



Total Solar Eclipse

- 20 March 2015 -

at BSRN Station Ny-Ålesund

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First total solar eclipse observation by a BSRN station:
20 March 2015, Ny-Ålesund (78.9° N, 11.9° E), Svalbard
(09:10 - 11:11 UTC, totality from 10:09:53 to 10:12:11 UTC)

Data publication in Earth System Science Data,
as a base for follow-up studies on micrometeorology etc.

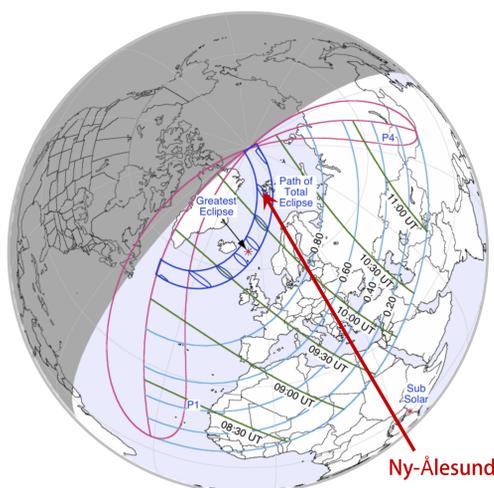


Fig. 1: Path of the total solar eclipse on 20 March 2015.
(<http://eclipse.gsfc.nasa.gov/SEplot/SEplot2001/SE2015Mar20T.GIF>)



Fig. 2: Solar eclipse over Ny-Ålesund, Svalbard. (© Photo Nathalie Grenzhäuser)

Meteorological Observation Conditions

- early morning cloud cover had vanished
- calm high pressure situation
- near surface wind dominated by local conditions: low wind speed
 - katabatic outflow from glaciers
 - sporadic cold air advection from south-west

Radiation Measurements

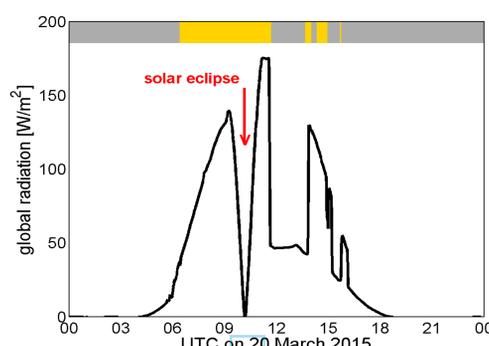


Fig. 4: Ny-Ålesund global radiation (SW_{down}) on 20 March 2015. The color bar indicates periods with solar elevation above or below the horizontal line (yellow and grey, respectively).

Geometric Observation Conditions

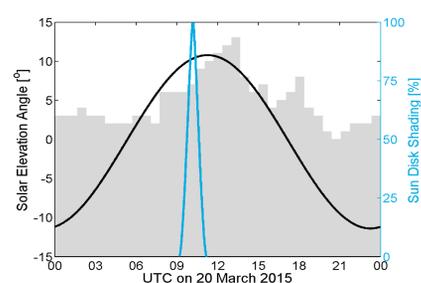


Fig. 5: Solar elevation angle (black line) for Ny-Ålesund coordinates (78.9° N, 11.9° E) on 20 March 2015, with local horizontal line (grey shading), respectively. The totality of the solar eclipse is indicated (cyan line).

- vernal equinox
 - horizontal line shaped by mountains to the South
 - ↓
- partial shading of radiation instruments while solar elevation remains below horizontal line

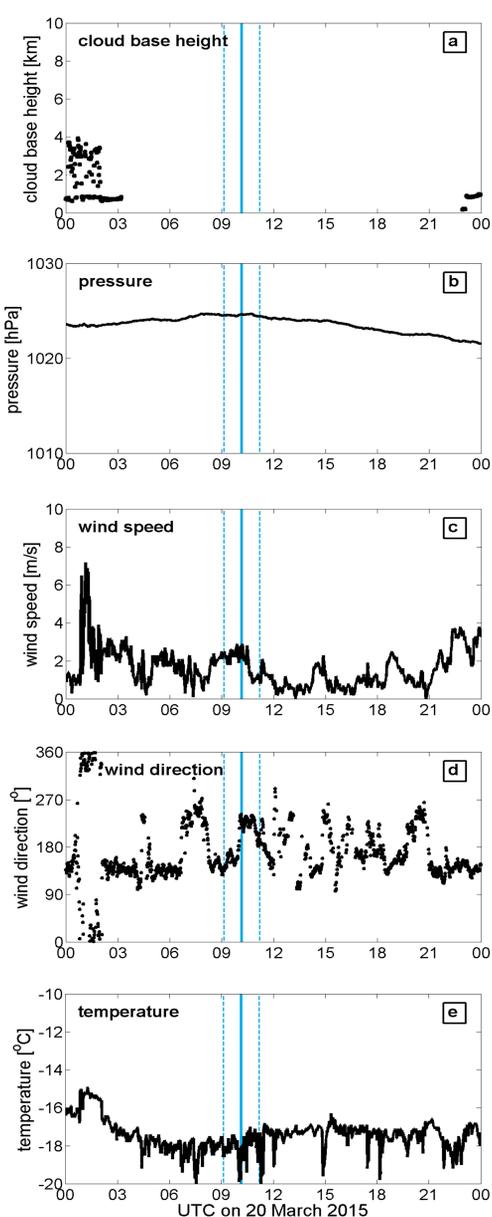


Fig. 3: Meteorological surface observations on 20 March 2015, with (a) cloud base height, (b) station level pressure, (c) 10 meter wind speed, (d) 10 meter wind direction, and (e) surface air temperature at 2 m height. Indicated is the duration of the solar eclipse (dashed blue lines, respectively) and the time of total eclipse (blue line).

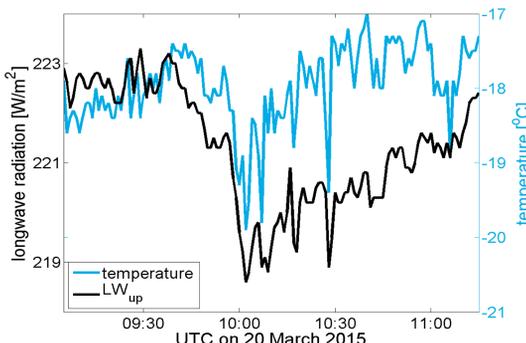
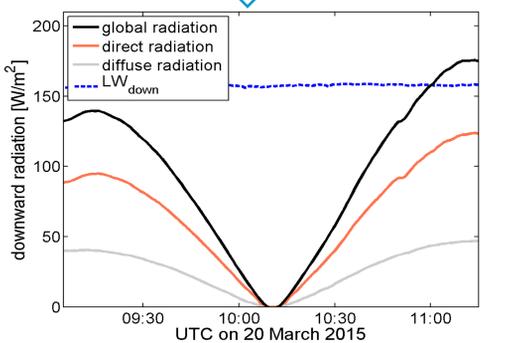


Fig. 6: The downward radiation components shortwave direct, diffuse and global radiation as well as downward thermal radiation (LW_{down}) and 2-meter temperature (LW_{up}) between 9:10 and 5:11:10 UTC on 20 March 2015.

Atmospheric Vertical Profiles

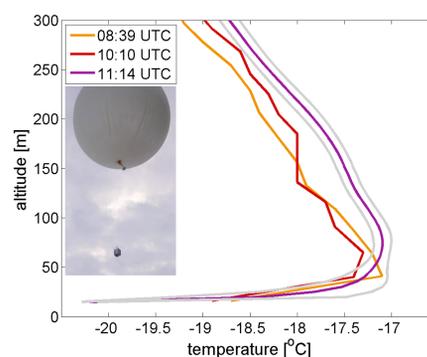


Fig. 7: Vertical temperature profiles from radiosondes launched on 20 March 2015. The radiosonde launched at 11:14 UTC has been processed as GRUAN reference sonde, and the according temperature profile (purple line) is provided with measurement uncertainty in each altitude level (grey lines).

- surface based inversion below 100 m altitude
 - ↓
 - stable conditions in the planetary boundary layer
 - potential changes in altitude of inversion top over time are within the radiosonde detection limit
 - ↓
- no temperature changes in the vertical column can be attributed to solar eclipse

The total solar eclipse left its imprint on the surface radiation diurnal cycle under favorable meteorological conditions. The data provide the unique occasion to study the atmospheric response to rapid cut-off and turn-on of shortwave radiation under low solar elevation angles in an Arctic environment.