Reproducing upper air temperature, humidity and wind characteristics in late 1930s-1960s by reanalyses

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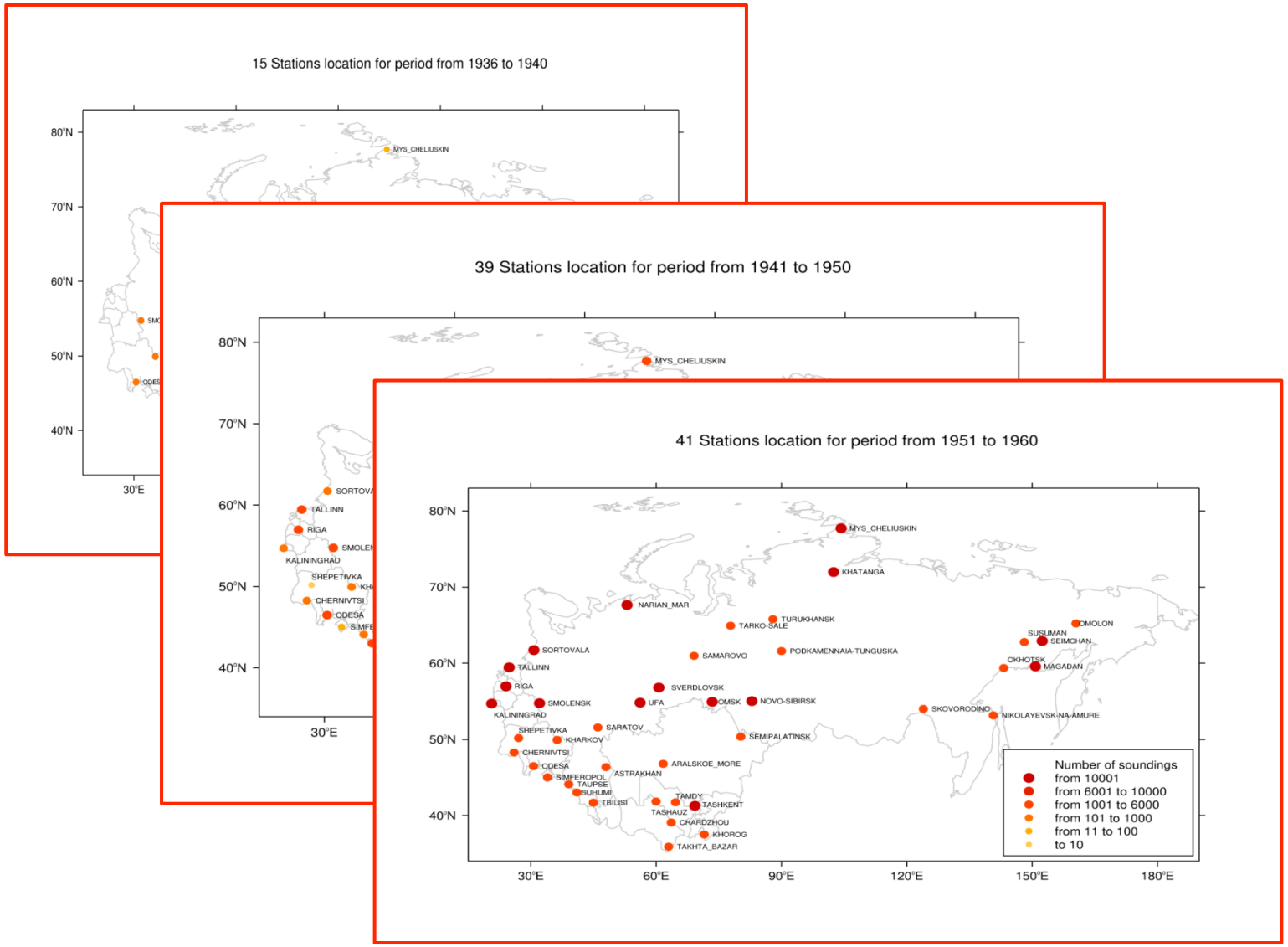
Upper-air data (41 stations)



Upper-air data

The final U/A dataset was compiled from three sources and put into single format as it was done for the U/A data in previous ERA CLIM Project. **The amount of soundings: 390 873. The amount of levels: 8 993 028**

```
23205   67   39   53    1    9 1940   11   19  1    5    2    9   400  1  612  0  -10.8  1  91  1    .  9    .  9
 23205   67   39   53    1    9 1940   11   19  1    5    2    9   500  1  534  0  -17.4  1  91  1    .  9    .  9
 23205   67   39   53    1    9 1940   11   21  1    5    2    9   400  1  581  0  -34.8  1  76  1    .  9    .  9
 23205   67   39   53    1    9 1940   11   21  1    5    2    9   500  1  491  0  -42.0  1   .  9    .  9    .  9
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 23205   67   39   53    1    9 1940   11   23  1   11    3    9   500  1  514  0  -24.7  1  72  1    .  9    .  9
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 23205   67   39   53    1    9 1943   11    9  1   11   10    9    20  1  994  0   -0.6  1  82  1    .  9    .  9
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 23205   67   39   53    1    9 1943   11   10  1   10    7    1     1  0 1027  0   -4.4  0  91  1    0  1    0  1
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```
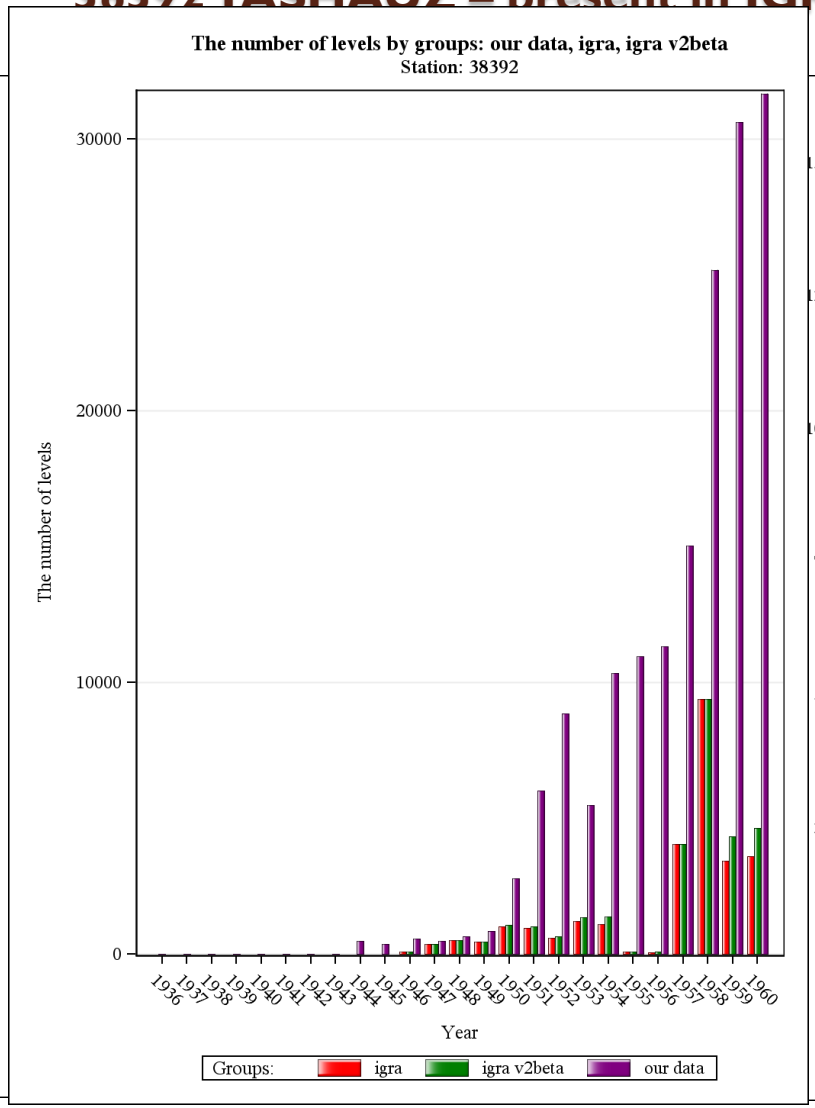
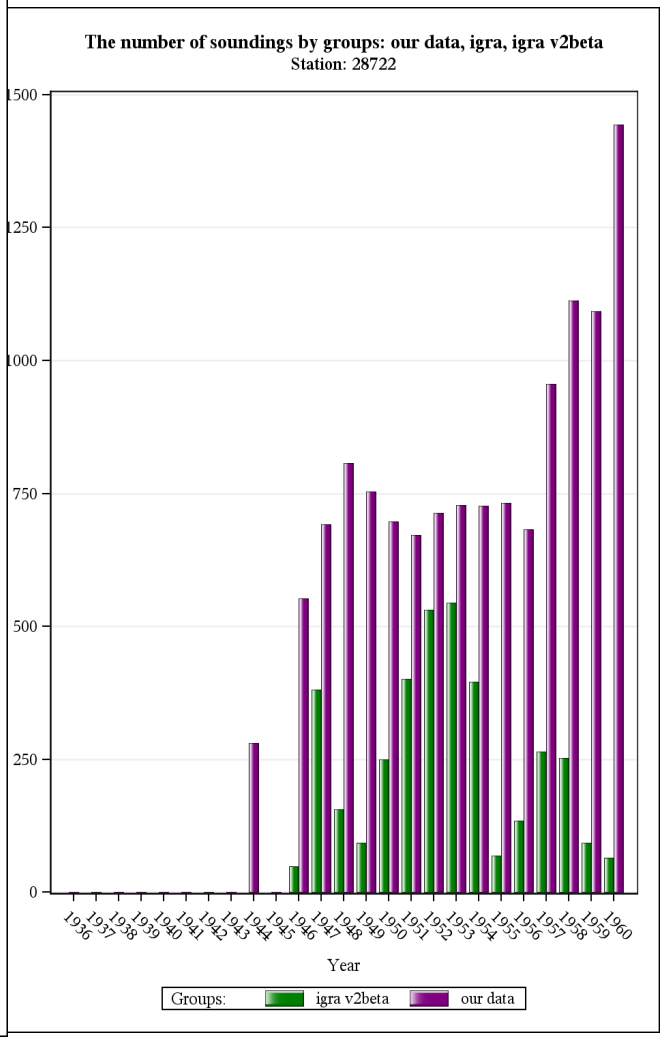

SAS Program fragment for output:
put index 6. (latdeg latmin londeg lonmin hgtstat year month day) (5.) q_day 3. (time nlev code) (5.)
H 6. q_H 3. P 5. q_P 3. T 7.1 q_T 3. U 4. q_U 3. winddir 5. q_winddir 3. windspeed 5. q_windspeed 3.;

Upper-air data:

station UFA (28722) – Missing in IGRA, partly present in IGRA2beta, 38392 TASHAUZ – present in IGRA





Upper-air data

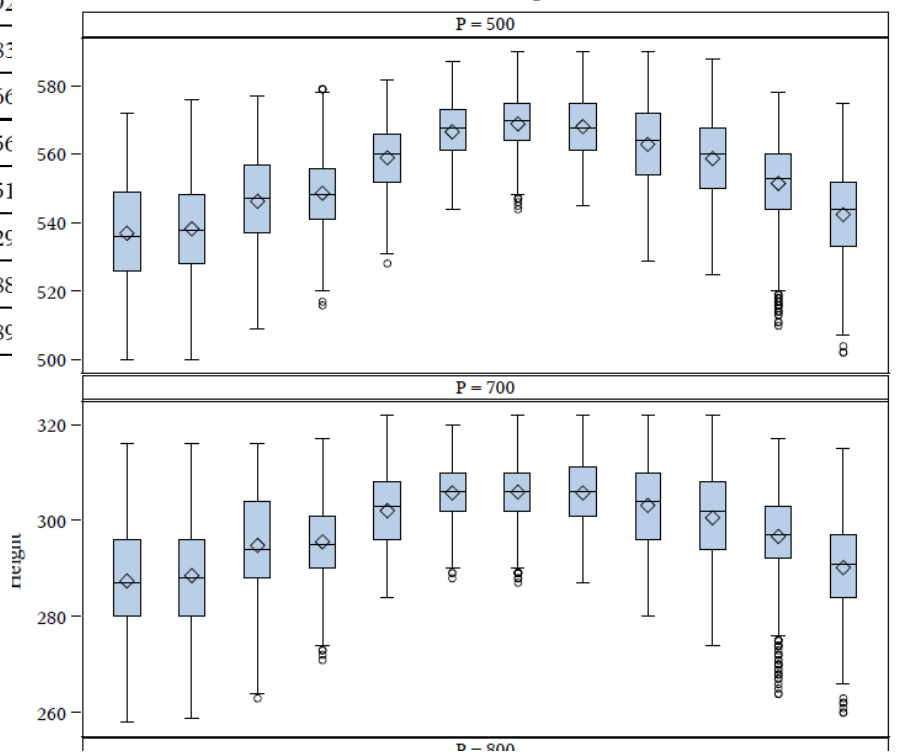
Table of year by month

year	month												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
19													
19													
19													
19													
19													
19													
To													

Analysis Variable : H

P	month	N Obs	Mean	Std Dev	Minimum	Maximum	N	10th Pctl	Median	90th Pctl
300	5	413	907.94	17.78	869.00	947.00	413	886.00	906.00	933.00
	6	405	920.09	13.74	884.00	954.00	405	902.00	921.00	936.00
	7	400	932.85	14.26	892					
	8	375	929.77	13.72	883					
	9	277	913.79	18.03	866					
	10	355	903.45	17.41	856					
	11	382	900.27	17.88	851					
	12	399	881.06	19.31	829					
500	1	423	527.66	15.32	488					
	2	389	527.79	16.22	489					

STATISTICS FOR H, T, U, Winddir and Windspeed OF STANDARD LEVELS



Upper-air data

How do we assess reproducibility?

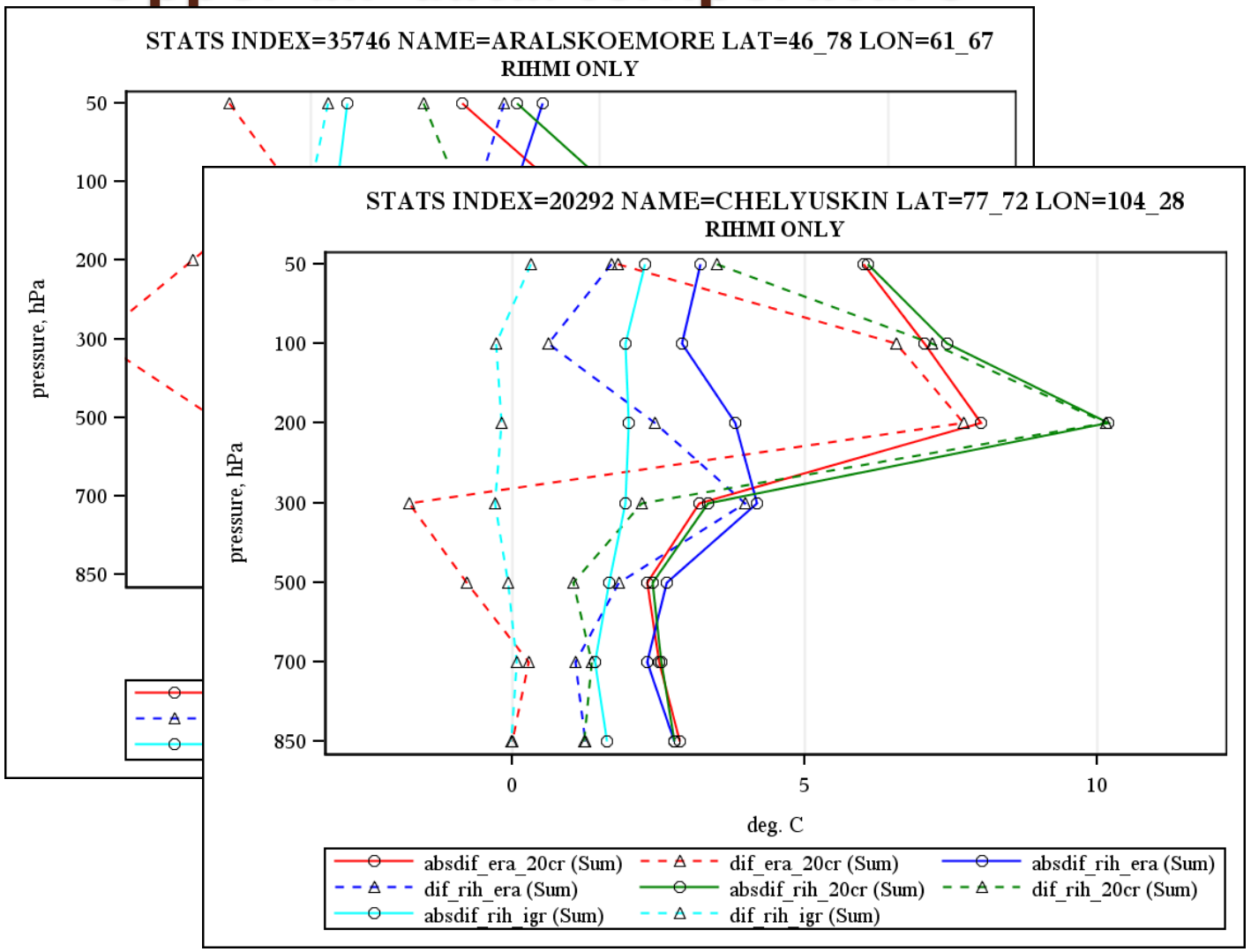
Assessed were:

temperatures on standard pressure levels,
wind speed on standard pressure levels ,
relative humidity in troposphere

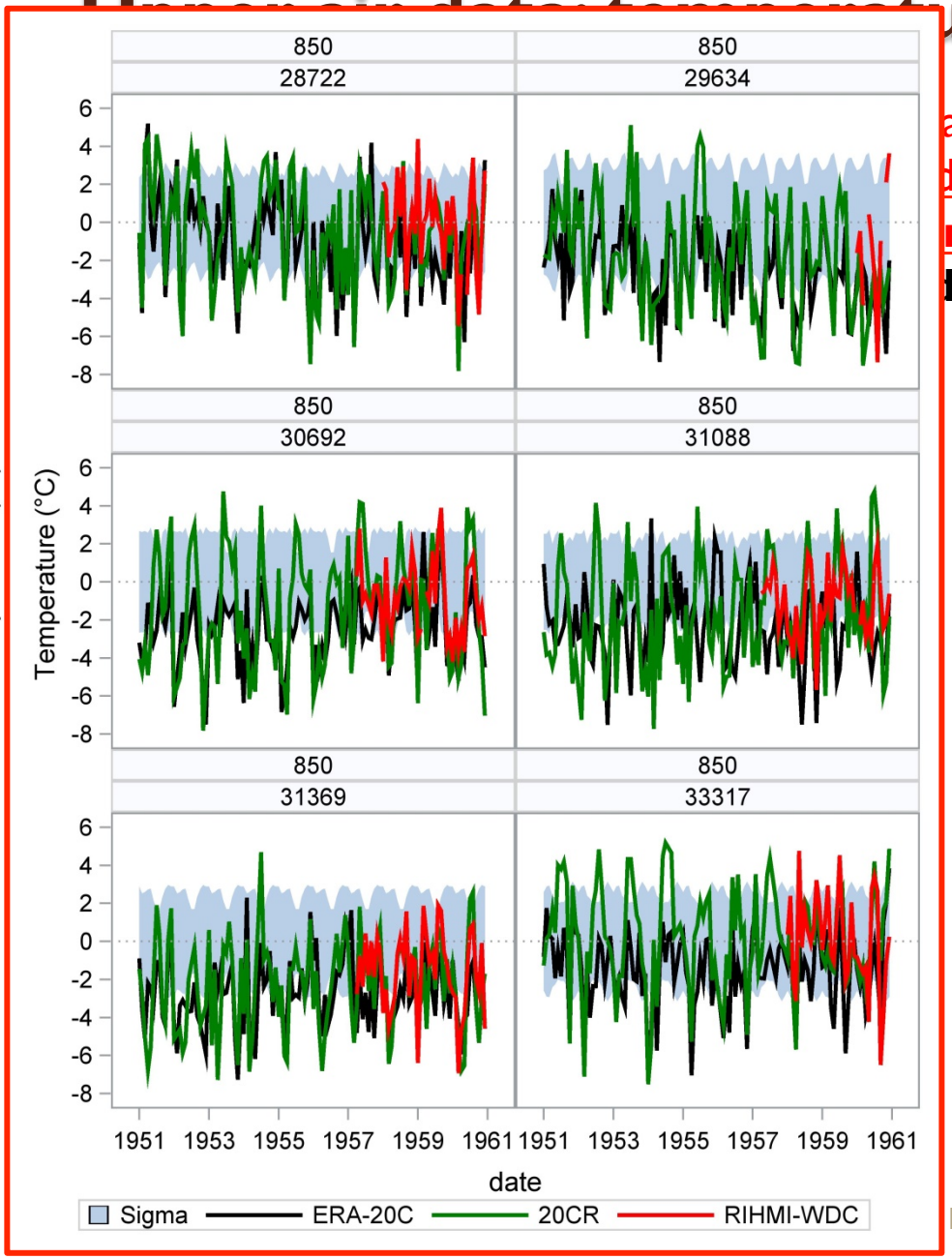
For assessment we used:

RIHMI digitized data for 41 stations for period 1960 and before (starting sometimes in 1936), with gaps and episodic observations
ERA-20C reanalysis reconstructed for station points
For temperature- NOAA-CIRES 20th Century Reanalysis version 2 (20CRv2): 1871-2012 reconstructed for station points
For relative humidity and wind speed (wind components) -NOAA-CIRES 20th Century Reanalysis version 2c (20CRv2c): 1851-2012 reconstructed for station points
Climatologies (monthly mean and sigma values) for each of 12 months for each station of 41 list, based on data from AEROSTAB /AEROSTAS RIHMI collection, 1985-2014

Upper-air data: temperature



Upper air data temperature

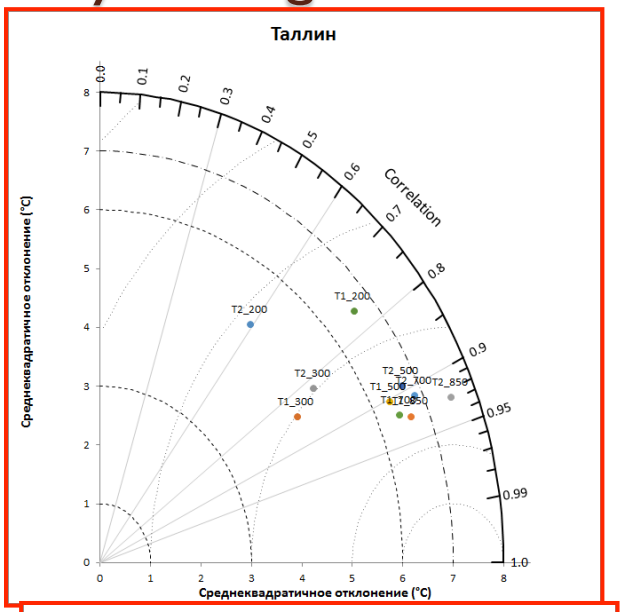


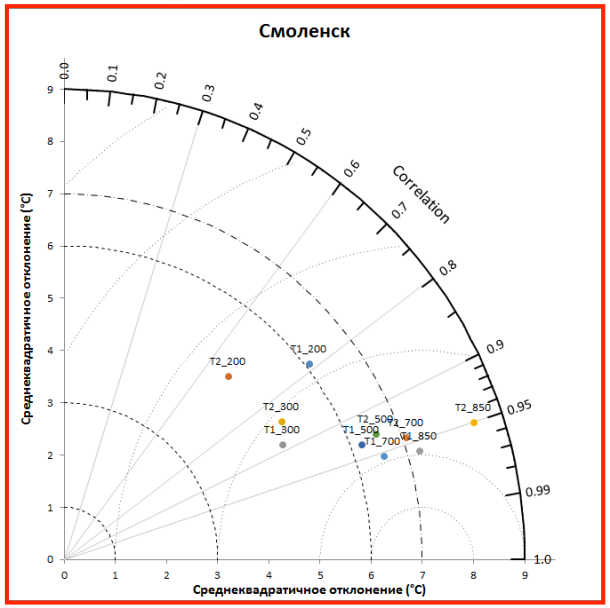
ameters, **for the same 41**
d
nalyses!!!
luce station climatologies
data (in more details – in

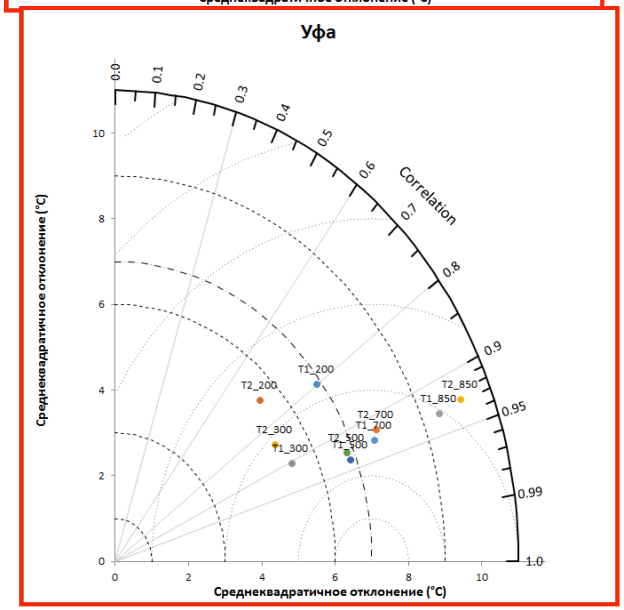
Panel: monthly anomalies for 100hPa Temperature for group of 6 stations for 1951-1960
Grey shaded – monthly climatology sigmas
ERA-20C – black
20CR v2 – green
RIHMI digitized - red
ERA-20c better corresponds to climatology!

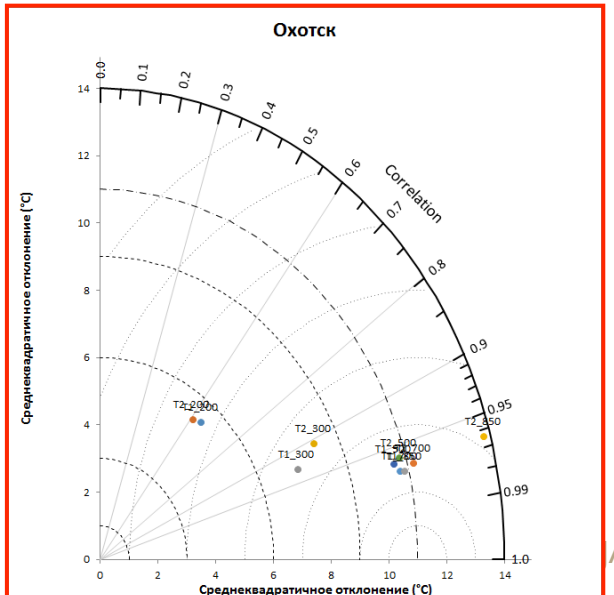
Upper-air data: temperature

Taylor diagrams: T1 –ERA-20C, T2-20CR v.2 – vs. RIHMI 41





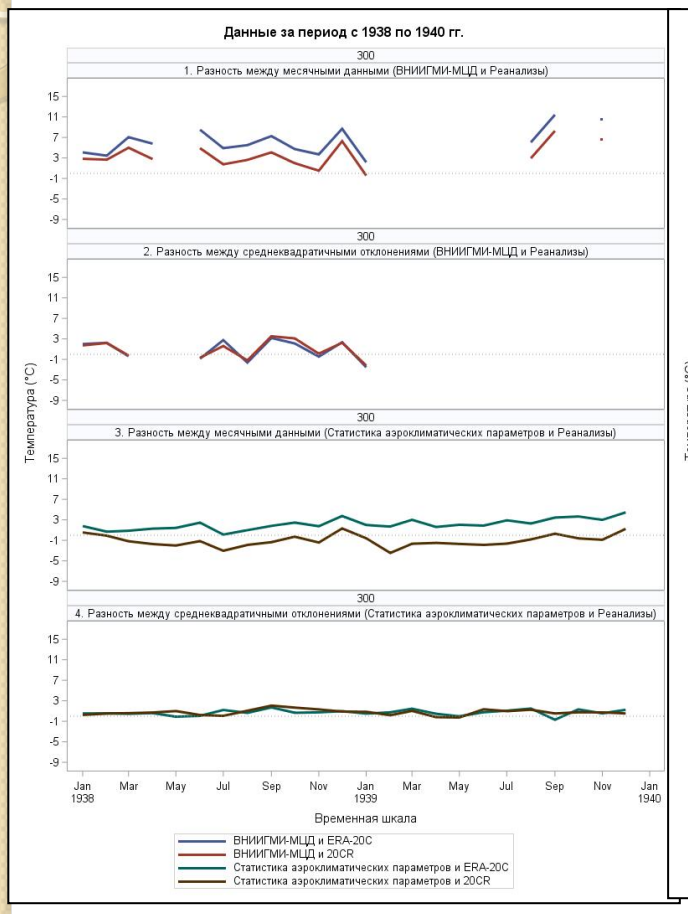


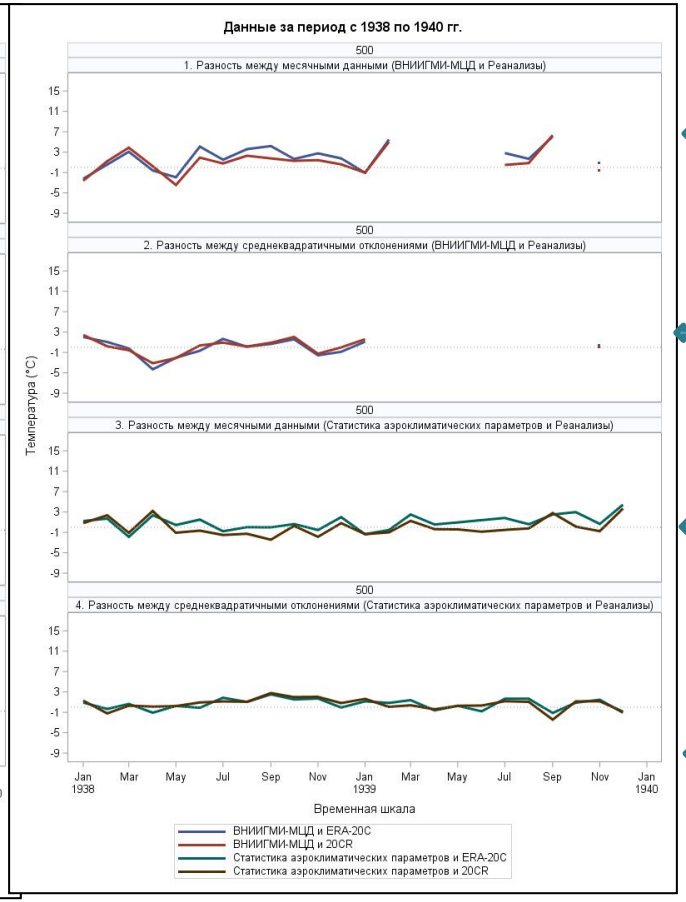


Upper-air data: temperature

station 26781 Smolensk, 1938-1940

300 hPa left, 500 hPa right





Mean RIHMI – Mean Reanalysis

Std RIHMI – Std Reanalysis

Mean Climate– Mean Reanalysis

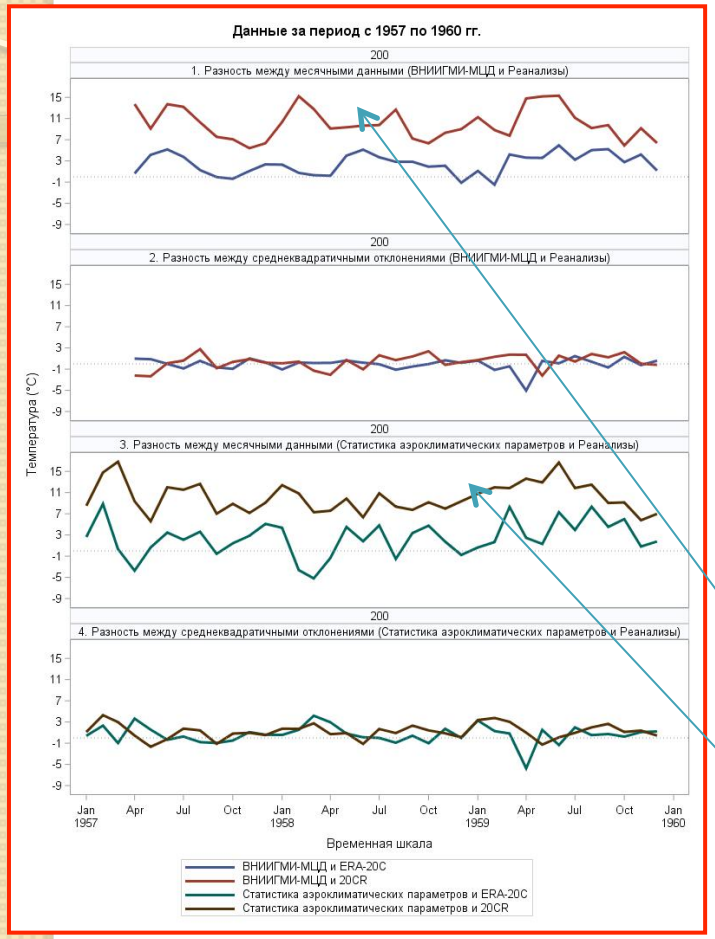
Std Climate – Std Reanalysis

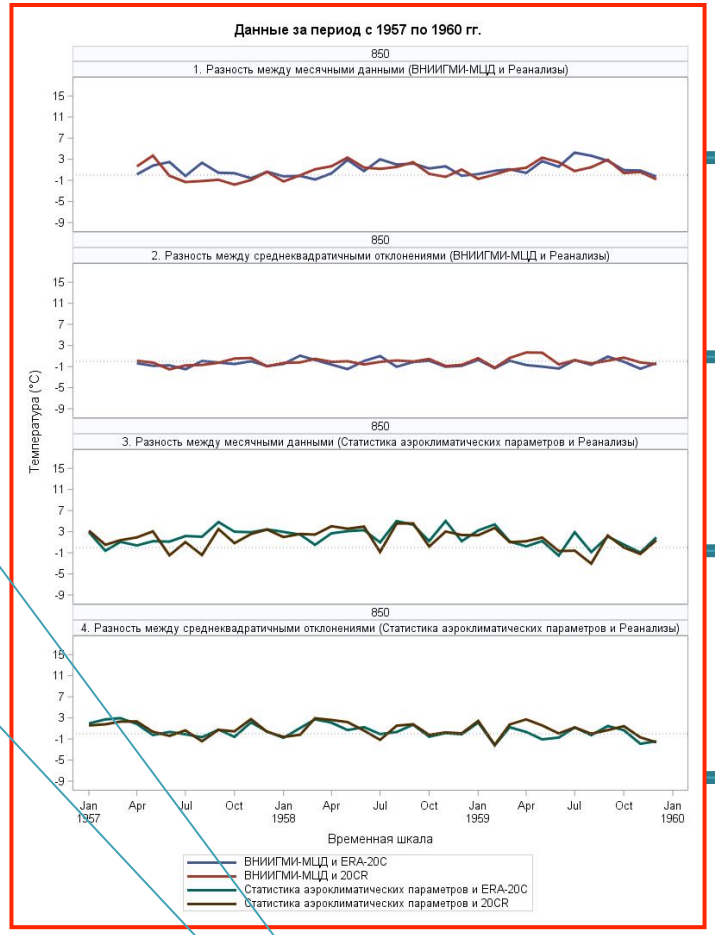
Brown – 20CR v2, dark green –ERA20C

Upper-air data: temperature

station 20292 Mys Cheliusin, 1957-1960

200 hPa left, 850 hPa right





Mean RIHMI – Mean Reanalysis

Std RIHMI – Std Reanalysis

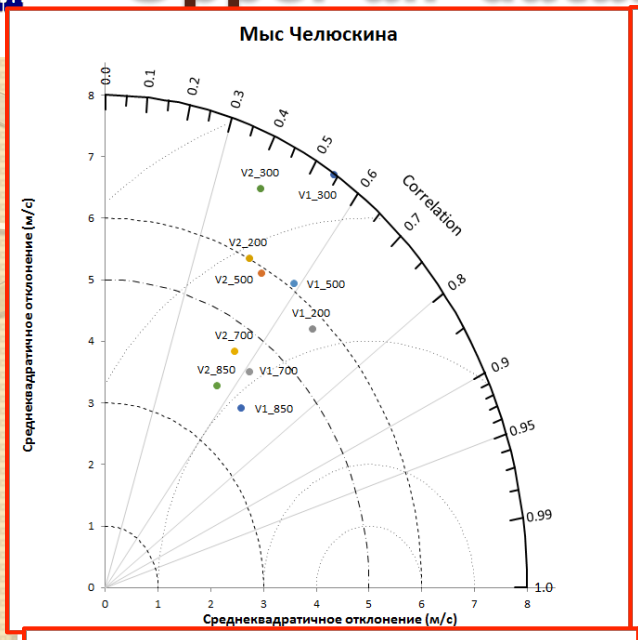
Mean Climate– Mean Reanalysis

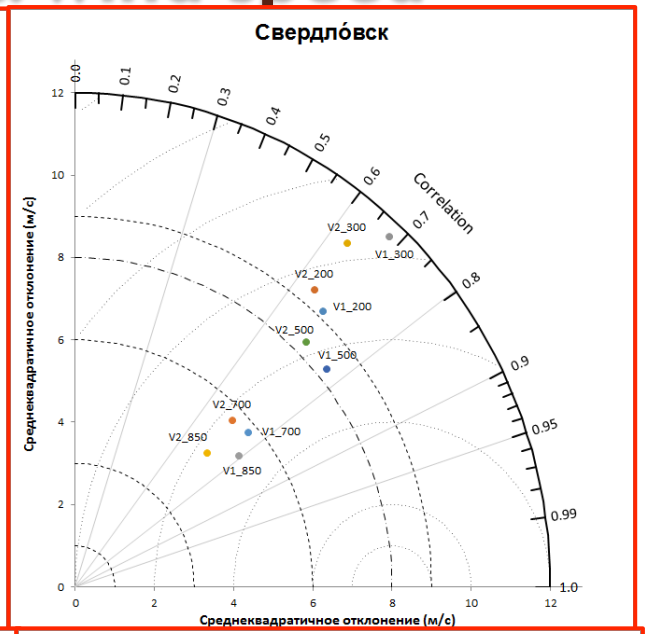
Std Climate – Std Reanalysis

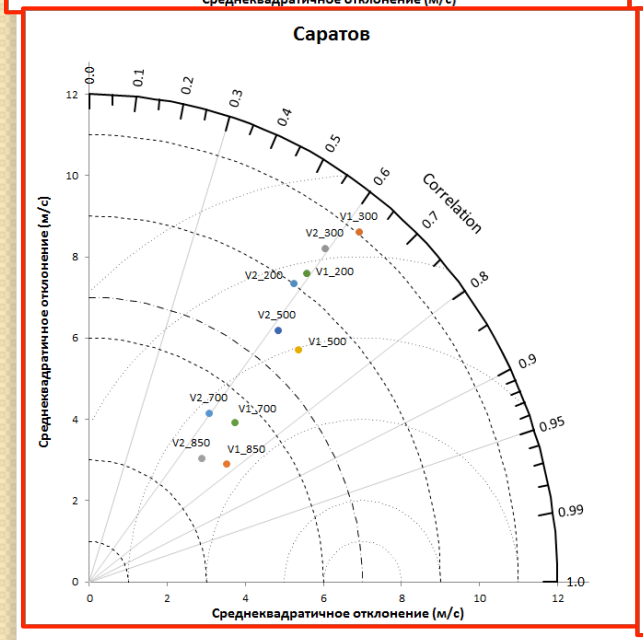
Brown – 20CR v2, dark green –ERA20C

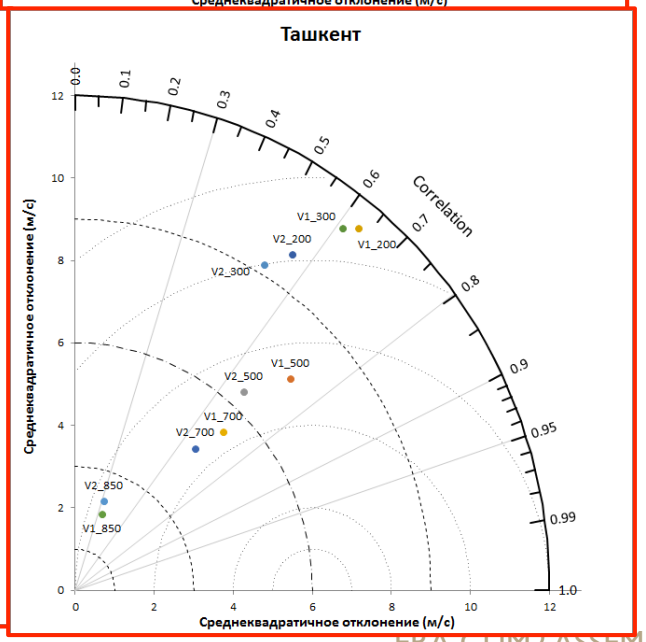
Polar stratosphere overcooled in 20CR

Upper-air data: wind speed



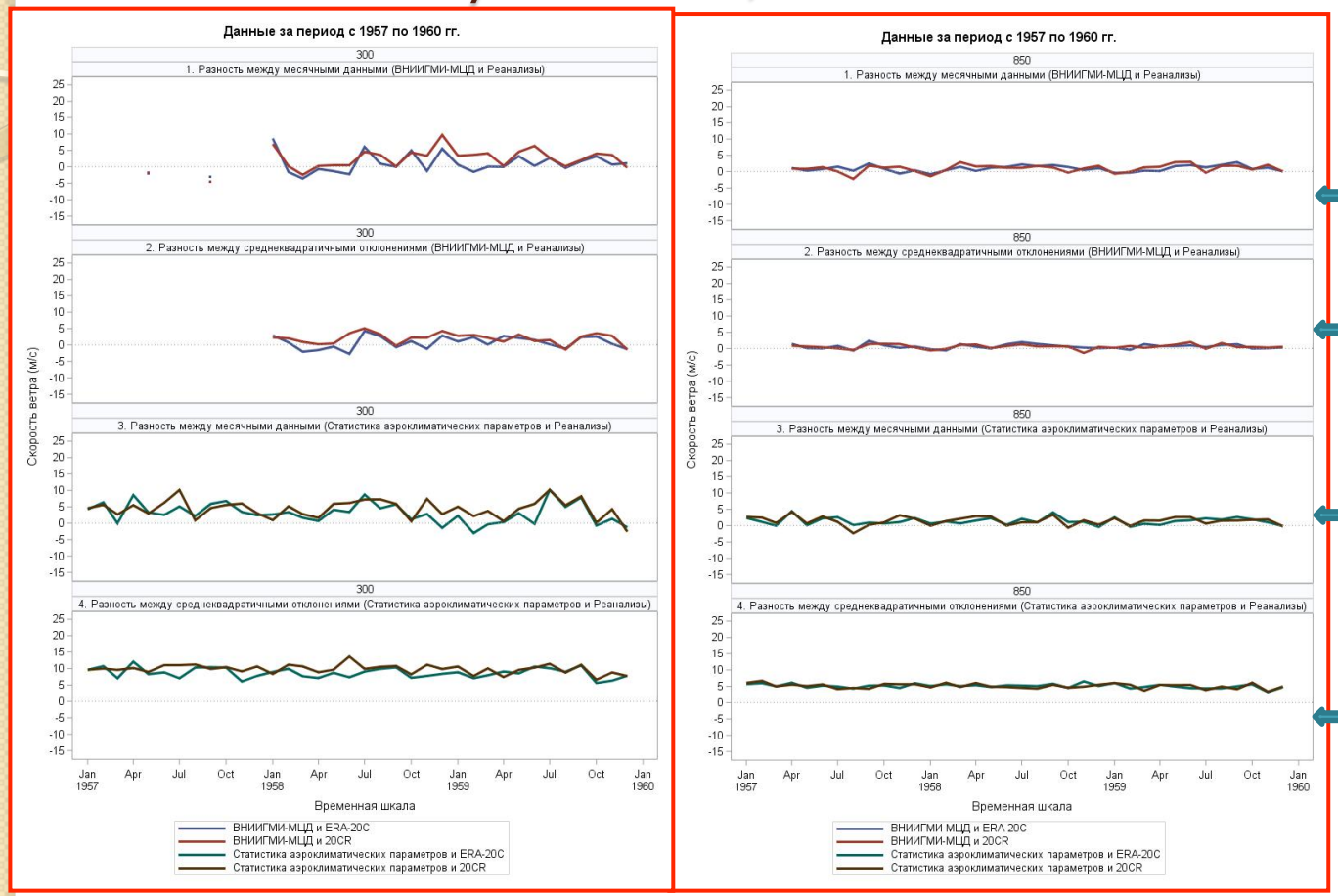






Upper-air data: wind speed

station 20292 Mys Cheliuskin, 1957-1960



Mean RIHMI – Mean Reanalysis

Std RIHMI – Std Reanalysis

Mean Climate– Mean Reanalysis

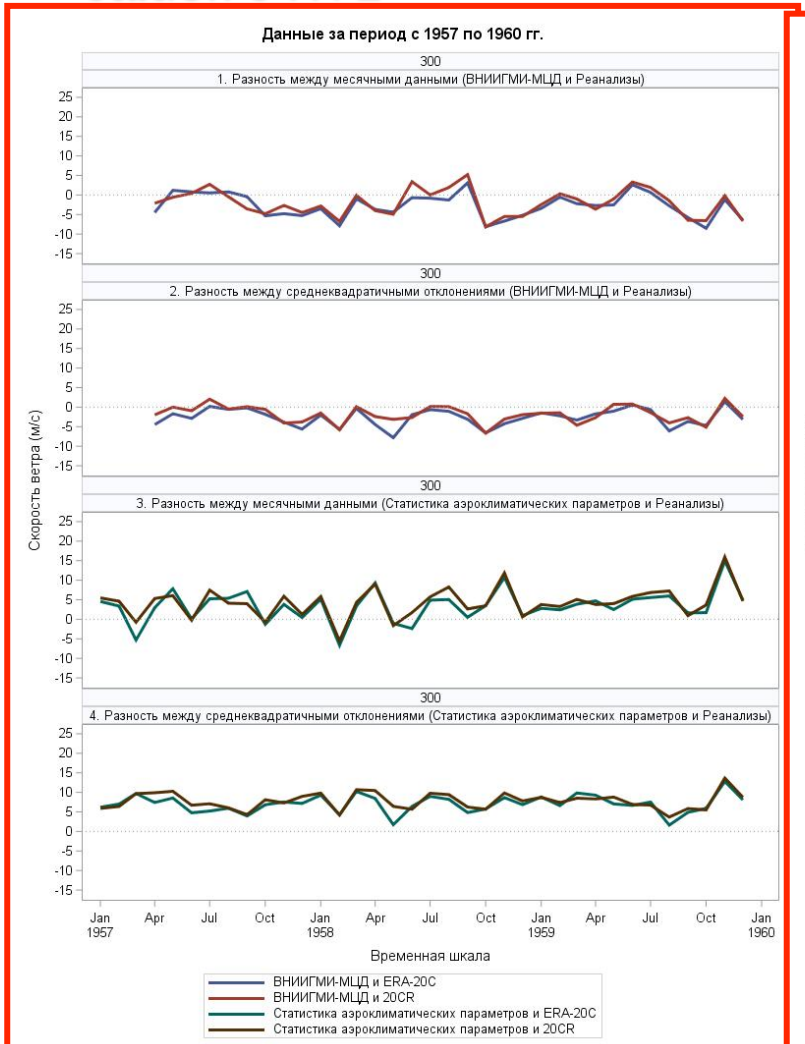
Std Climate – Std Reanalysis

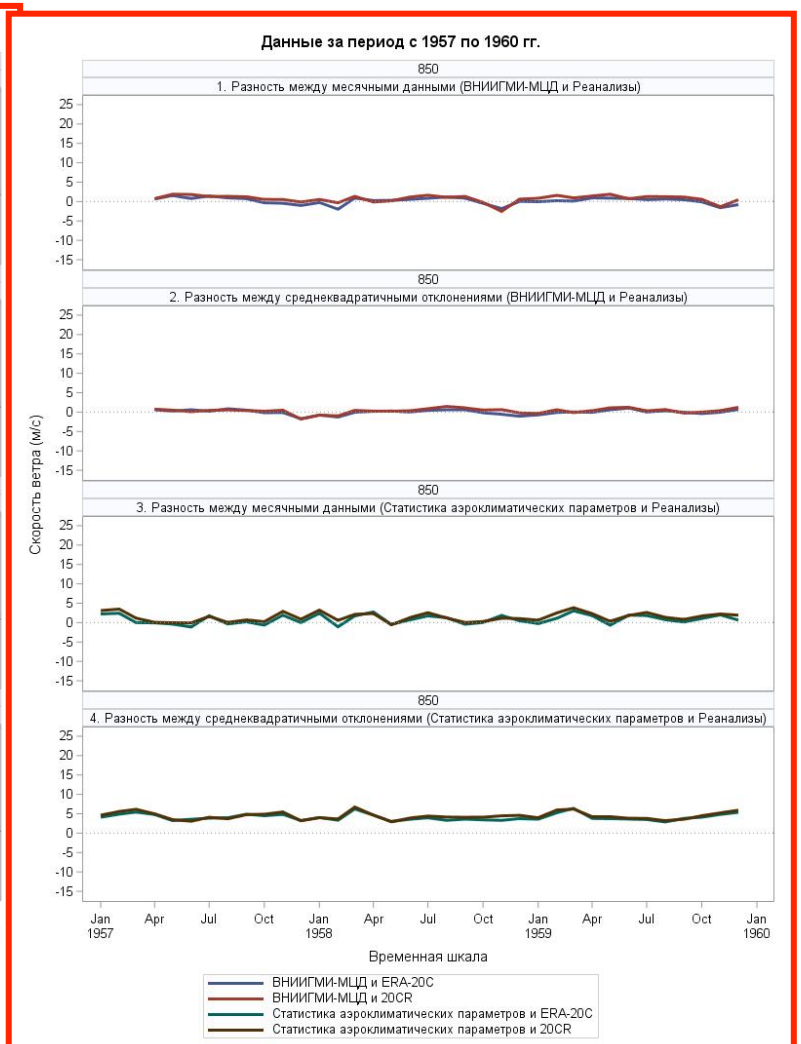
Brown – 20CR v2, dark green –ERA20C

Monthly STD in reanalyses are underestimated for W, esp. in stratosphere

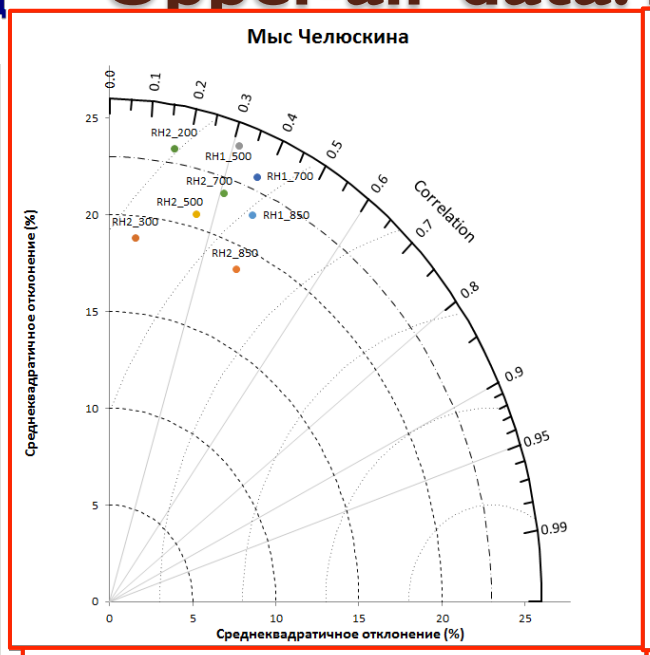
Upper-air data: wind speed

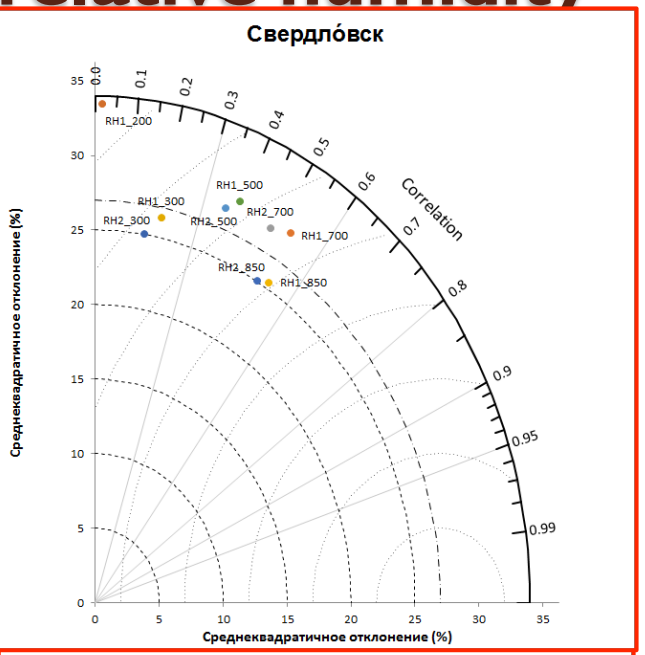
station 34172

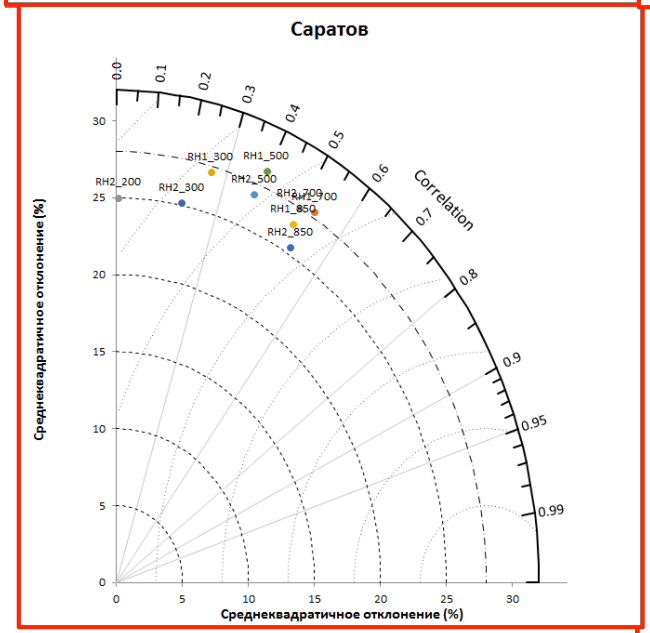


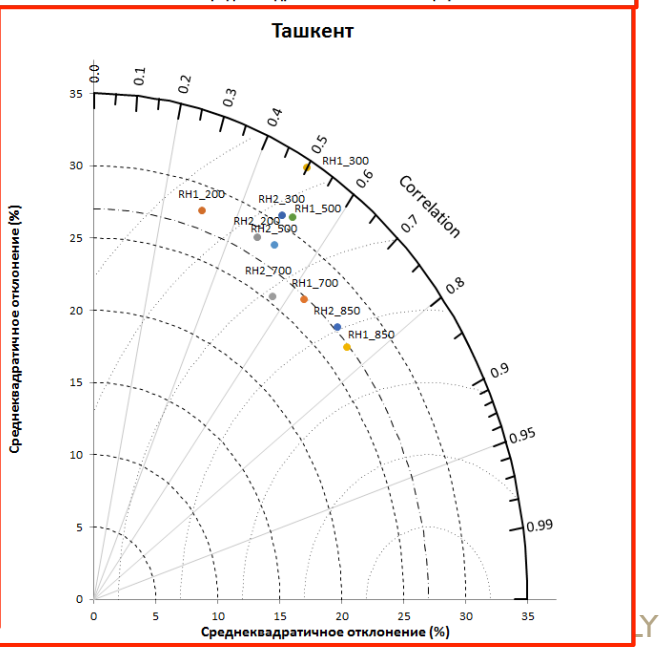


Upper-air data: relative humidity









Upper-air data: relative humidity

station

Brown – 20CR v2, dark green –ERA20C

Conclusions

Reproducibility by ERA-20C and 20CR v.2 was assessed based on 41 stations early data and on 41 station climatology

For monthly STD values: STD's for T, and RH agree pretty well. No persistent shifts. But: Monthly STD in reanalyses are underestimated for W, esp. in stratosphere

For monthly mean values:

T: In 20CR v.2 polar stratosphere is essentially overcooled, polar troposphere is overcooled as well, but less. Both reanalyses and RIHMI data are highly correlated

W: differences are more essential, but no obvious shifts

RH: essential differences between all values, low correlations, and persistent shifts are hardly detectable

The QCd data were provided to ERA CLIM2

Deliverable 4.5 will be uploaded within this month

Looking forward to obtain access to reanalyses that used rescued UA data to assess effects from the inputs of UA data!

A paper at WCRP Int. Reanalysis Conference

Brown – 20CR v2, dark green –ERA20C

Thank you for attention!