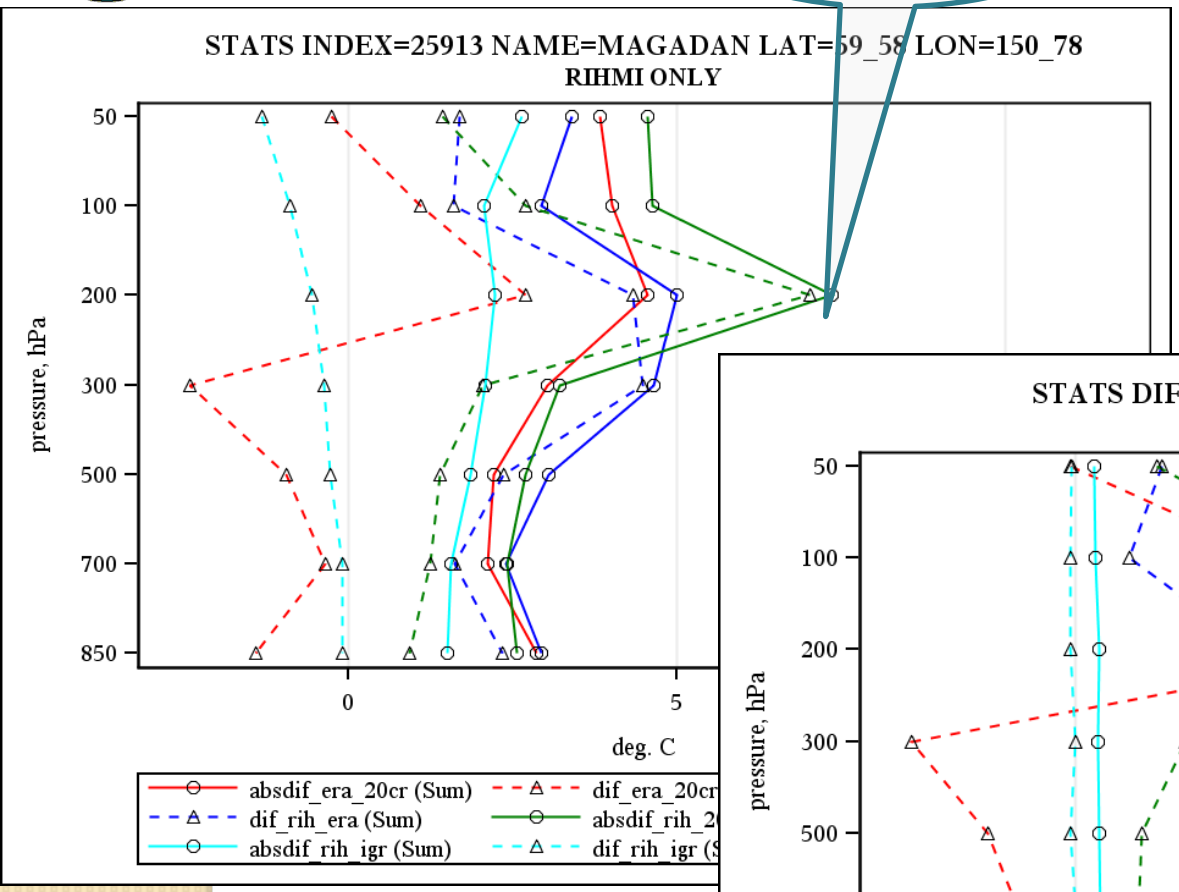


TYPICAL!!!!

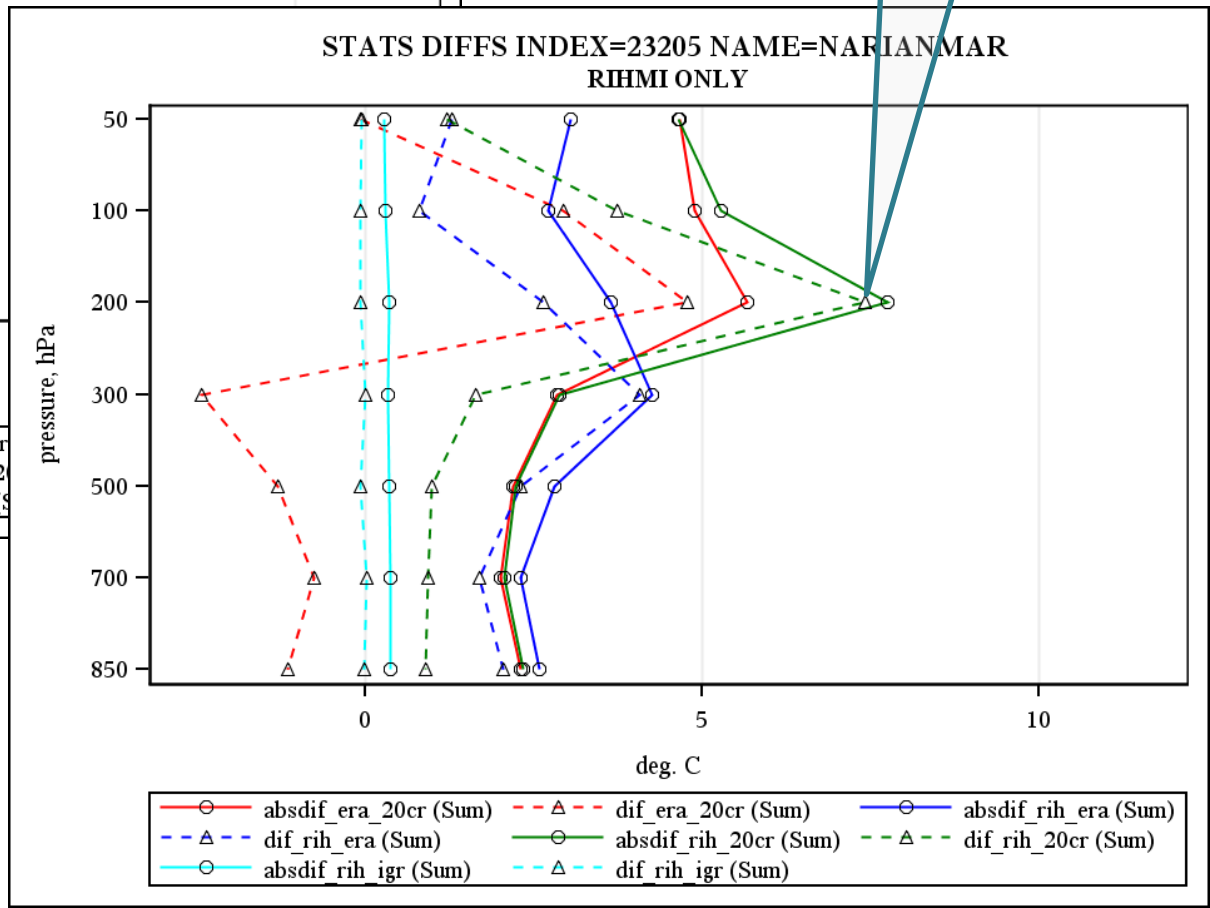


ВНИИГМИ-МЦД

TYPICAL!!!!



TYPICAL!!!!



- For synchronous sub-daily U/A temperature data:
- Vertical profiles of difference statistics in ERA-20C and 20CR-v2c reanalyses are identical for "ALL" and "RIHMI ONLY" situations
- Mean of absolute values of difference statistics are similar for differences between reanalyses and for differences between RIHMI station data and both reanalyses, for 850, 700, 500, and in most cases for 300 hPa. At 200 hPa and above, these values increase essentially.
- For the northern and east-northern stations, at 200 hPa these values are essentially bigger for RIHMI-20CR differences!
- Based on pairwise comparisons of three sources of data/ products, we say "CLOSER" rather than "BETTER"

Thank you for attention!

The contents and format of data set of snow cover characteristics for stations
We plan to retain the existing QC flags ideology for all additional data

Field number	Field contents	Notes
1	WMO index of station	
2	Year	
3	Month	
4	Day	
5	Snow depth	In cm
6	Extent of snow cover around the station	In numbers on ten-number scale, see Table 2 on next slides
7	Q- Complementary flag of snow depth	See Table 3 on next slides

Table 2

Extent of snow cover around the station

Observation period	Extent of snow cover around the station	Value Q
Before July 1959	50% and less than 50% of the area around the station	0
	More than 50% of the area around the station	1
From August 1959 up to the present day	Extent of snow cover around the station is estimated from ten-number scale. For example, the lack of snow is 0, 20% of the area around the station covered with snow is 2, 50% of the area around the station covered with snow is 5, etc.	From 0 to 10

Table 3

Complementary flag of snow depth (is constructed together with other meteorological data (T, P, Q, data at neighbour times and stations)

SITUATION	FLAG
Value of snow depth is correct	0
Continuous snow melting	1
Snow cover absent at site, however there is snow in the neighbor vicinity and a state of it is specified.	2
Snow cover is less than 0.5 cm	3
Observations were not made or value is rejected	9

The format of data set of snow cover state characteristics

N	Field contents
1	Index WMO
2	Latitude
3	Longitude
4	Year
5	Month
6	Day
7	Route (Path) type 1 - field environment; 2 - forest environment; 3 – ravine (canions)
8	Extent of snow cover over route surroundings (0 -10)
9	Extent of snow cover along a route (0-10)
10	Extent of crust along a route (0-10)

N	Field contents
11	Snow cover depth average (sm)
12	Snow cover depth maximum (sm)
13	Snow cover depth minimum (sm)
14	Snow density (g/sm^A3)
15	Thickness of crust layer (mm)
16	Thickness of water-inundated snow cover (sm)
17	Thickness of pure water (sm)
18	Water equivalent of snow cover (mm)
19	General water amount (mm)
20	Snow covering type
21	Snow cover type

The data set contains data for 1966 - 2013.

WP4 - Quantifying and reducing uncertainties [Months: 1-36]

T4.2 - Diagnostics and uncertainty assessments of reanalysis output [Months: 1-36]
RIHMI: Assessments of reanalysis uncertainty for upper-air temperature and humidity against radiosondes at selected station locations

Use ERA-20C U/A T and Q, stations selections over the territory of Russia:
Station data selections for period of 2000's – well checked, have alternative sources, etc.
Station data selections from data prepared for ERA CLIM and ERA CLIM2 (late 40's – early 50s)