

Solar radiation measurements at Budapest-Lőrinc station, Hungary

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Fig.1. Panoramic picture of Budapest-Lőrinc station

Introduction and brief history of station:

- Location: lat.47°50'N, long. 19°05'E, 139 m.a.s.l.
- Founded: 1st May, 1952
- Solar radiation measurements started in 1967 (global radiation and radiation balance).
- Budapest-Lőrinc is a WMO Regional Center for Solar Radiation from 1978.
- Calibration with Eppley HF absolute pyrheliometer from 1980.
- Observations of total ozone has been started in 1969 with Dobson spectrophotometer. The Brewer spectrophotometer was installed in March 1998.
- Monitoring of UV-B radiation has been started in 1994.

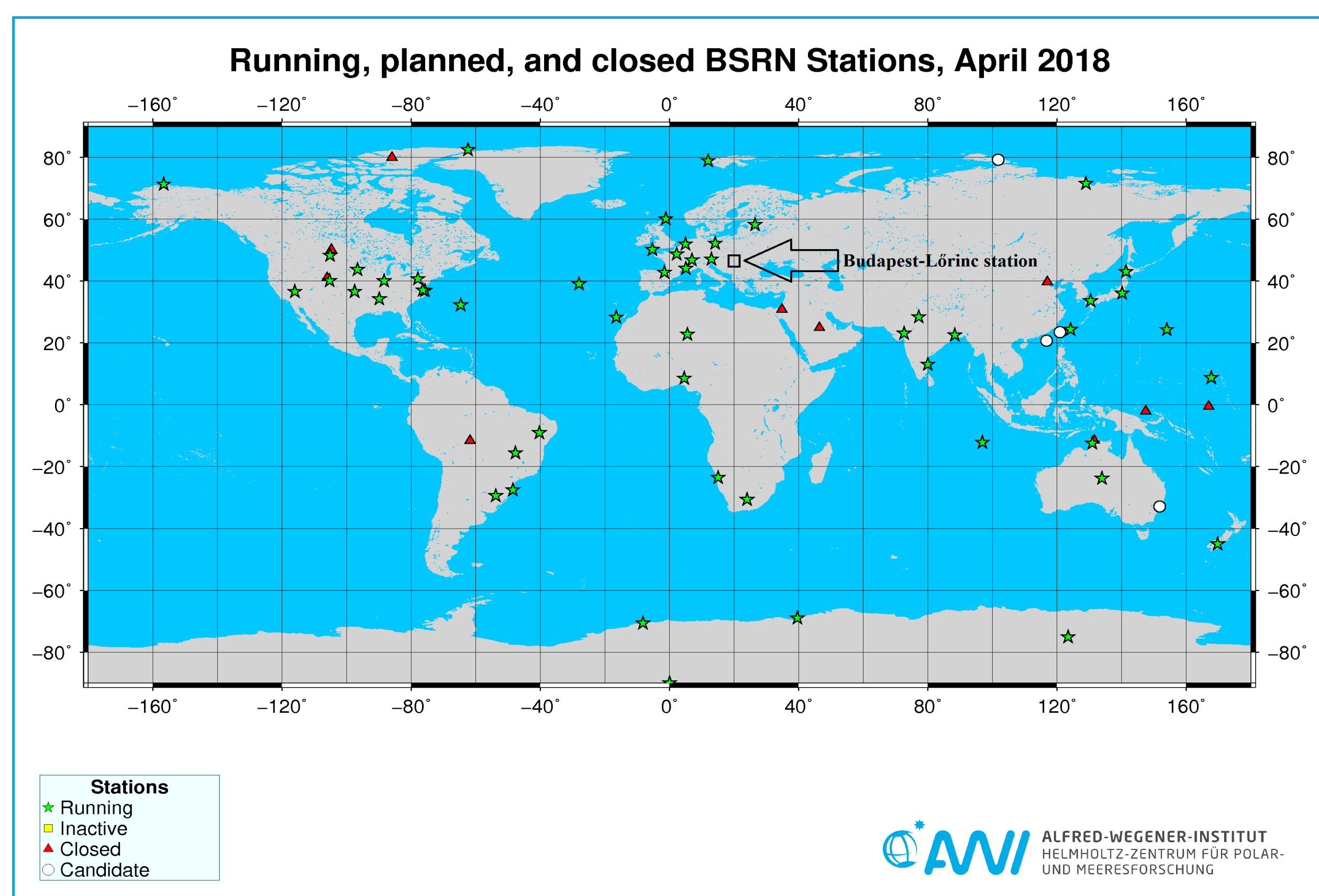


Fig.2. Location of Budapest-Lőrinc station

Additional measurements at Budapest-Lőrinc station:

- Total ozone and spectral UVB-UVA measurements with Brewer spectrophotometer;
- Broadband UVB measurements (SolarLight UV-Biometer);
- Air pressure measurements (Vaisala PTB 100);
- Air temperature and humidity measurements (Vaisala HMP 155);
- Professional synoptic station;
- Radiosonde launching twice a day (UTC 00 and 12);
- Cloud heights, cloud coverage, height of the mixture layer and boundary layer measurements (Lufft CHM 15k).

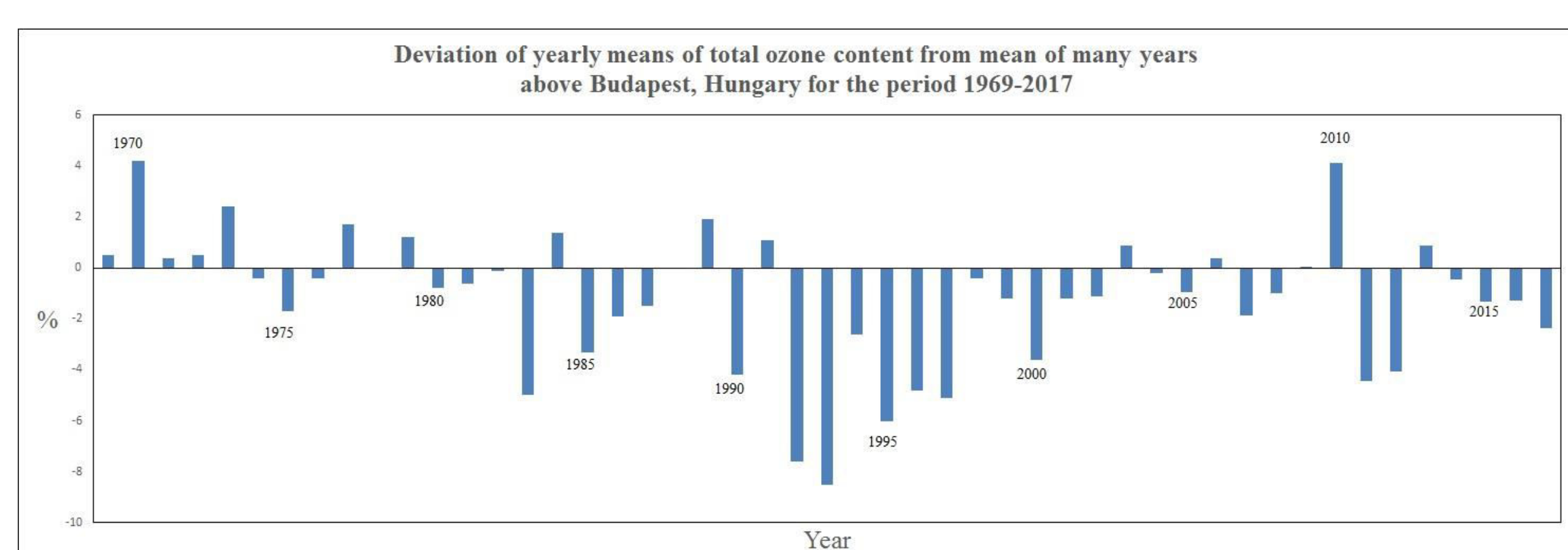


Fig.3. Percentage deviation of yearly means of total ozone from the mean of many years

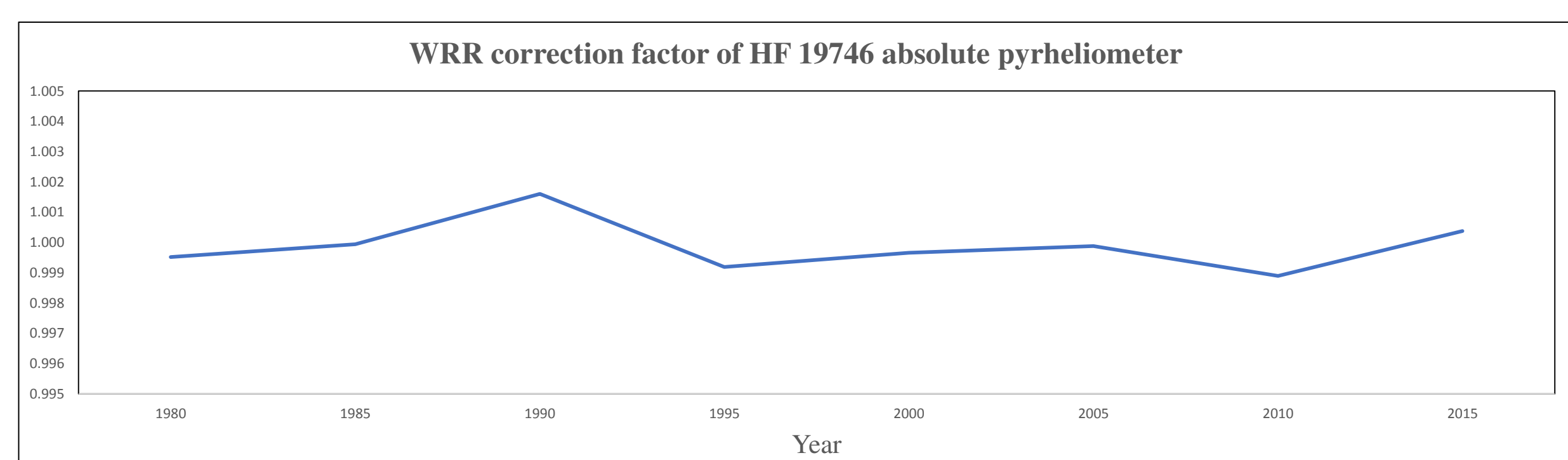


Fig.4. WRR correction factor of HF 19746

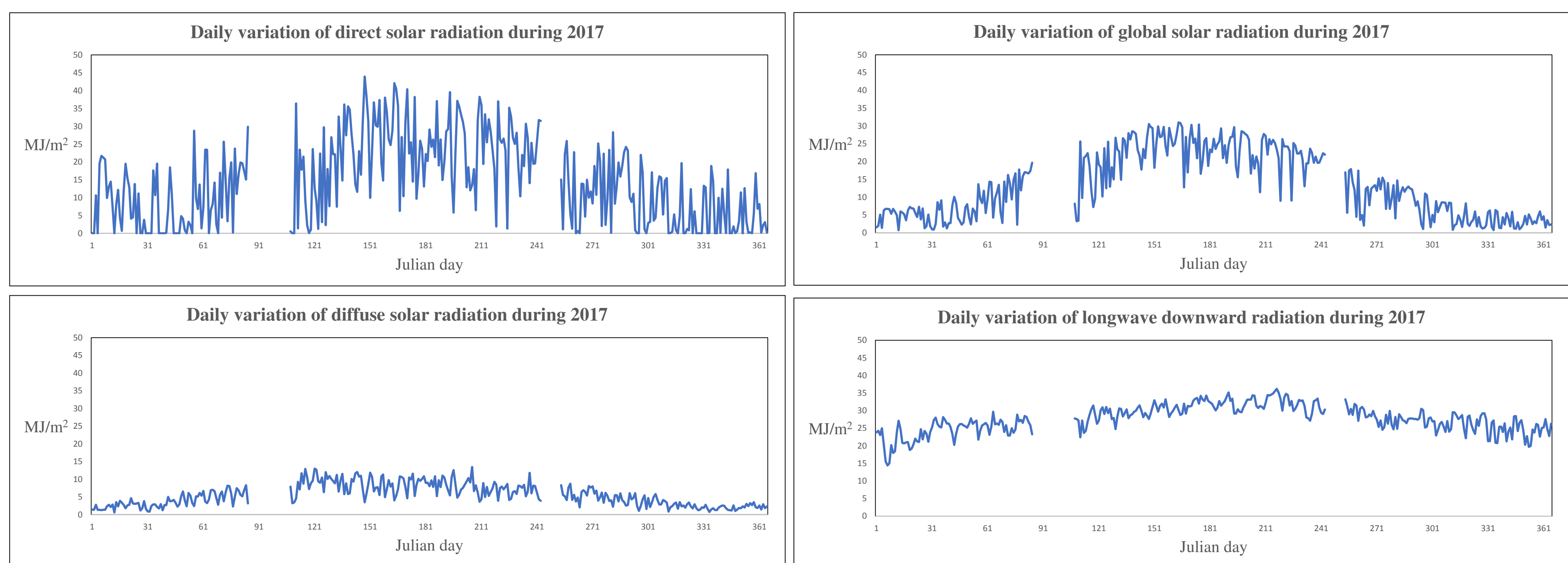


Fig.5. Daily variation of BSRN parameters

The components of the operational measurements program are as follows:

- Global solar radiation (Kipp&Zonen CMP11 pyranometer, ventilated);
- Reflected radiation (Kipp&Zonen CMP6 pyranometer);
- Longwave downward radiation (Kipp&Zonen CGR4 pyrgeometer, shaded and ventilated);
- Longwave upward radiation (Kipp&Zonen CGR3 pyrgeometer);
- Direct solar radiation (Kipp&Zonen CH1 pyrheliometer);
- Diffuse solar radiation (Kipp&Zonen CMP11 pyranometer, ventilated);
- Kipp&Zonen SOLYS2 Sun Tracker;
- Aerosol optical depth measurements with SP02 sunphotometer;
- Aerosol optical depth, total ozone and precipitable water vapor measurements with SolarSIM spectrophotometer;
- Campbell Scientific CR3000 data logger with 2 sec sampling time, 1 min (ave, min, max) and 10 min averages.



Fig.6. Global and UV radiation measuring instruments



Fig.7. SolarSIM spectrophotometer



Fig.8. Brewer spectrophotometer



Fig.9. Direct and diffuse radiation measuring instruments

Calibrating facilities:

For calibration of shortwave sensors a reference set is used with the next components:

- Kipp&Zonen BD solar tracker;
- HF19746 primary standard pyrheliometer (WRR constants since 1980 can be seen in Fig. 4);
- Two secondary standard Kipp&Zonen CH1 pyrheliometers;
- Hukseflux SR25 pyranometer to measure the reference diffuse radiation;
- Primary standard CMP11 pyranometer (ventilated);
- Agilent 34970A multimeter and Campbell Scientific CR3000 data logger with special program to control the calibration of reference set.

For calibration of the longwave sensors, modified reference Eppley PYR and Kipp&Zonen CGR4 pyrgeometers are used (last calibration of both was in WRC 09.2014).



Fig.10. Eppley PYR and Kipp&Zonen CGR4 pyrgeometers