Radiation measurements in Paramaribo, Suriname

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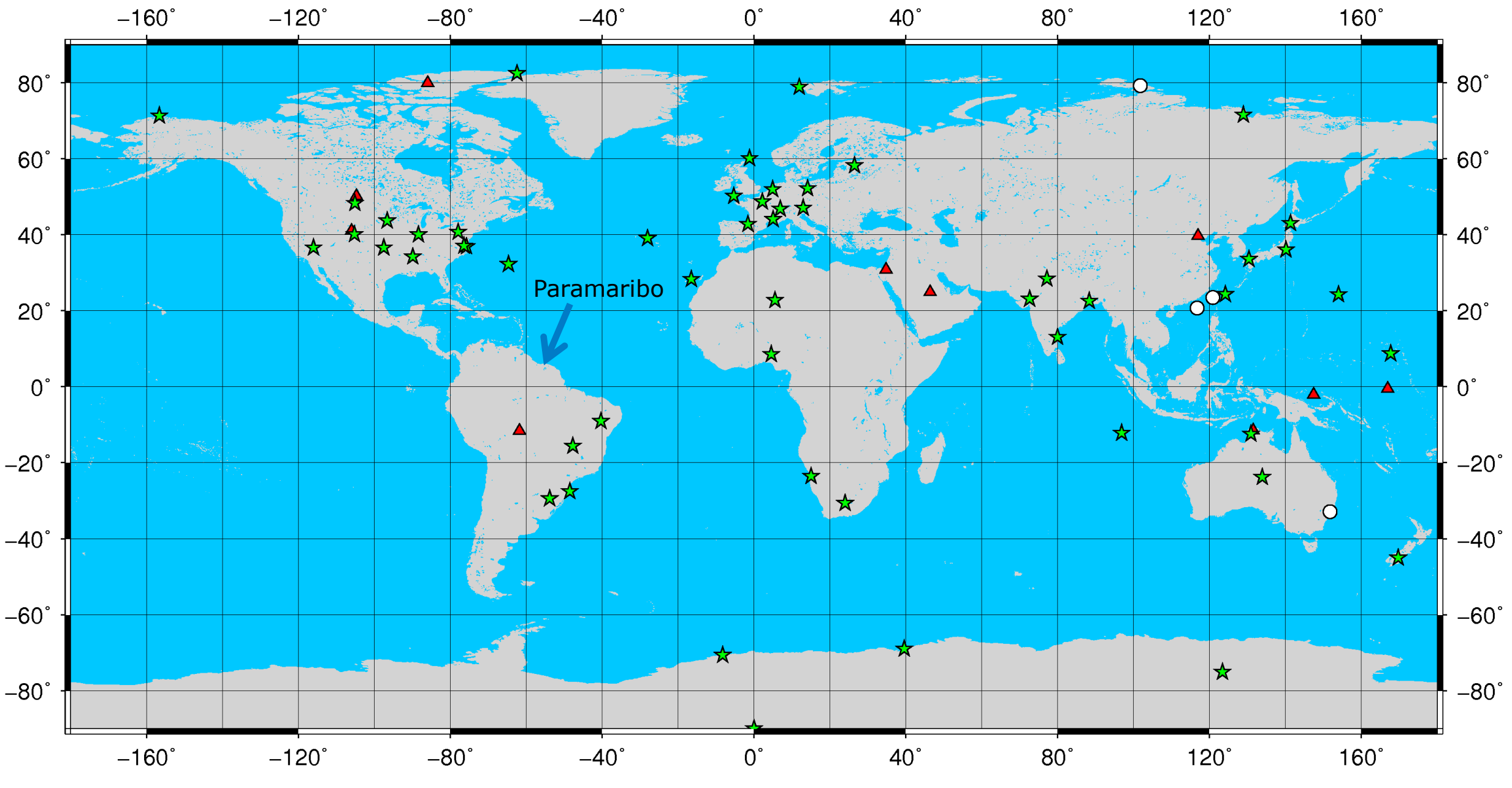
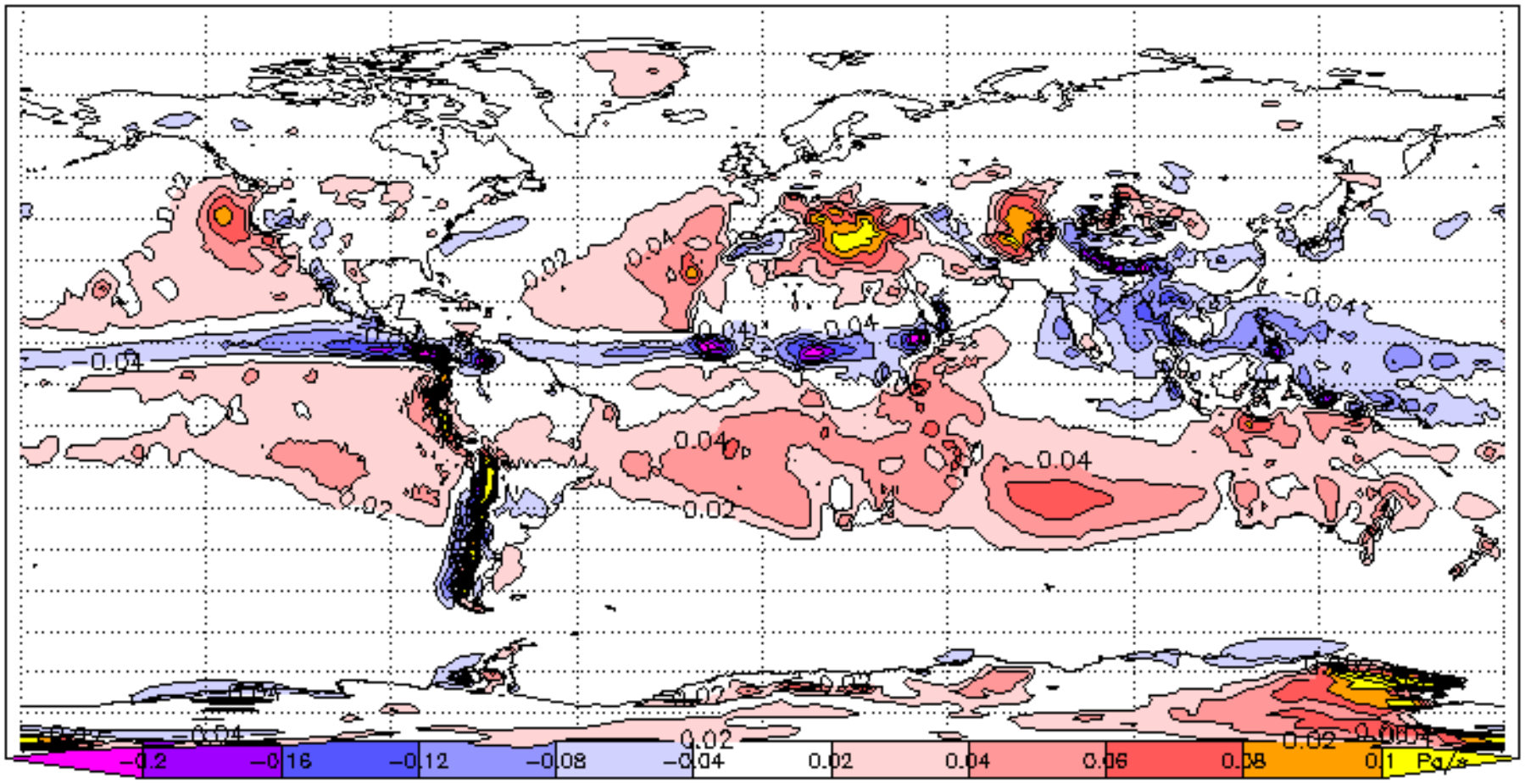
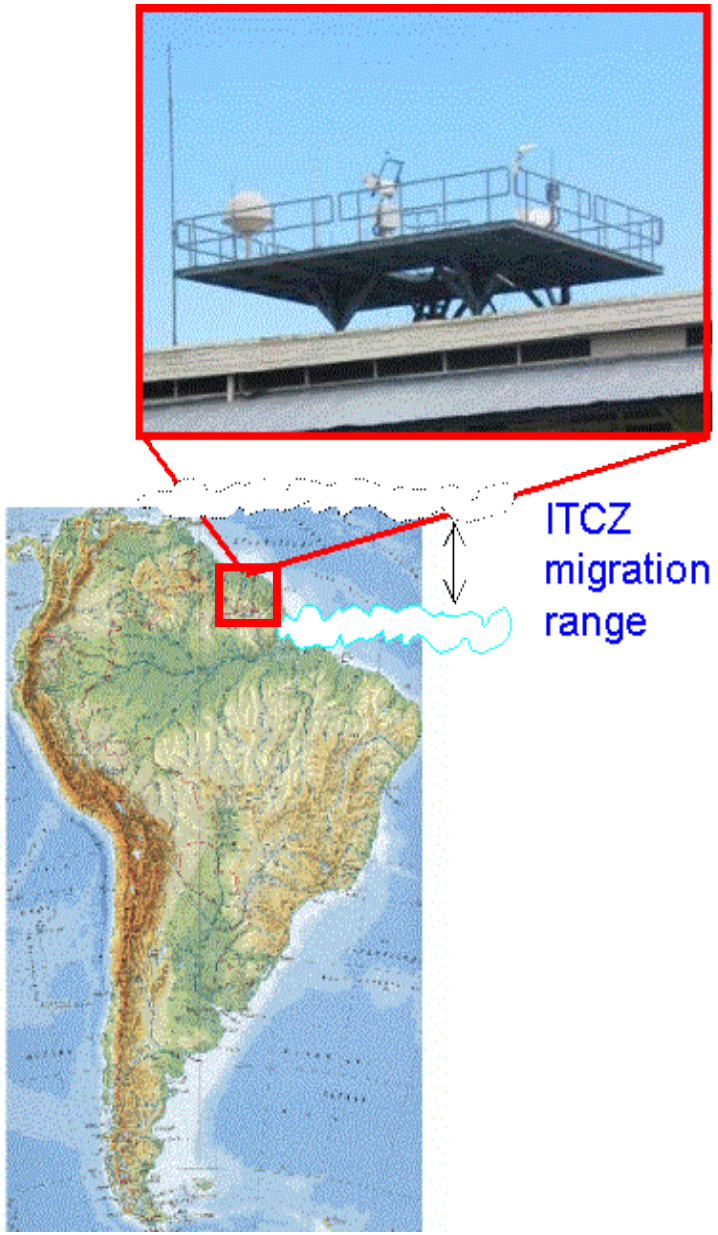
Running, planned, and closed BSRN Stations, April 2018



monthly average vertical wind at 500 hPa, July 1979

ITCZ - Intertropical Convergence Zone



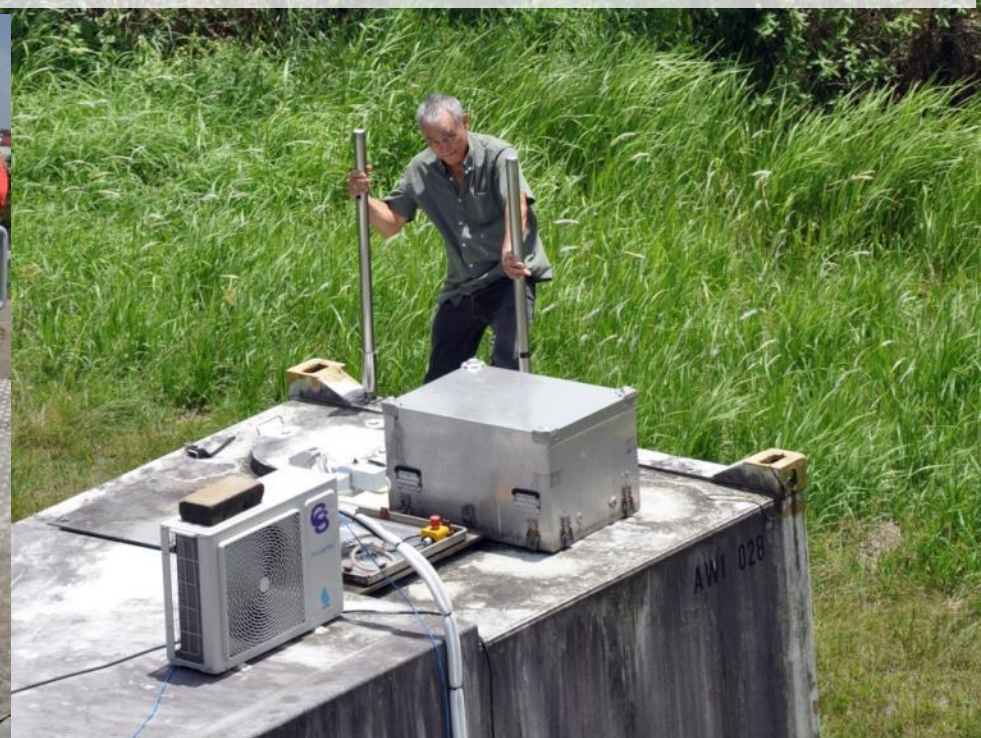


Suriname

- Tropical rainforest climate (i.e. >60mm rain in driest month)
- ITCZ migrates over the site twice per year
- Two rainy seasons, two dry seasons
- Unique location on two hemispheres

Paramaribo atmospheric observatory

- Operated by Meteorological Service of Suriname, in contract with KNMI
- Upper air measurements of ozone since 1999 (Brewer, ozonesondes).
- Participating in NDACC, SHADOZ, WOUDC, WMO-GAW.
- Hosted several measurement campaigns
- CO and CH4 measurements (FTIR), in contract with Univ. Bremen since 2005

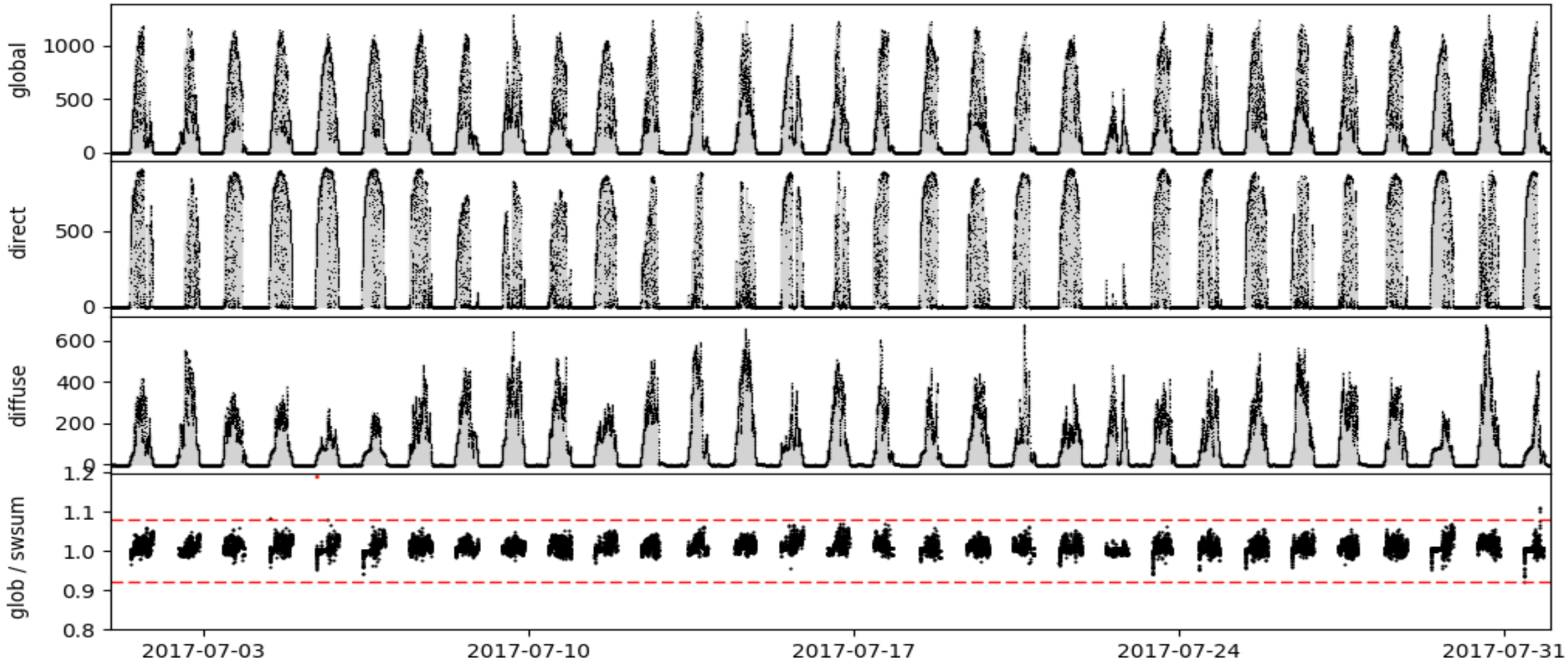


Radiation measurements:

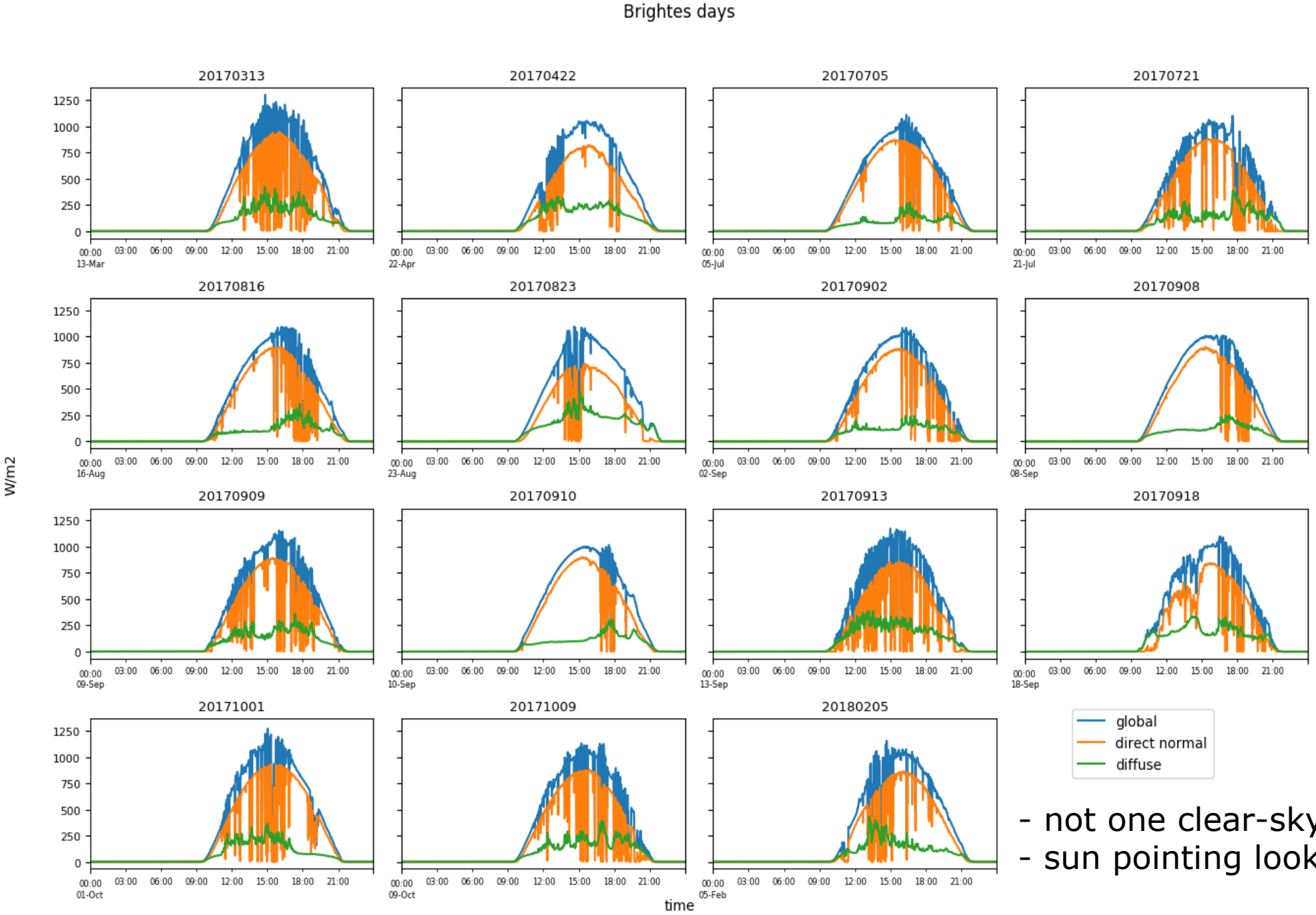
- SW direct, pyrheliometer K&Z CH1
- SW diffuse and global, pyranometer K&Z CM22
- LW downward, pyrgeometer K&Z CG4

} all calibrated in Davos: June 2018

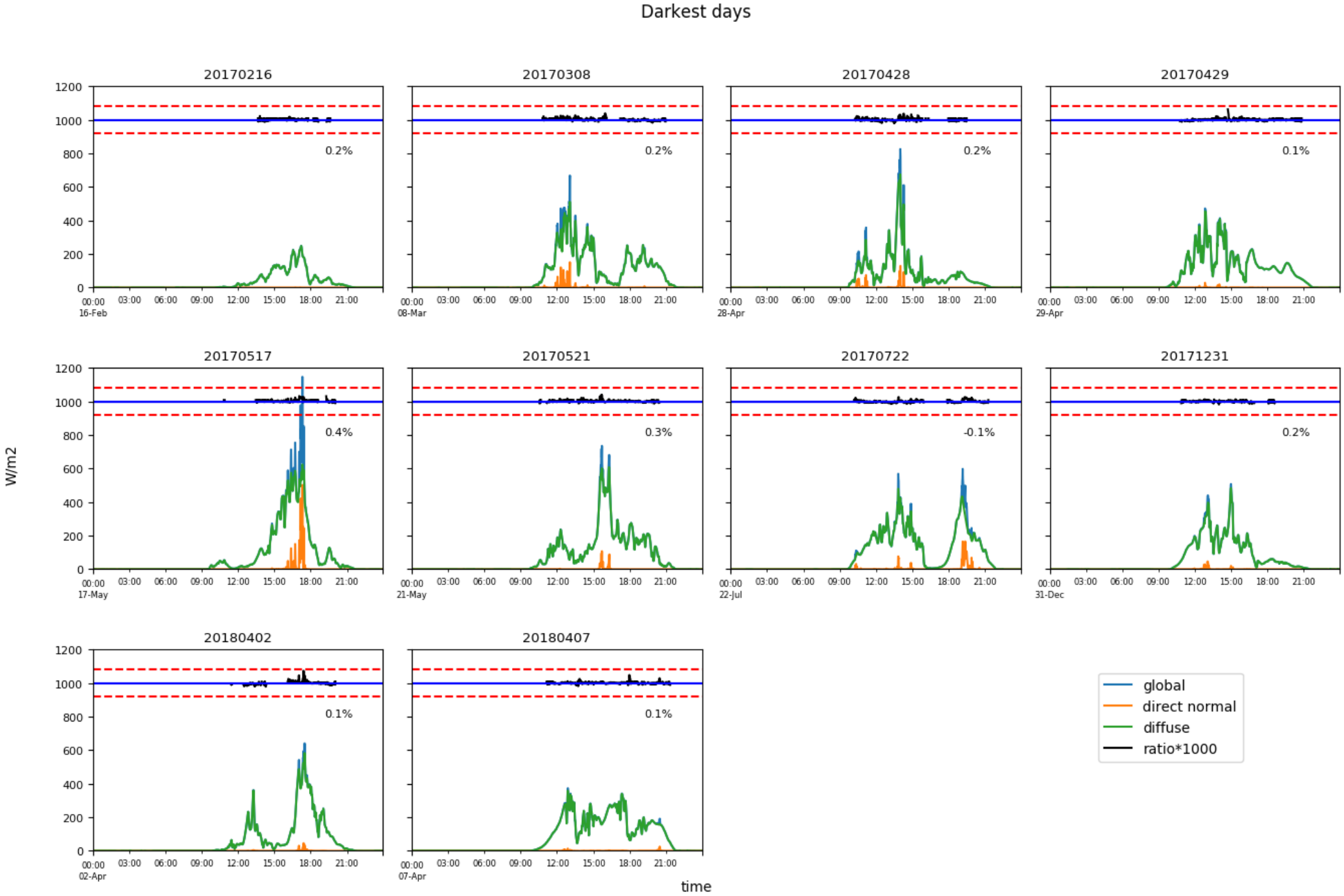
- all instruments mounted on sun tracker K&Z 2AP

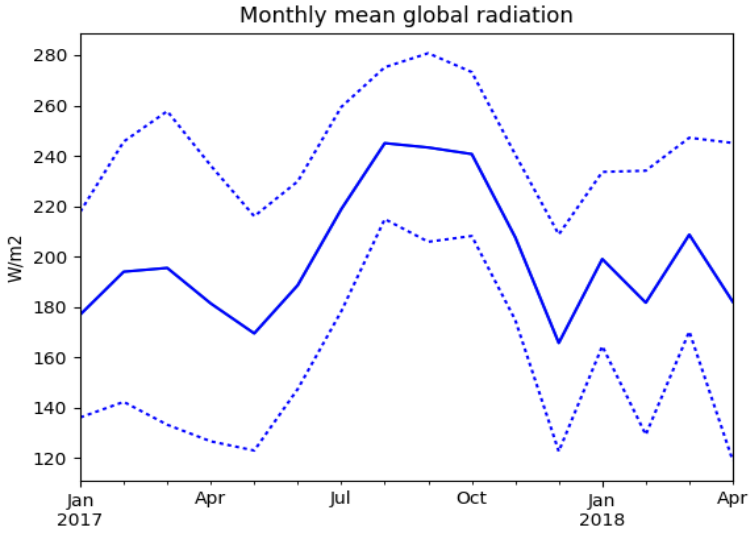


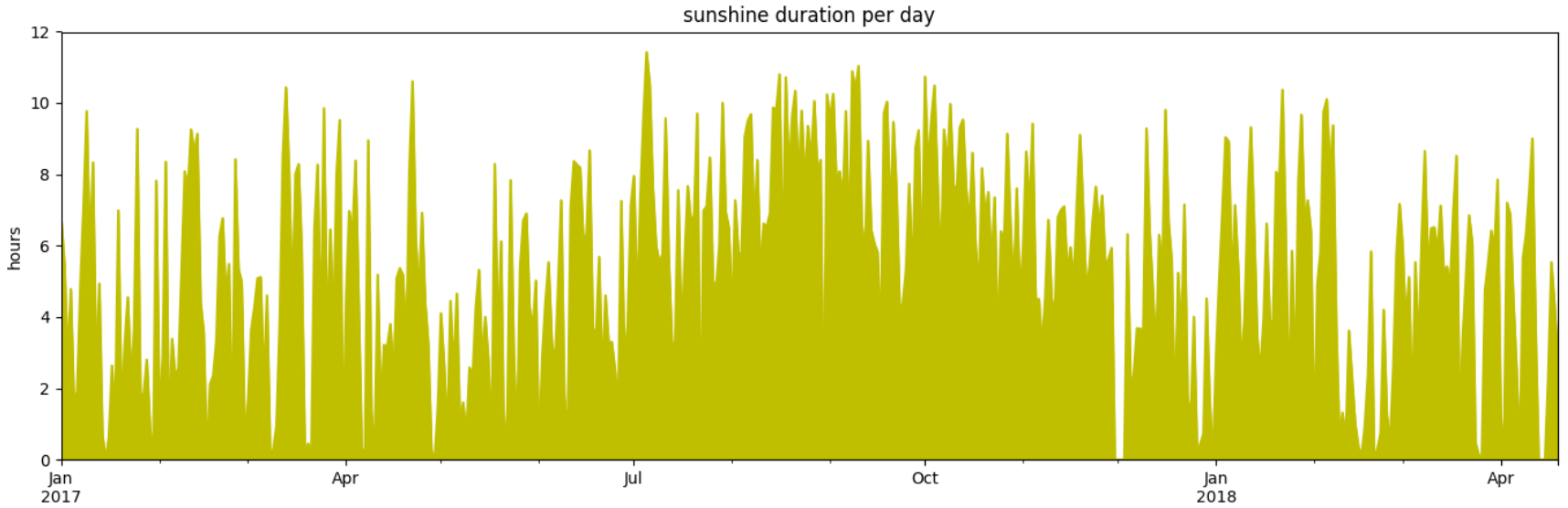
- instruments measuring since 2007
- pointing and time-synchronization much improved since 2017
- data presented here: January 2017-April 2018



- not one clear-sky day in 16 months!
- sun pointing looks ok (not totally off)


Darkest days
20170216
20170308
20170428
20170429
20170517
20170521
20170722
20171231
20180402
20180407
0.2%
0.2%
0.2%
0.1%
0.4%
0.3%
-0.1%
0.2%
0.1%
0.1%
W/m2
time
global
direct normal
diffuse
ratio*1000

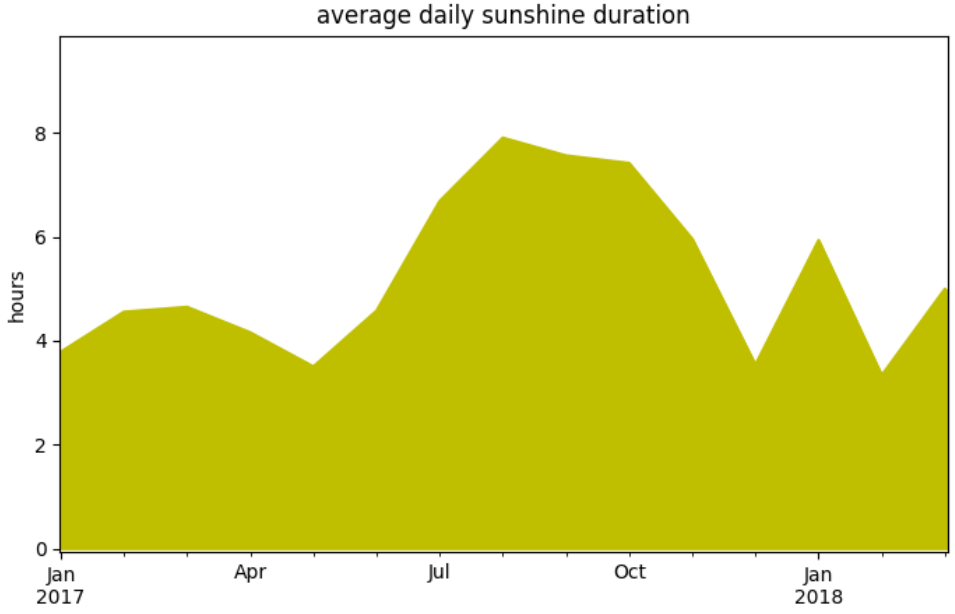




mean global radiation: ~200 W/m2

standard deviation of daily means: ~50 W/m2

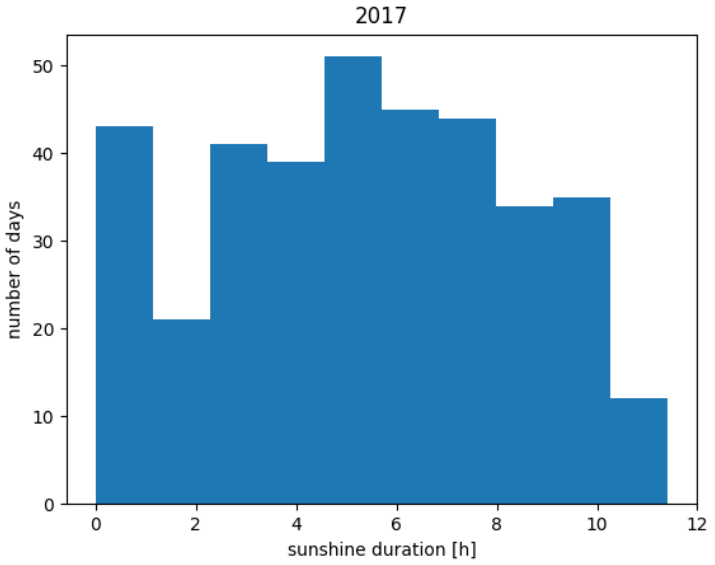
January 2017 – April 2018

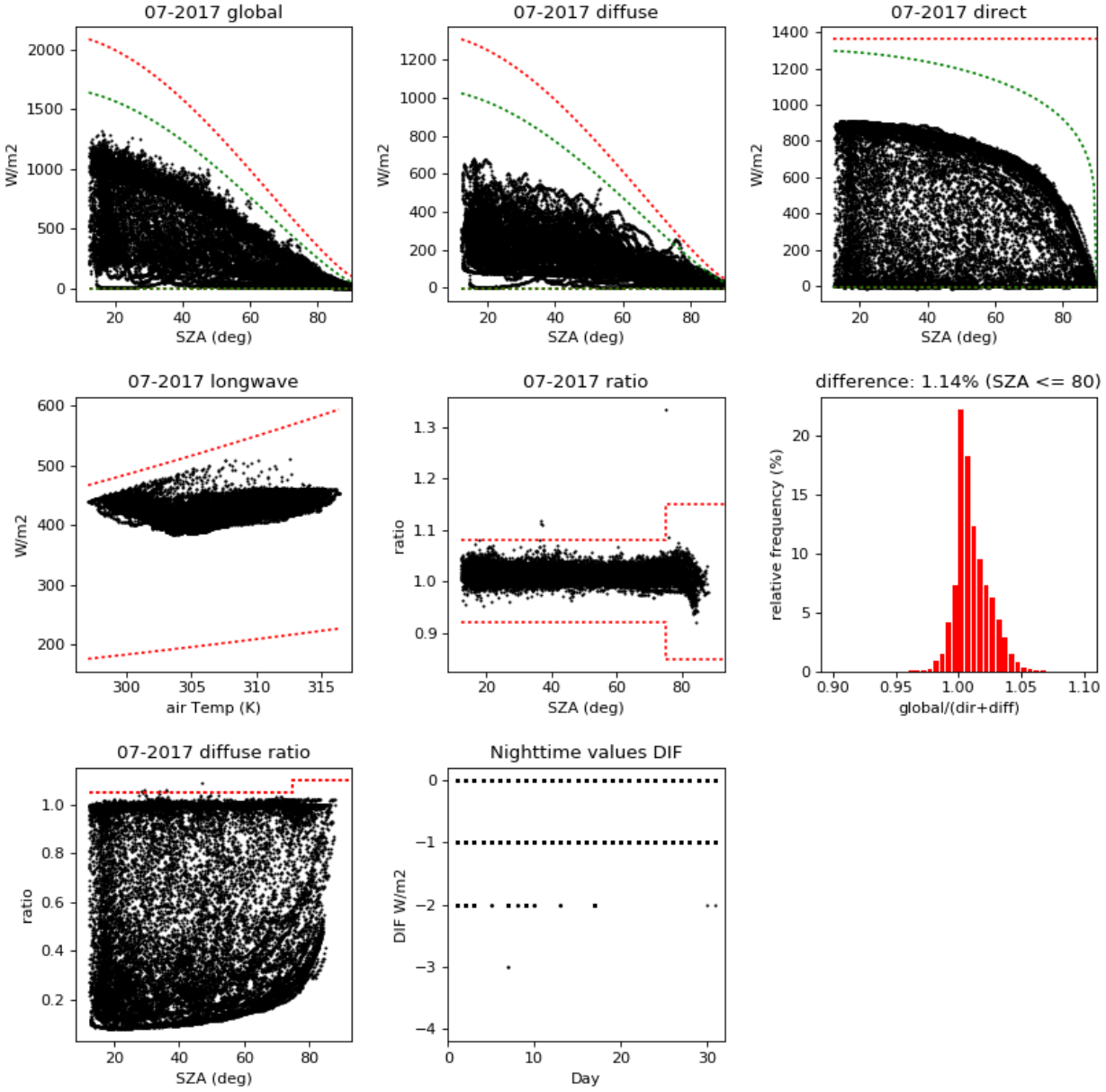


sunshine duration:

average 5 hours per day in 2017

similar to the Netherlands





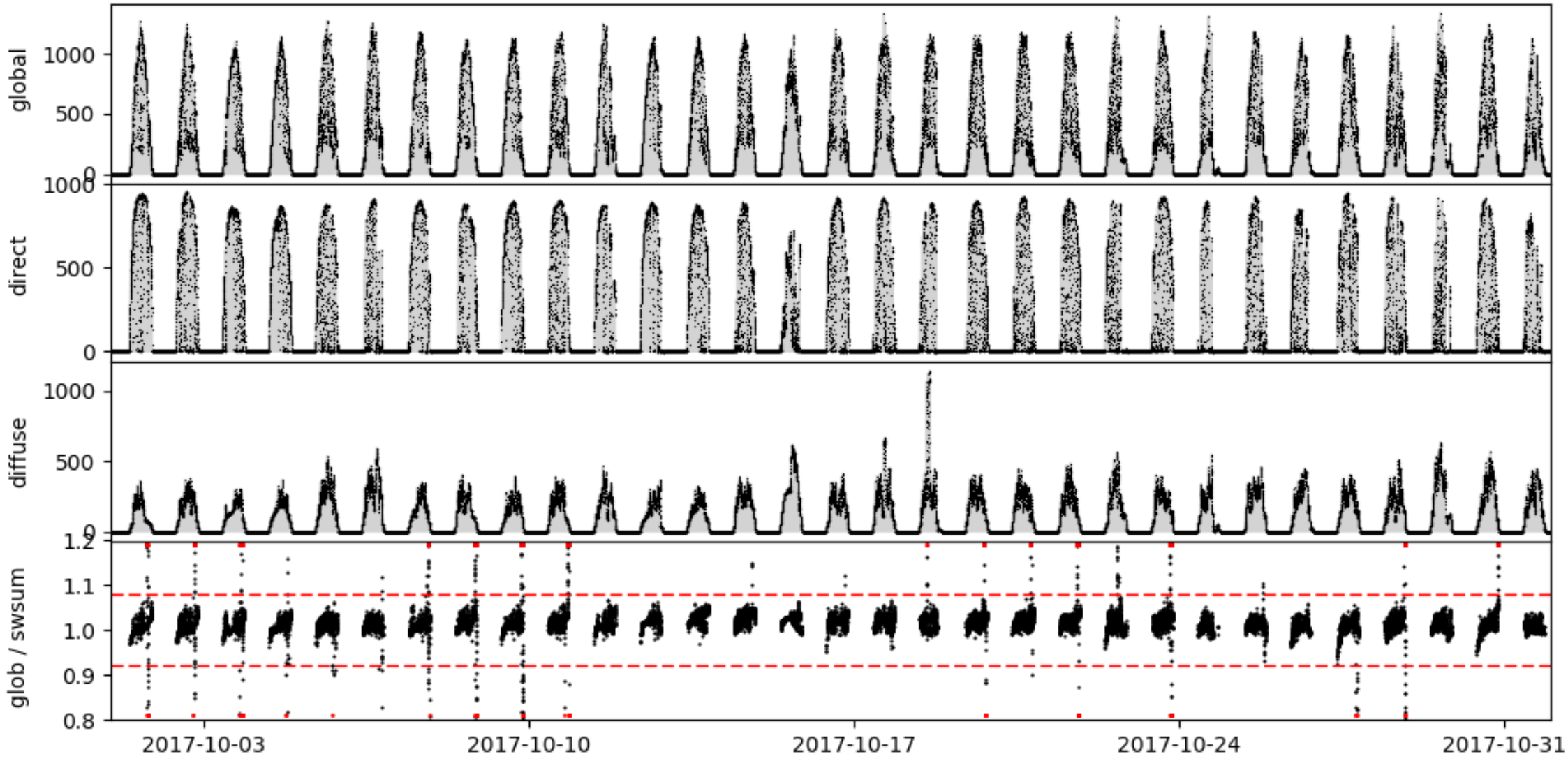
Quality checking

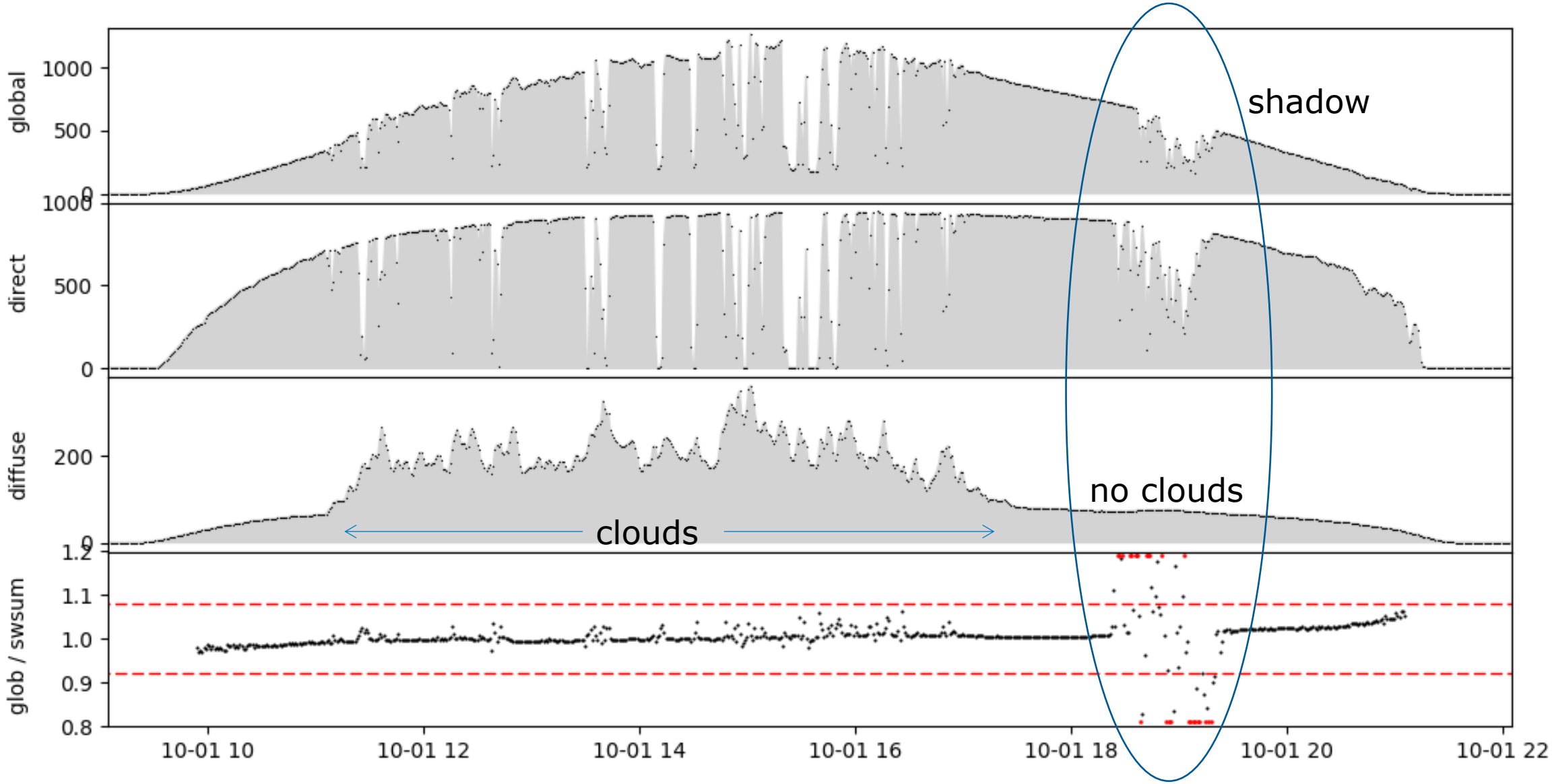
following BSRN QC tests, V2.0 (Long & Dutton):

- physically possible limits
- extremely rare limits
- limits global / sw-sum
- limits diffuse / global
- comparison LWdn to air temp (since July 2018)

in addition:

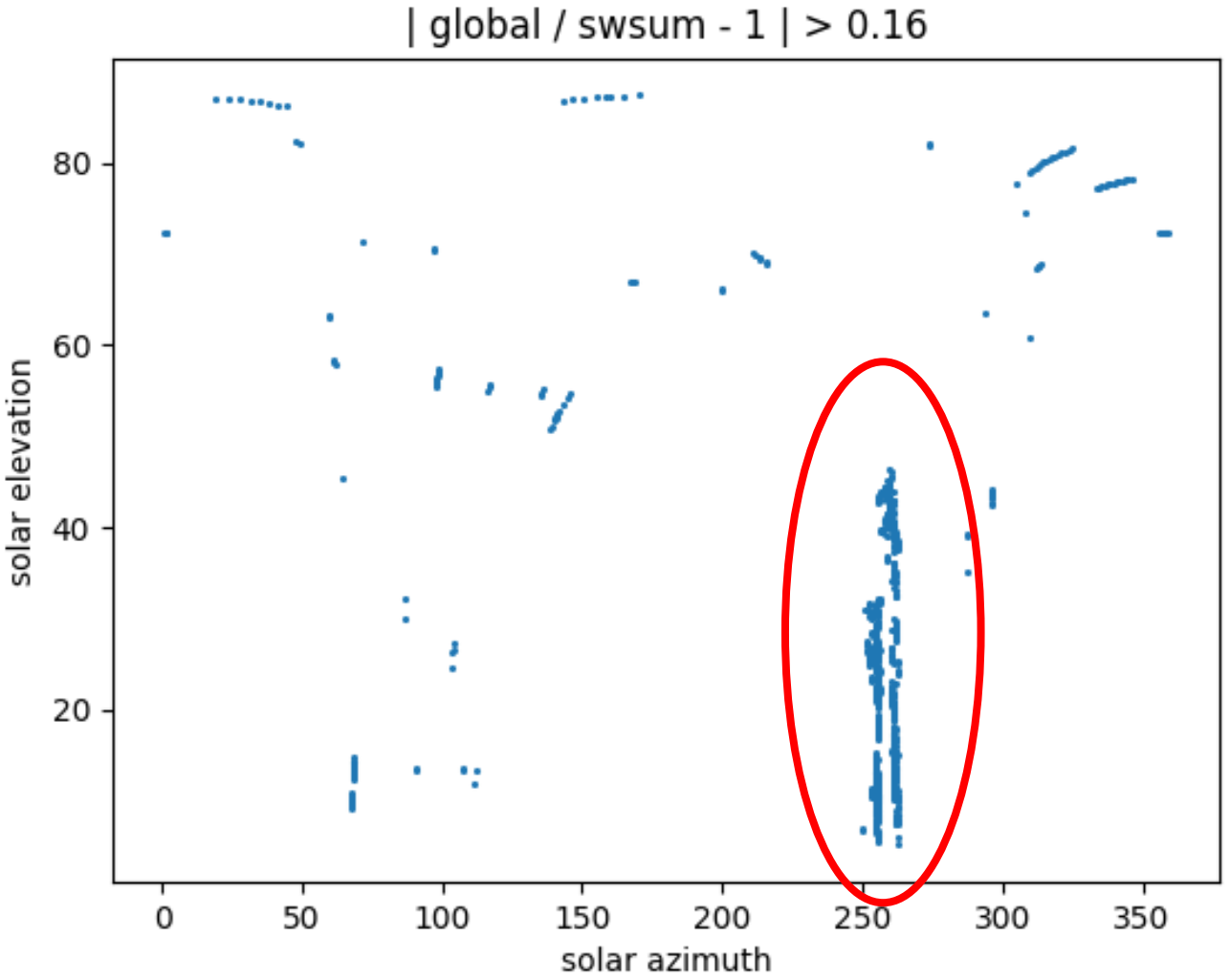
- nighttime values diffuse, to detect instrumental problems
- distribution of ratio global / sw-sum
- timelines


global
1000
500
0
direct
1000
500
0
diffuse
1000
500
0
glob / swsum
1.2
1.1
1.0
0.9
0.8
2017-10-03
2017-10-10
2017-10-17
2017-10-24
2017-10-31

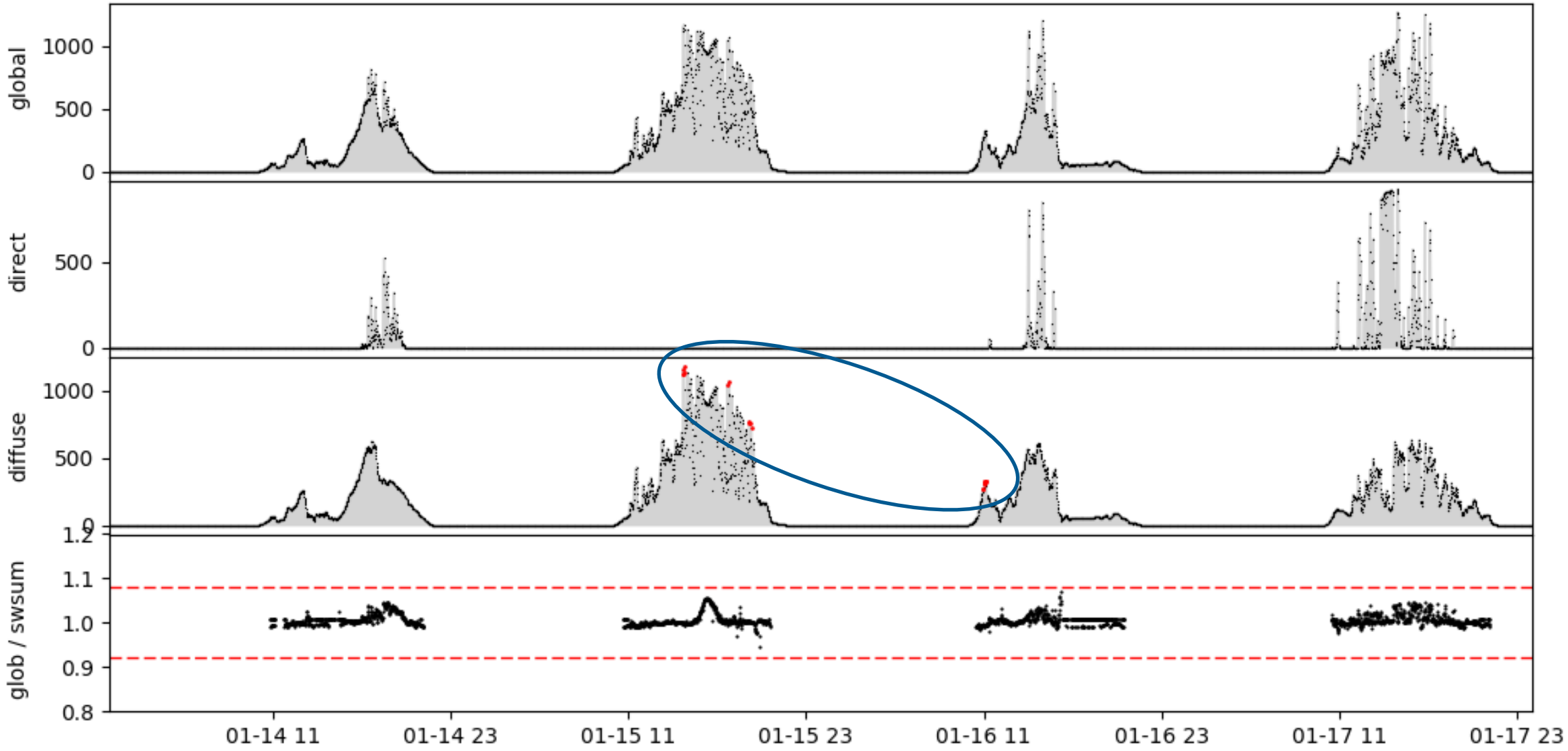

global
1000
500
0
direct
1000
500
0
diffuse
200
0
glob / swsum
1.2
1.1
1.0
0.9
0.8
shadow
no clouds
clouds
10-01 10
10-01 12
10-01 14
10-01 16
10-01 18
10-01 20
10-01 22

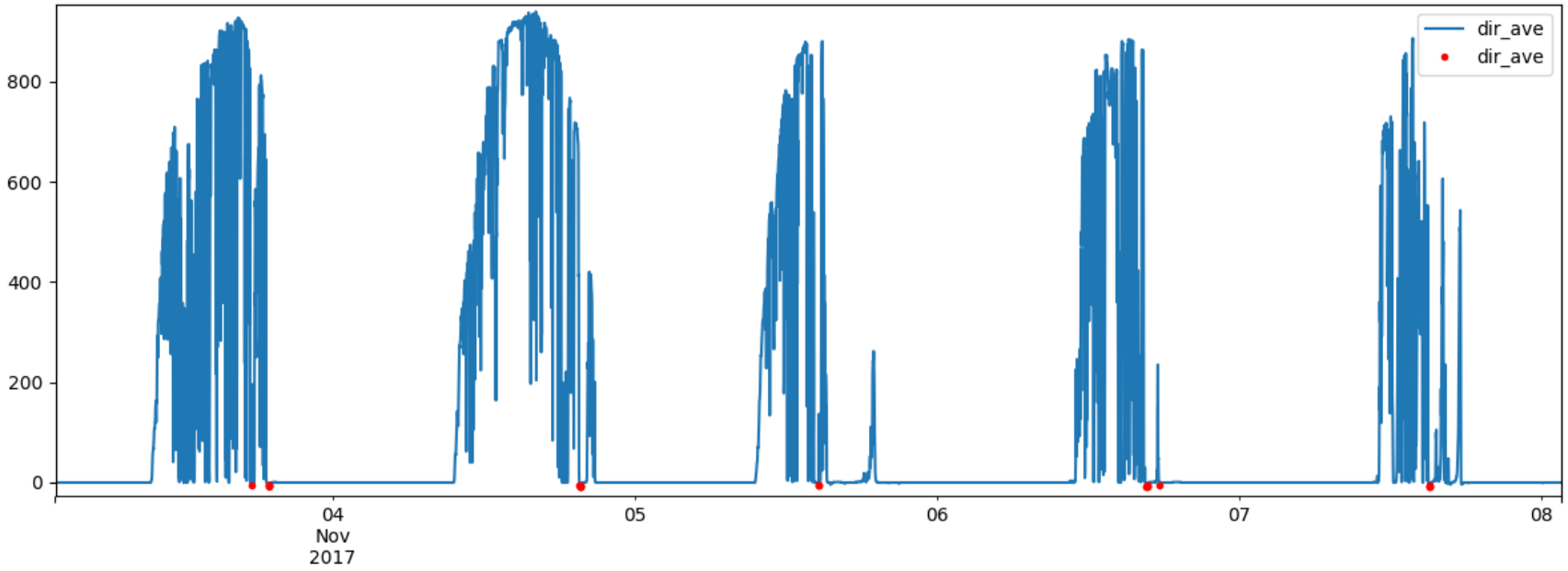
Where is the shadow coming from?

- two thin obstacles, in the West
- throwing shadow during winter months' sunset
- wind meter and gps receiver (?)
- will be moved to a better location



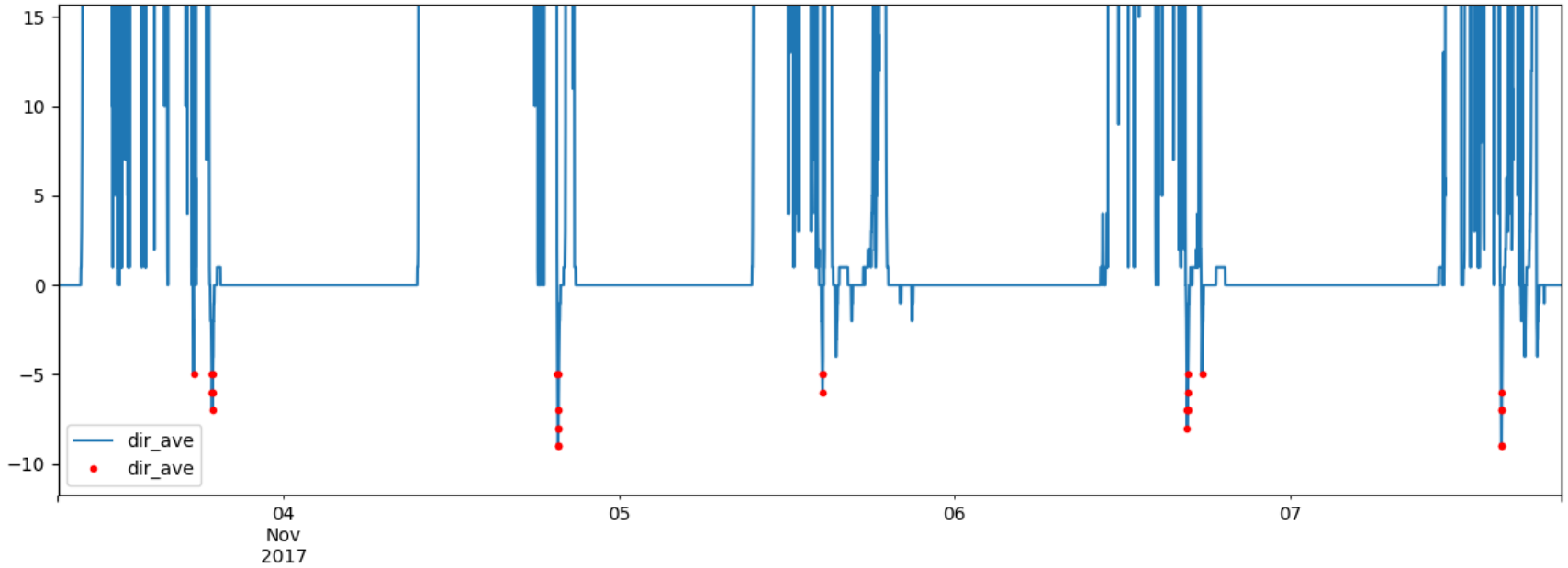
diffuse > physically possible limit?

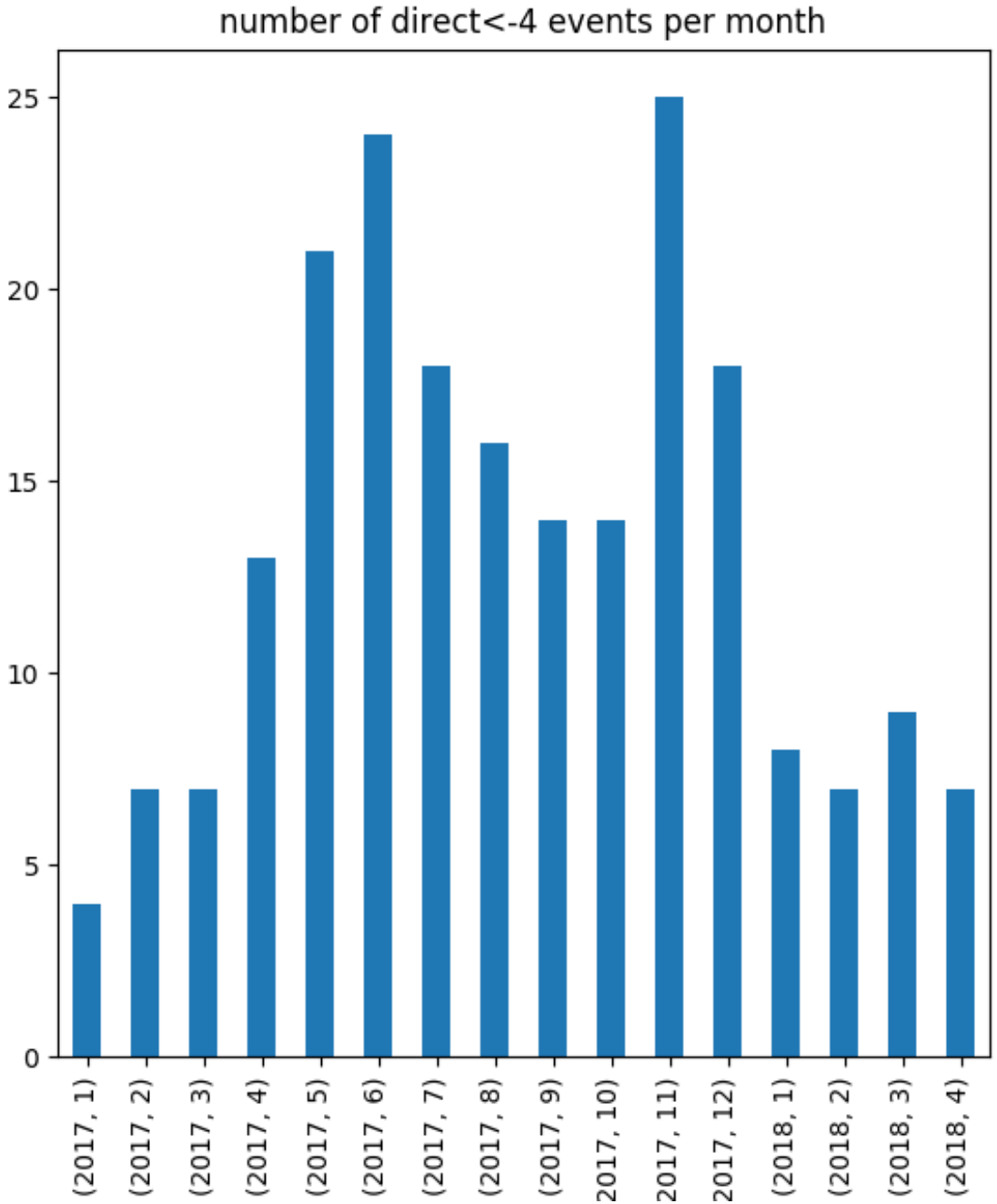


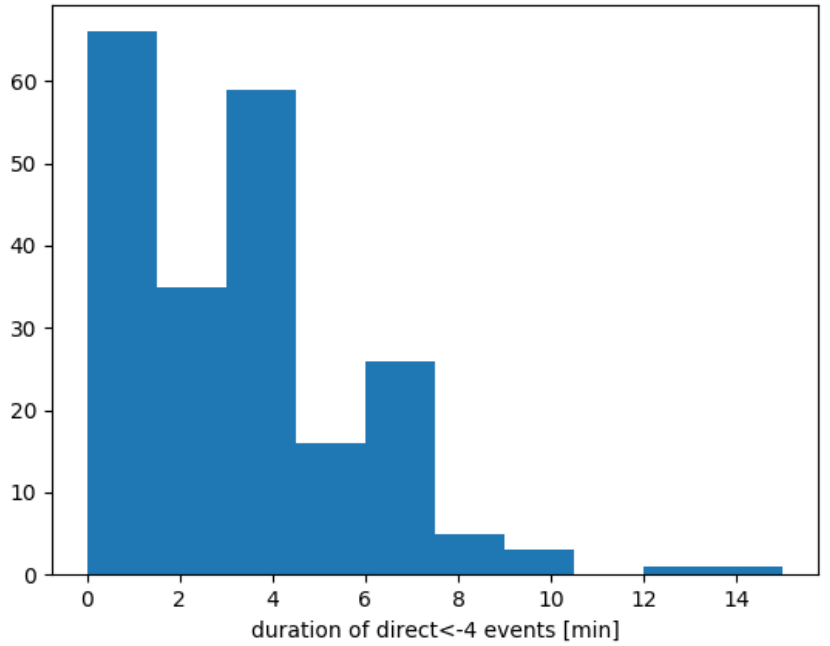


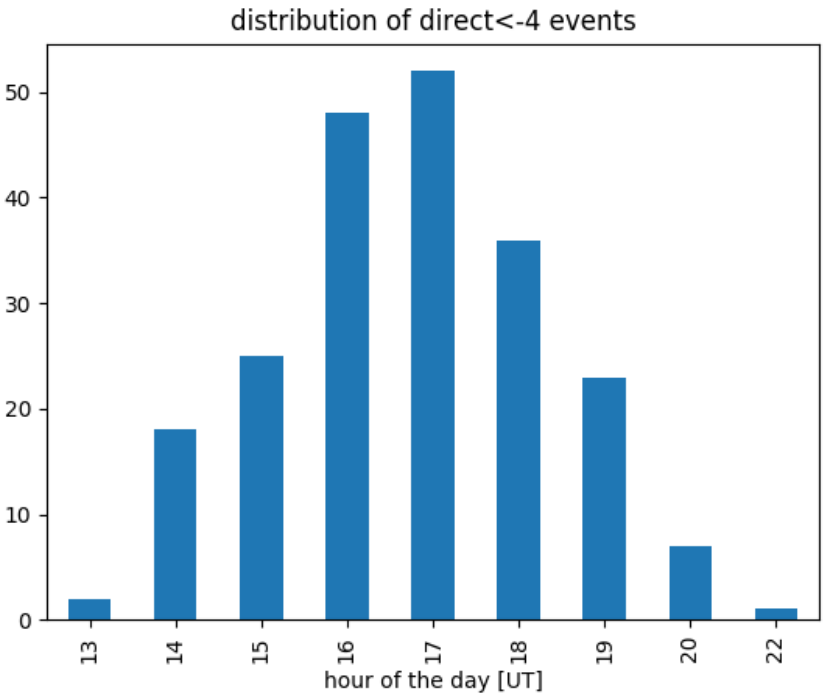
many events with direct < -4 W/m2

→ heavy rainfall




number of direct<-4 events per month
25
20
15
10
5
0
(2017, 1)
(2017, 2)
(2017, 3)
(2017, 4)
(2017, 5)
(2017, 6)
(2017, 7)
(2017, 8)
(2017, 9)
(2017, 10)
(2017, 11)
(2017, 12)
(2018, 1)
(2018, 2)
(2018, 3)
(2018, 4)


60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
duration of direct<-4 events [min]

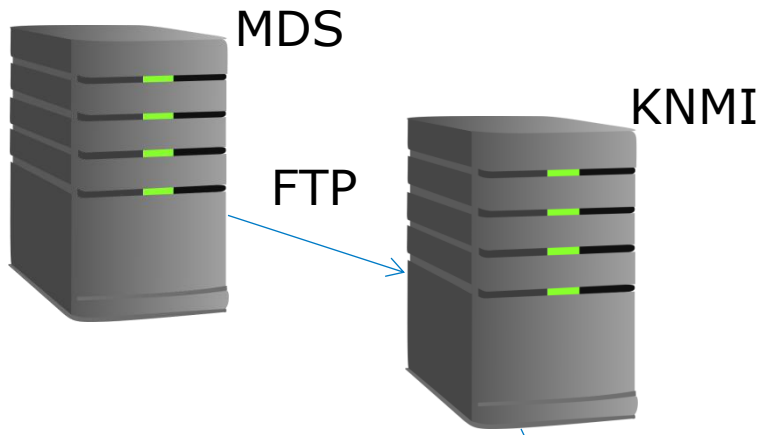

distribution of direct<-4 events
50
40
30
20
10
0
13
14
15
16
17
18
19
20
22
hour of the day [UT]

Auxiliary measurements

- Relative Humidity: E+E33 → since July 2018
- Temperature: PT 1000 → since July 2018
- Pressure: PTB 220

- All instruments calibrated by KNMI end 2017
- Instruments are part of the KNMI calibration cycle

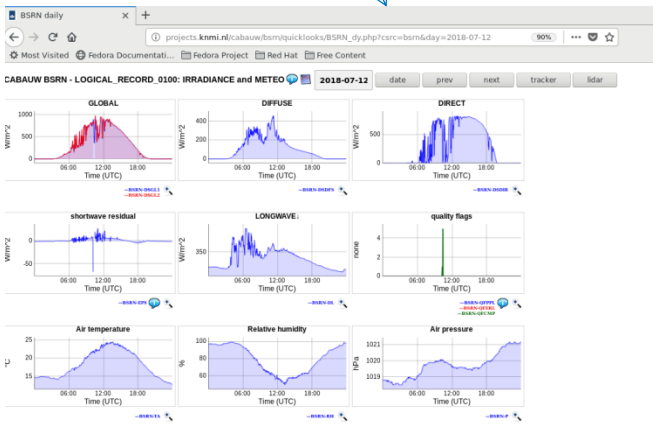
Data stream



- transfer to KNMI, on a daily basis (FTP)
- conversion to BSRN format
- fed to automatic daily quality monitoring tool at KNMI *(see presentation Wouter Knap)*
- filtering of known events

(work in progress)

QA-tools



And more to do:

- moving obstacles in vicinity of instruments
- BSRN file header, station description, etc
- electronic logbook and event-monitoring tool for local operators
- find additional funding for instruments to replace during calibration
- .....

Conclusions

- Paramaribo is unique location:
  - Seasons/weather ruled by ITCZ: large variability, many clouds, thunderstorms
  - Situated on both meteorological hemispheres
  - Location would fill gap in BSRN station map
- Data from last 16 months mostly well-behaved, ...
- some quality issues identified (obstacles, event logging)
- Radiation instruments and T, RH, p are all recently calibrated, and will be re-calibrated every few years
- Daily quality monitoring will be incorporated in KNMI tools within a few months
- Data delivery can start within a few weeks (excluding holidays)