



Characteristics of the radiation balance of the tundra from measurements at HMO Tiksi and Comparison of BSRN and Russian Radiation Techniques

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- The Baseline Surface Radiation Network (BSRN) Program was developed in 1992 to provide a worldwide network to continuously measure short-wave and long-wave radiative fluxes at the Earth's surface with standardized and rigorously calibrated measurements suitable for climate monitoring. As of 2008 BSRN had 43 stations reported. The Former Soviet Union operated 160 actinometric stations starting in 1955 with similar motivations of characterizing solar direct and diffuse radiation properties for environmental monitoring. In Tiksi, Russia at the new International Hydrometeorological Observatory, radiation measurements are being made with both standard Russian radiation sensors and a full BSRN suite of sensors. This study presents inter-comparison of the measurements of direct, total, and diffuse solar radiation. These results had be used to evaluate the usability of the extensive and multi-decadal Russian radiation network as a foundation for long-term Arctic climate studies.S

Instruments

Russian sensors, installed in HMO
Tiksi



Sensors BSRN on the roof of HMO
Main building



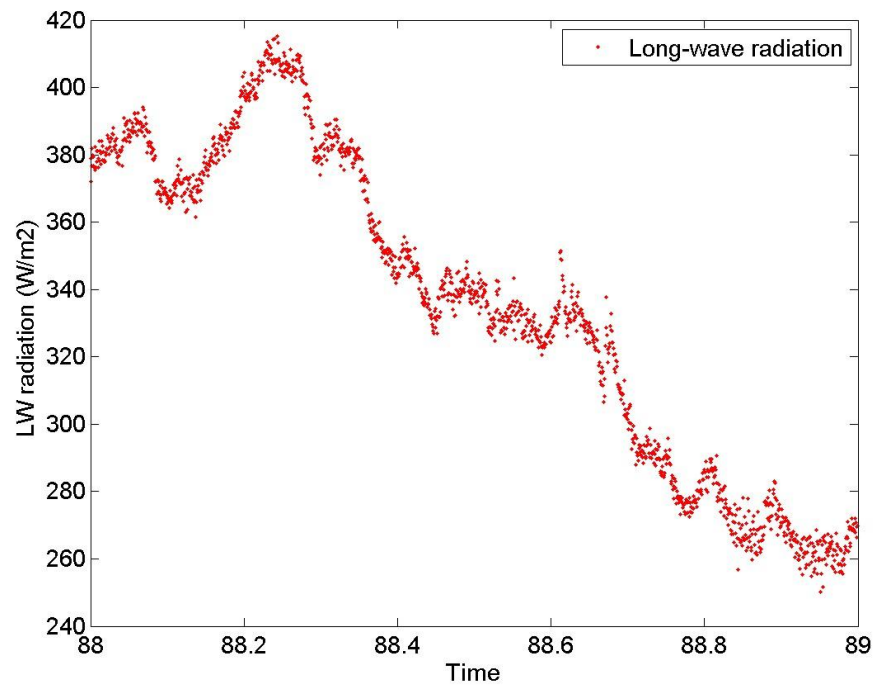
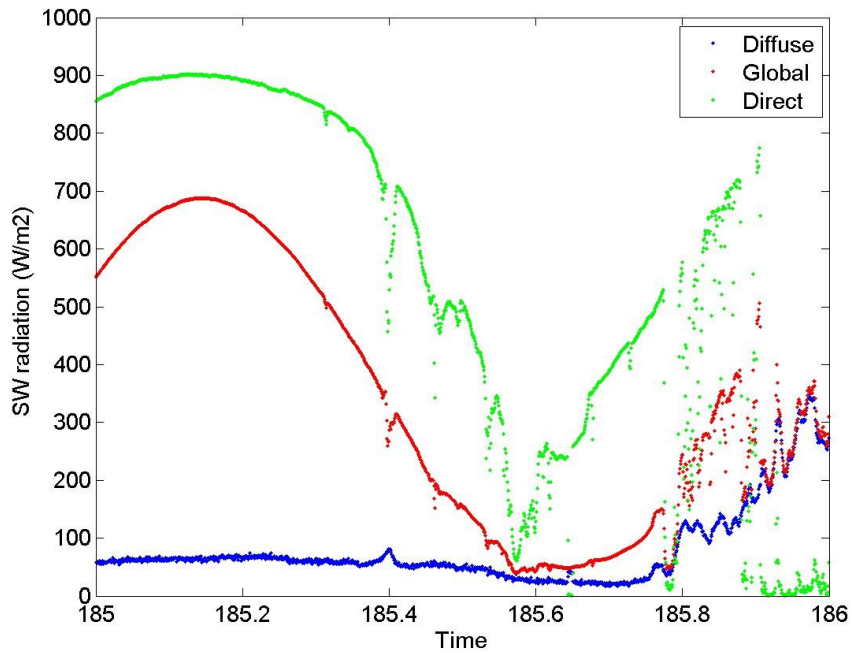
Albedo rack

- The Russian radiation sensors (MF-19) installed at September 2009.
- BSRN sensors installed at June 2010
- Albedo rack installed at April 2011

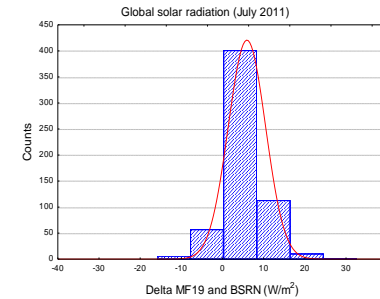
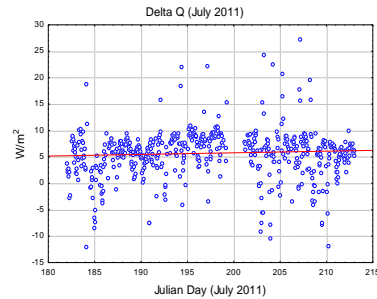
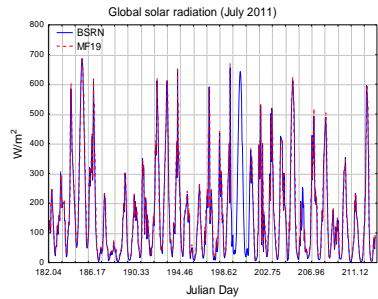
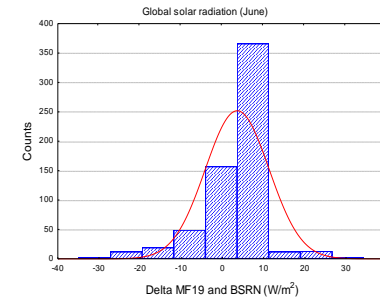
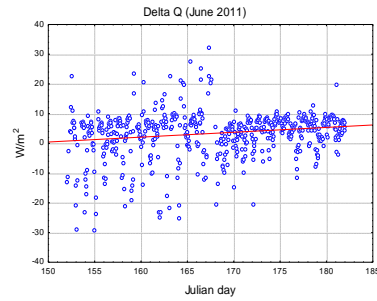
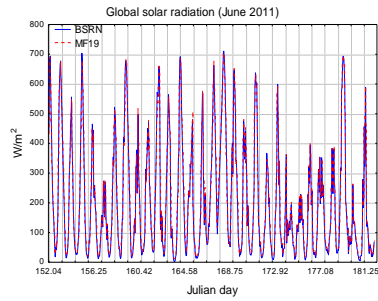
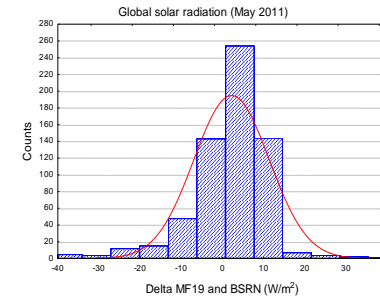
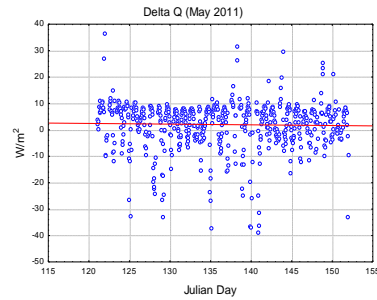
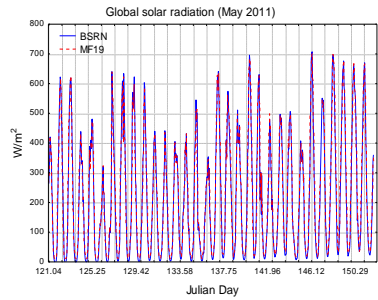
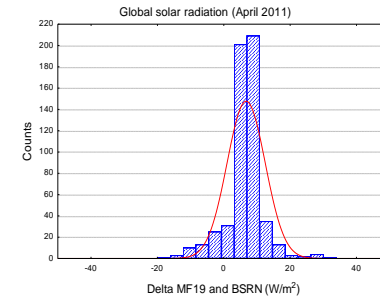
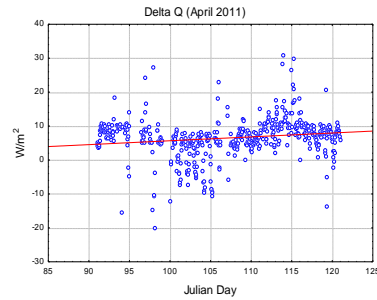
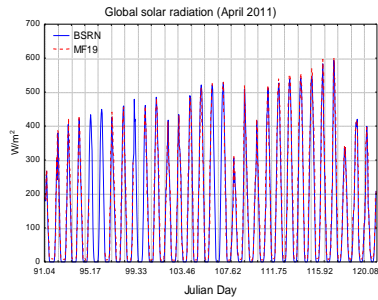
Technical characteristics

Parameter/Sensor	Characteristics
Direct solar radiation Eppley NIP	Spectral range: 200 – 4000 nm, measurement range: 0 – 1200 W/m ² , error: 2% or ±3 W/m ²
Global solar radiation CMP22 (Kipp&Zonen)	Spectral interval: 200 – 4000 nm, measurement range: 0 – 4000 W/m ² , error: ±9 W/m ²
Diffuse solar radiation PSP (Eppley)	Spectral interval: 200 – 4000 nm, measurement range: 0 – 1000 W/m ² , error: ±5 W/m ²
Global solar radiation MF-19 (M-80)	Spectral interval: 200 – 4000 nm, measurement range: 0.01 – 1600 W/m ² , error ±20 W/m ²
Direct solar radiation MF-19 (AT-50)	Spectral interval: 200 – 4000 nm, measurement range: 0.01 – 1600 W/m ² , error <1.7%
Long-wave radiaton PIR (Eppley)	Spectral interval: 4.5 – 42 μm, measurement range: 200- 4000 W/m ² , error: ±5 W/m ²

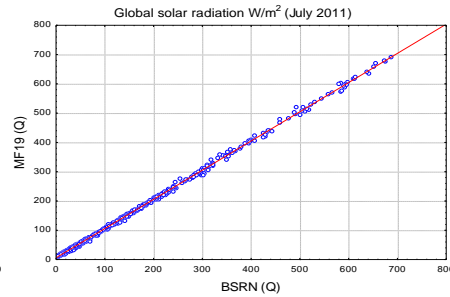
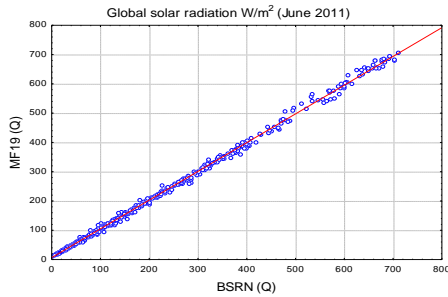
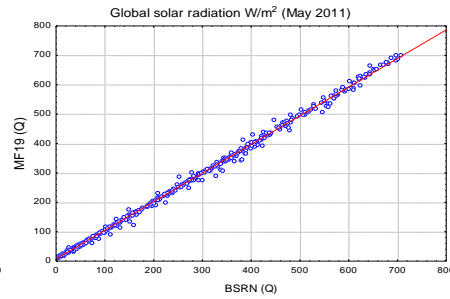
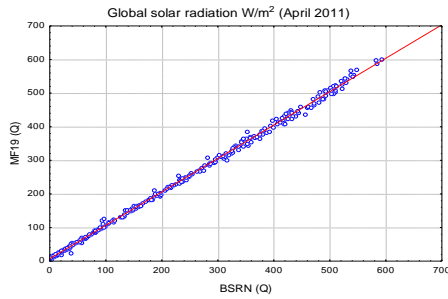
Daily data



Comparison of global radiation (Q) measurements in April – July 2011



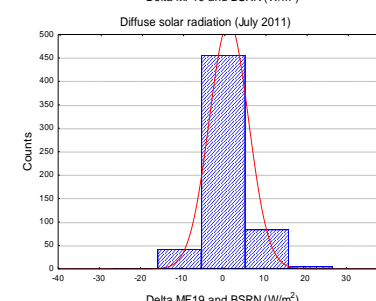
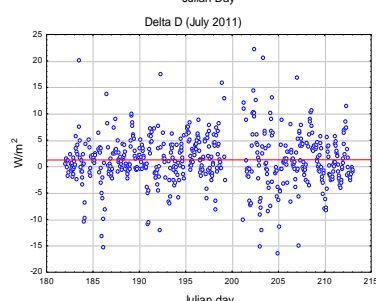
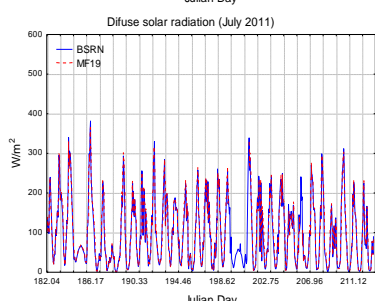
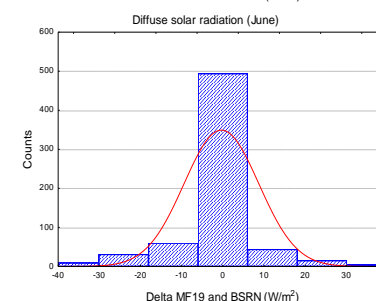
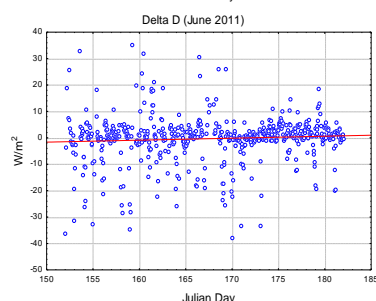
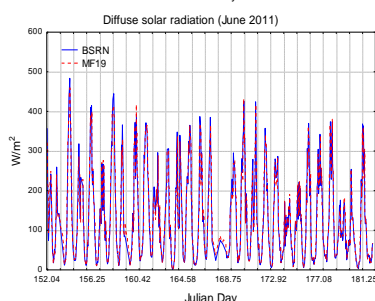
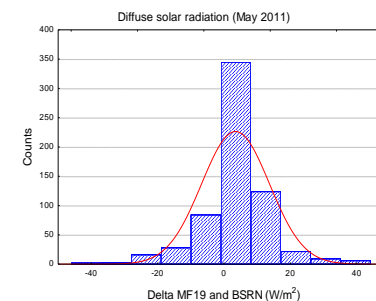
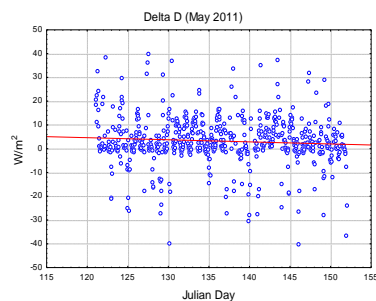
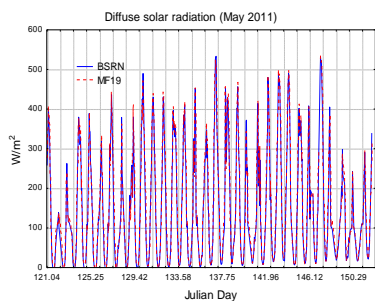
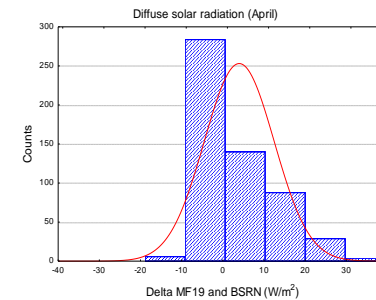
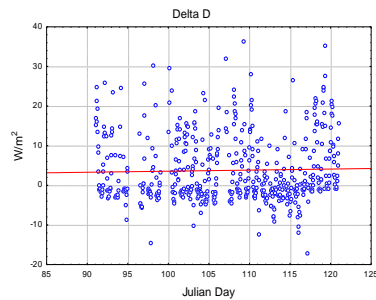
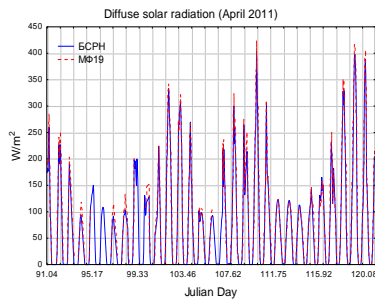
Statistics of comparison global radiation measurements data



	Mean MF-19	Mean BSRN	Mean delta	STD of delta	R
April	150,2	144,7	6,4	5,7	> 0.99
May	208,6	207,3	2,0	9,1	> 0.99
June	192,2	188,9	3,4	7,7	> 0.99
July	151,6	150,7	5,7	4,5	> 0.99

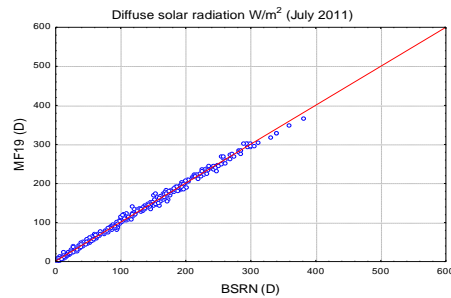
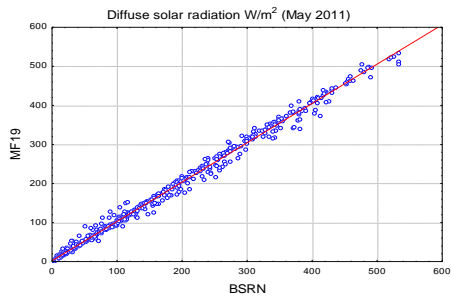
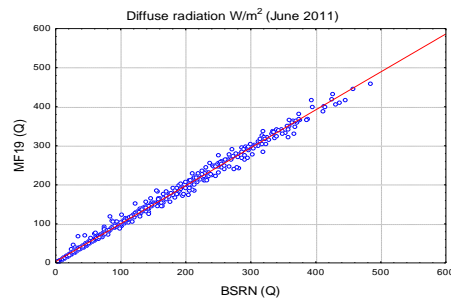
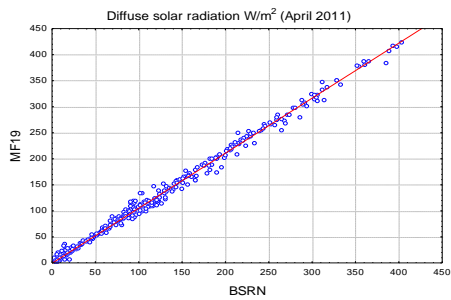


Comparison of diffuse radiation (D) measurements in April – July 2011





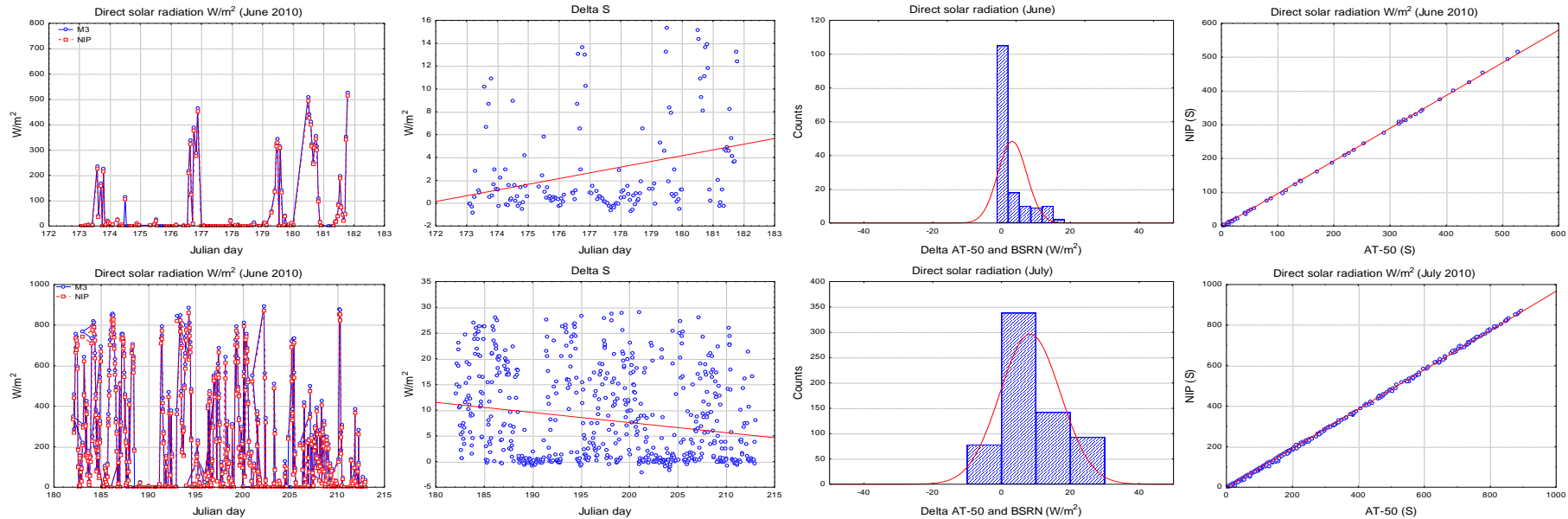
Statistics of comparison diffuse radiation measurements data



	Mean MF-19	Mean BSRN	Mean delta	STD of delta	R
April	81,3	75,8	3,8	8,4	> 0.99
May	148,5	146,1	3,2	10,1	> 0.99
June	130,4	130,7	-0,3	8,6	> 0.99
July	95,8	92,6	1,2	4,7	> 0.99



Comparison of direct radiation measurements (Dir) in June – July 2011

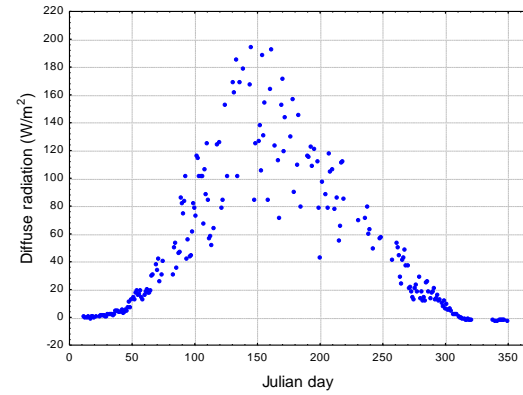
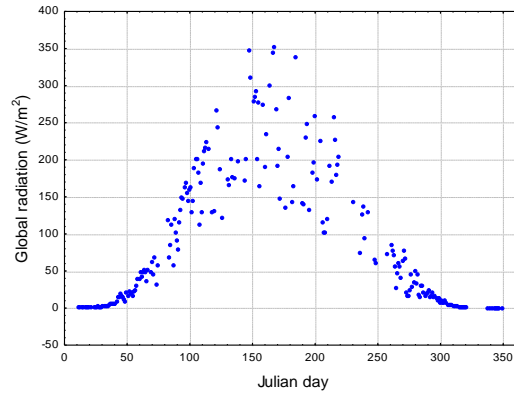
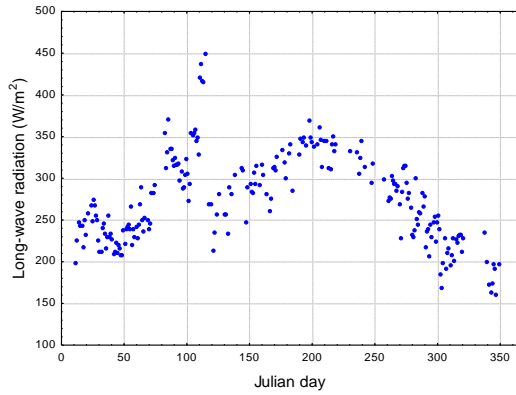


Statistics of comparison of direct radiation measurements data

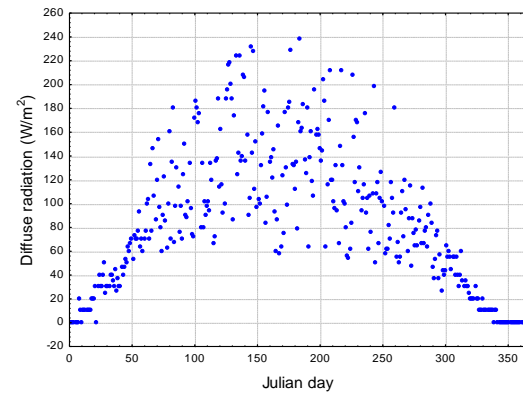
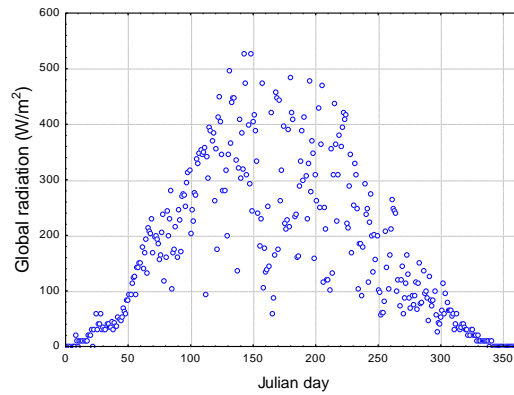
Direct	Mean AT-50	Mean NIP	Mean delta	STD of delta	R
July	181.32	173.27	9.28	9.77	> 0.99

Daily averaged data plots

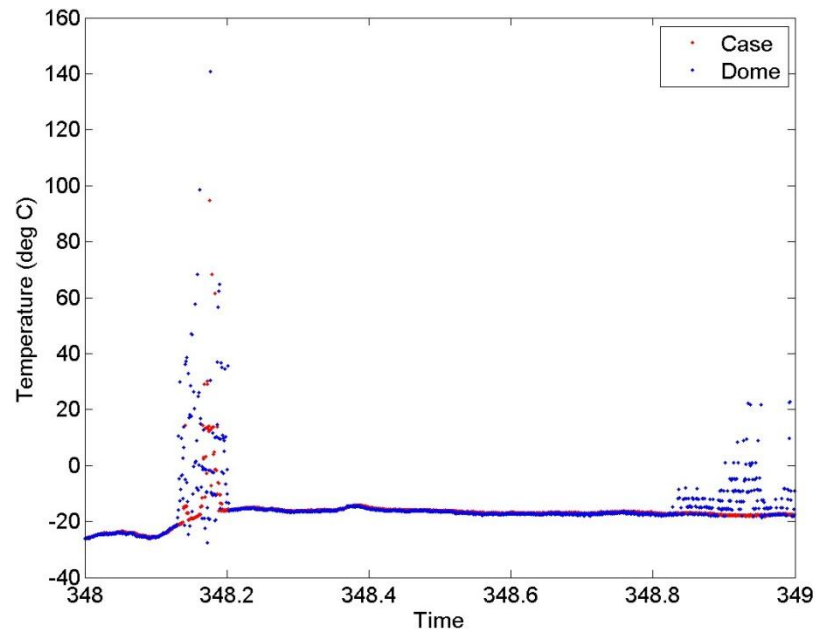
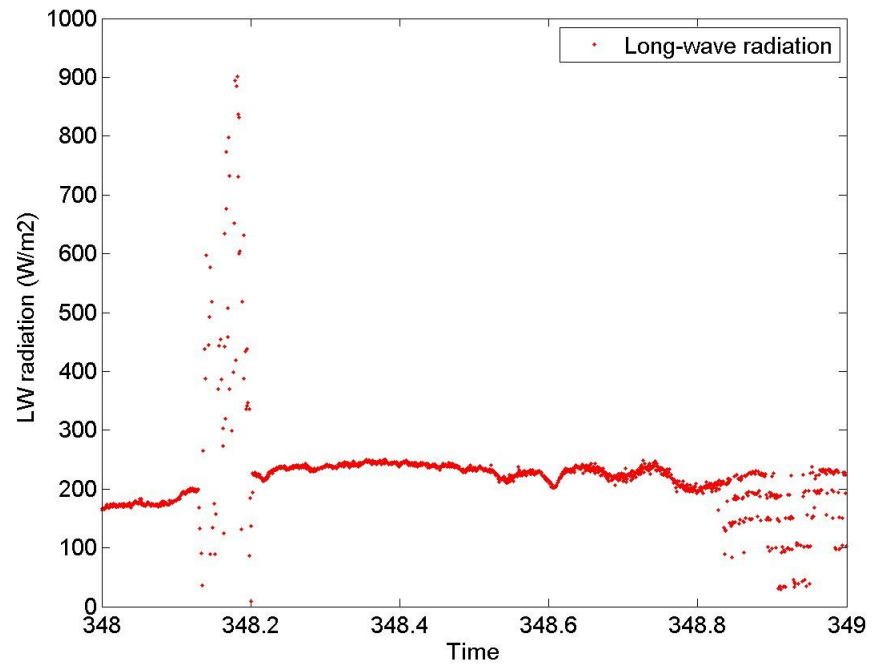
Tiksi



Verhojansk



Possible errors



Summary

- Comparative analysis has show a good results. A more detailed analysis in the future will allow to match the data of observations of the 20th century from USSR meteorological stations with the modern data.

- To obtain the best results all sensors should be calibrated at 2013 year.
- Spare set of instruments.
- Obtain regular maintenance of sensors.



Thank you for attention!