Spectral and broadband snow albedo measurements at Dome-C and Ny-Ålesund

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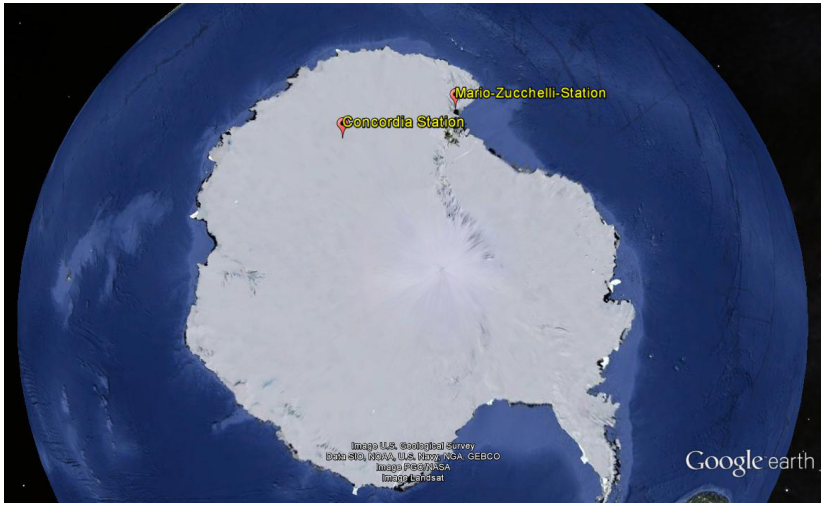
13 th BSRN Scientific Review and Workshop
ISAC – CNR
Bologna, 9-12 September, 2014

ISAC-CNR Radiometric Observations activities in polar regions

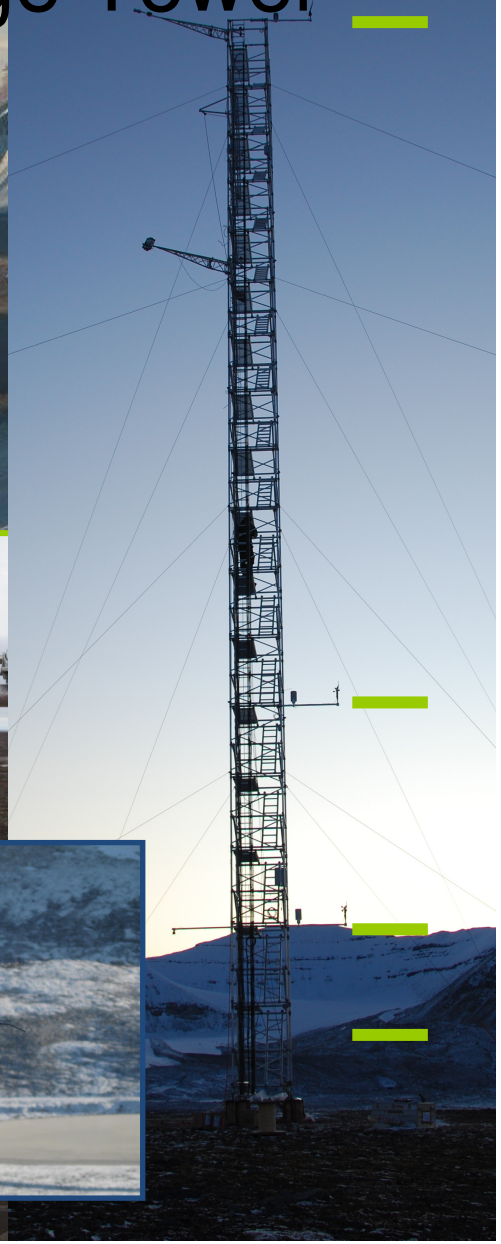
- Remote sites:
  - "Concordia" Station BSRN site (Antarctica, since 2006)
  - "Mario Zucchelli" Station – Terra Nova Bay (Antarctica, 2000)
  - Ny-Ålesund (79°N Svalbard) Climate Change Tower (Arctic, 2009



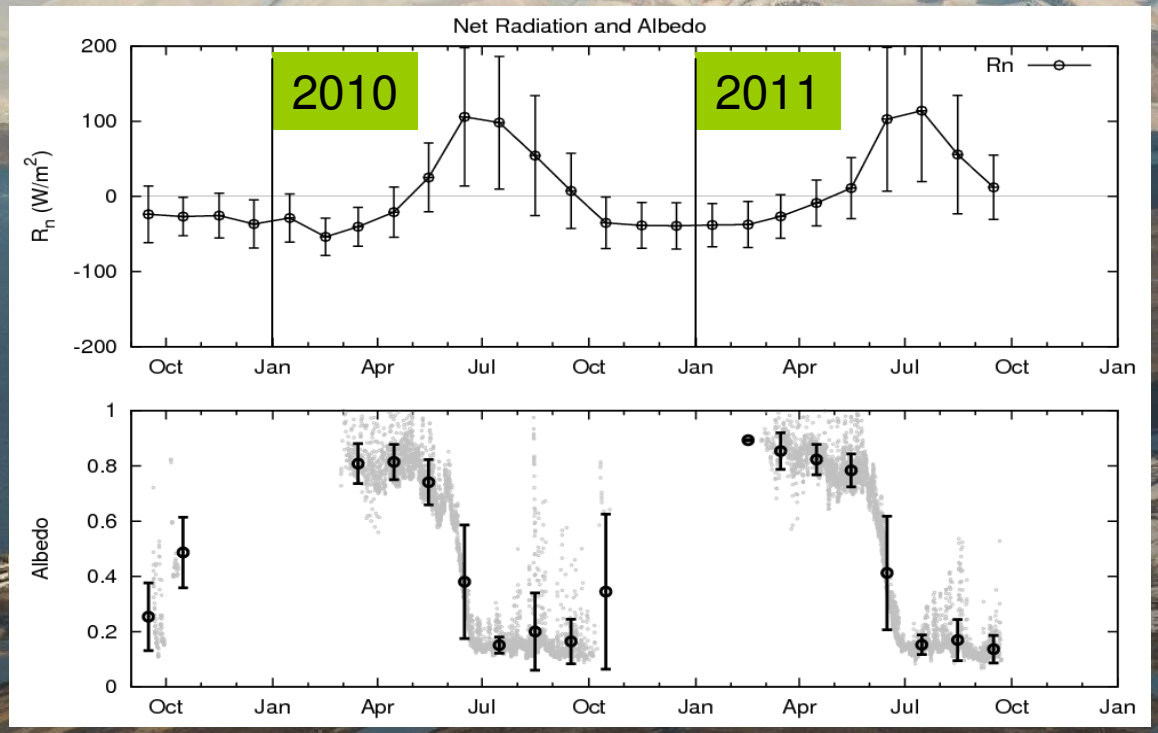
Amundsen-Nobile Climate Change Tower

The basic setup:

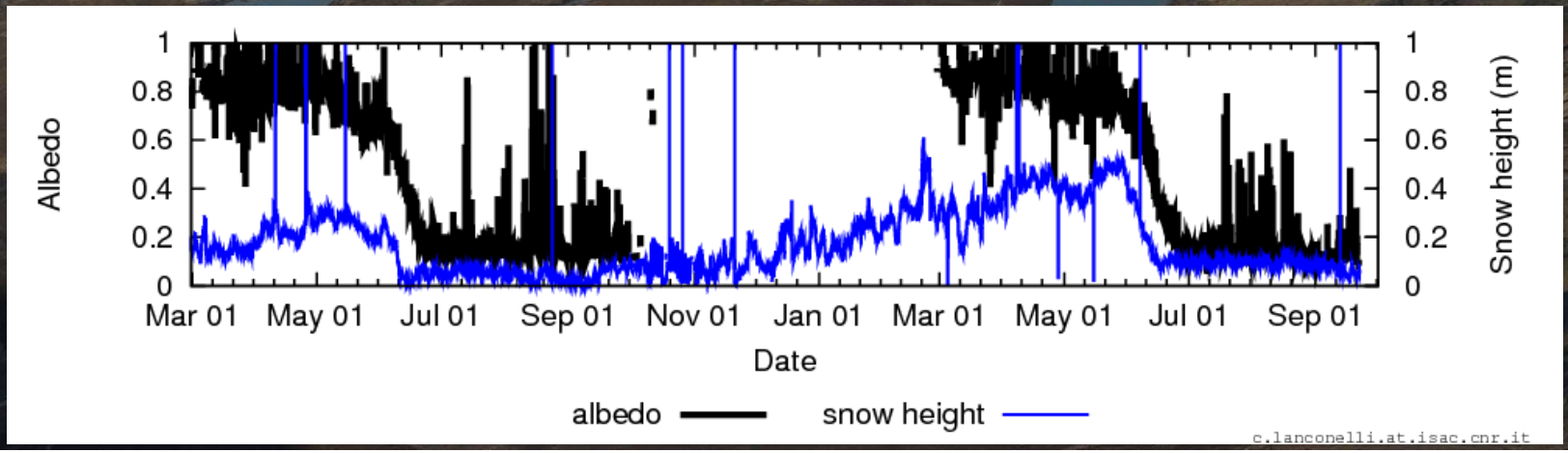
- 32 mt alu tower installed in 2009
- Four T,RH and wind levels
- Net Radiometer CNR-1, and ventilated CM11, CG4 for upwelling components
- Snow height (sonic) and skin temperature (IR camera)
- Sonic anemometers and KH20
- Real time data
- Internet connected



Albedo and surface radiation balance Ny-Ålesund



Monthly average net flux R_n range from values of about –50 Wm^{-2} during winter to values of about 100 Wm^{-2} in summer months
Albedo drop from 0.8 to 0.2 in nearly 25-30 days starting from the end of May.



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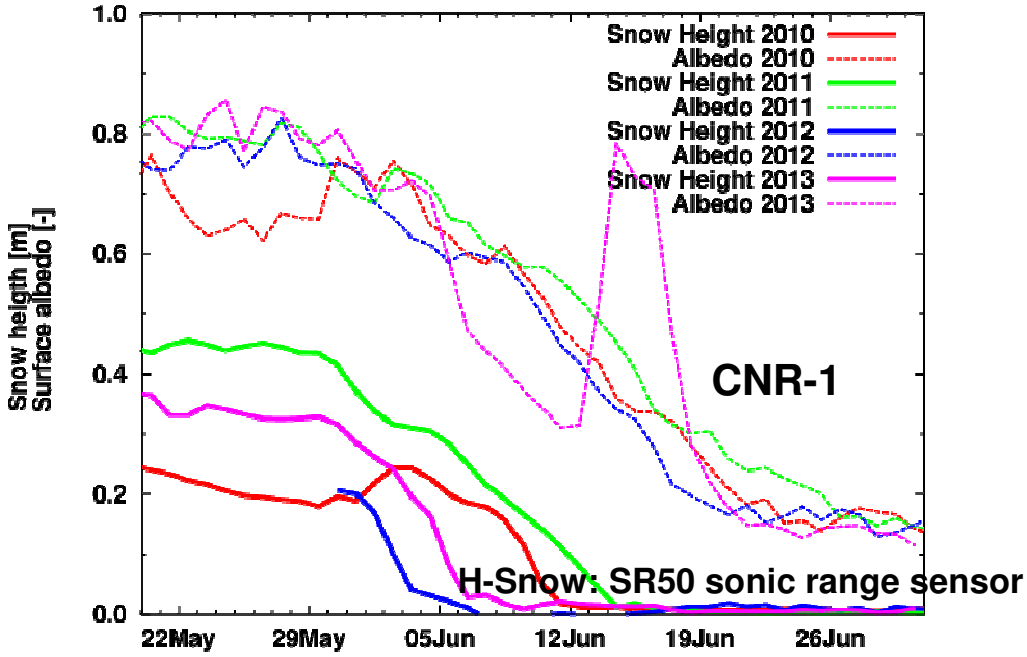
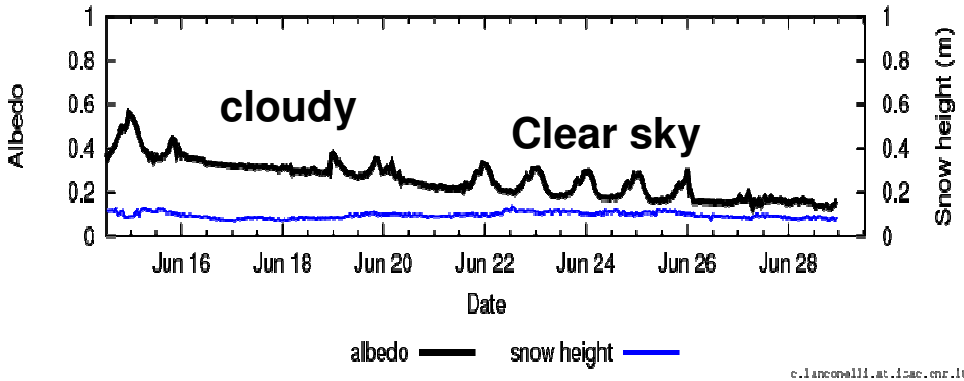
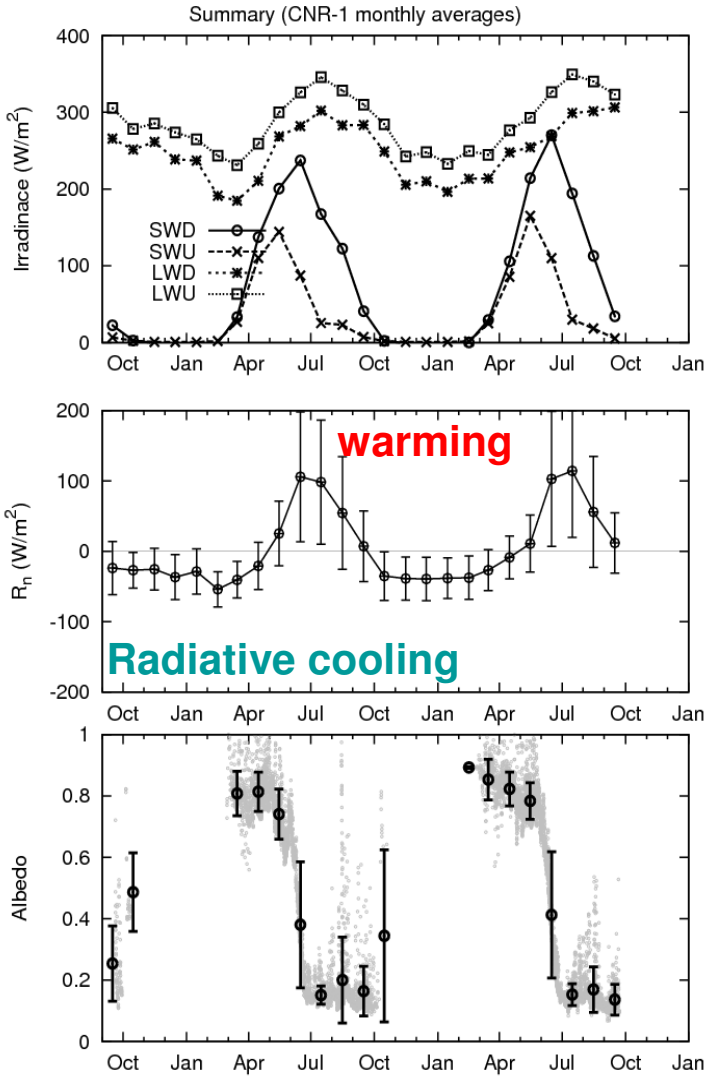
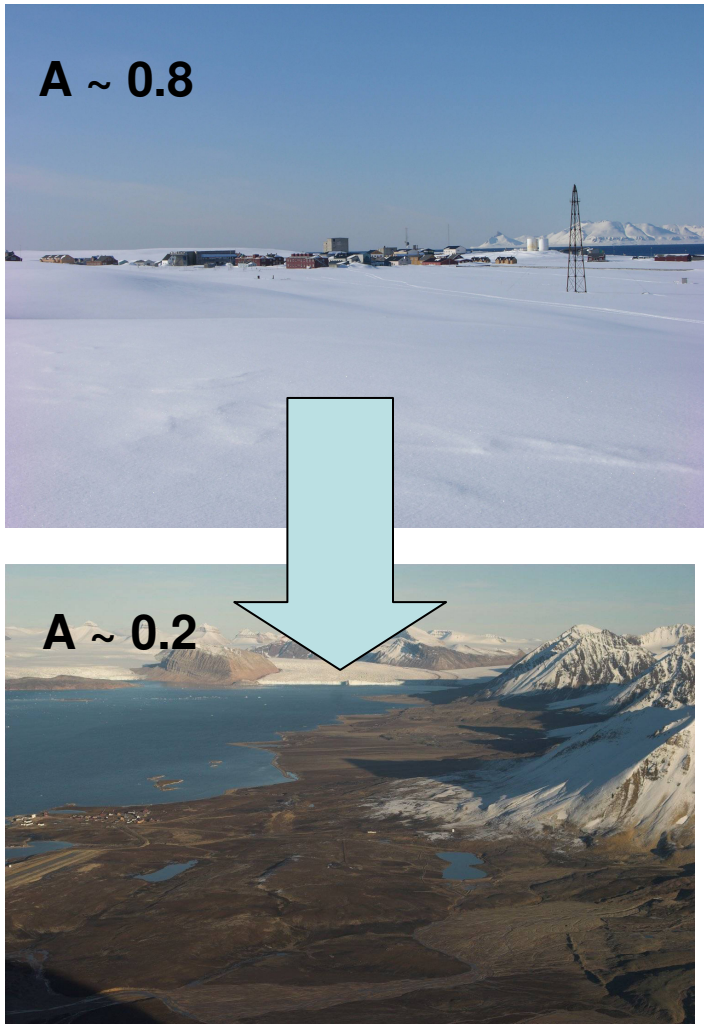


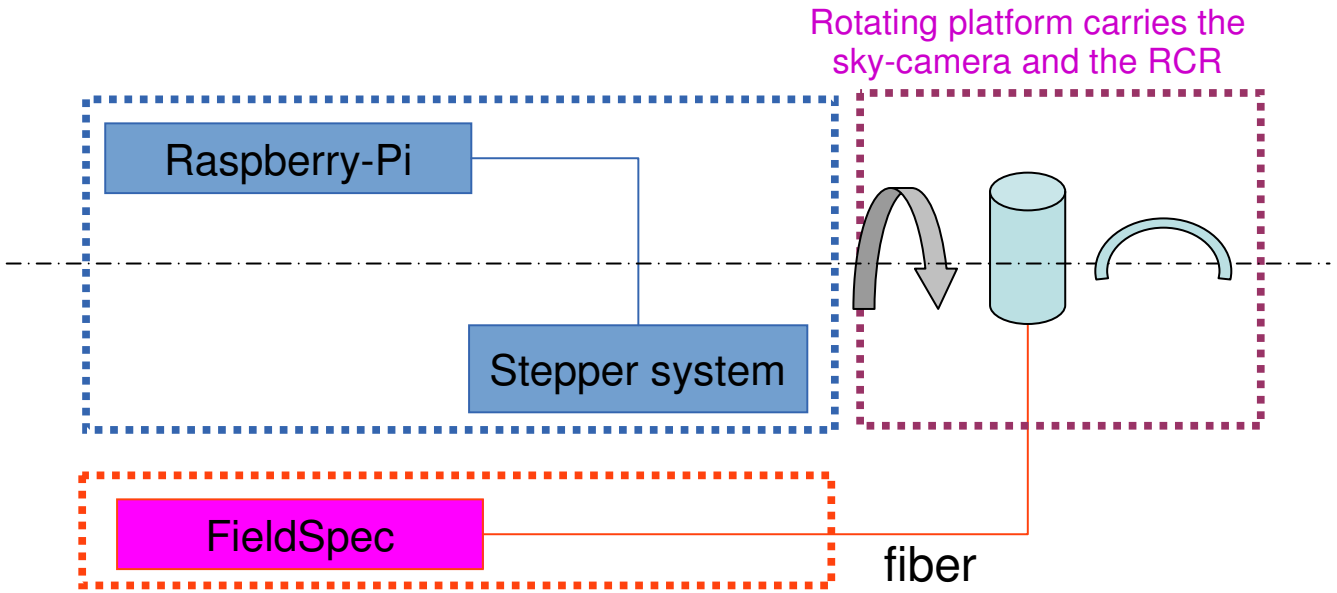




2014: can we improve our knowledge of the melting period from a radiative point of view?



- Monitoring the spectral reflectance and/or **albedo** within 350-2500nm with a commercial handheld field spectrometer (ASDI FieldSpec3)
  - To setup a Labview code to acquire measurements operated remotely
- Which are the connections between spectral and broadband albedo? spectral-to-broadband parameterization
- How the sky status affect in terms of cloud cover and turbidity the albedo.
  - During the whole experiment fish-eye images were taken every 5 minutes.
- Testing of a system for the remote operation of the spectroradiometer

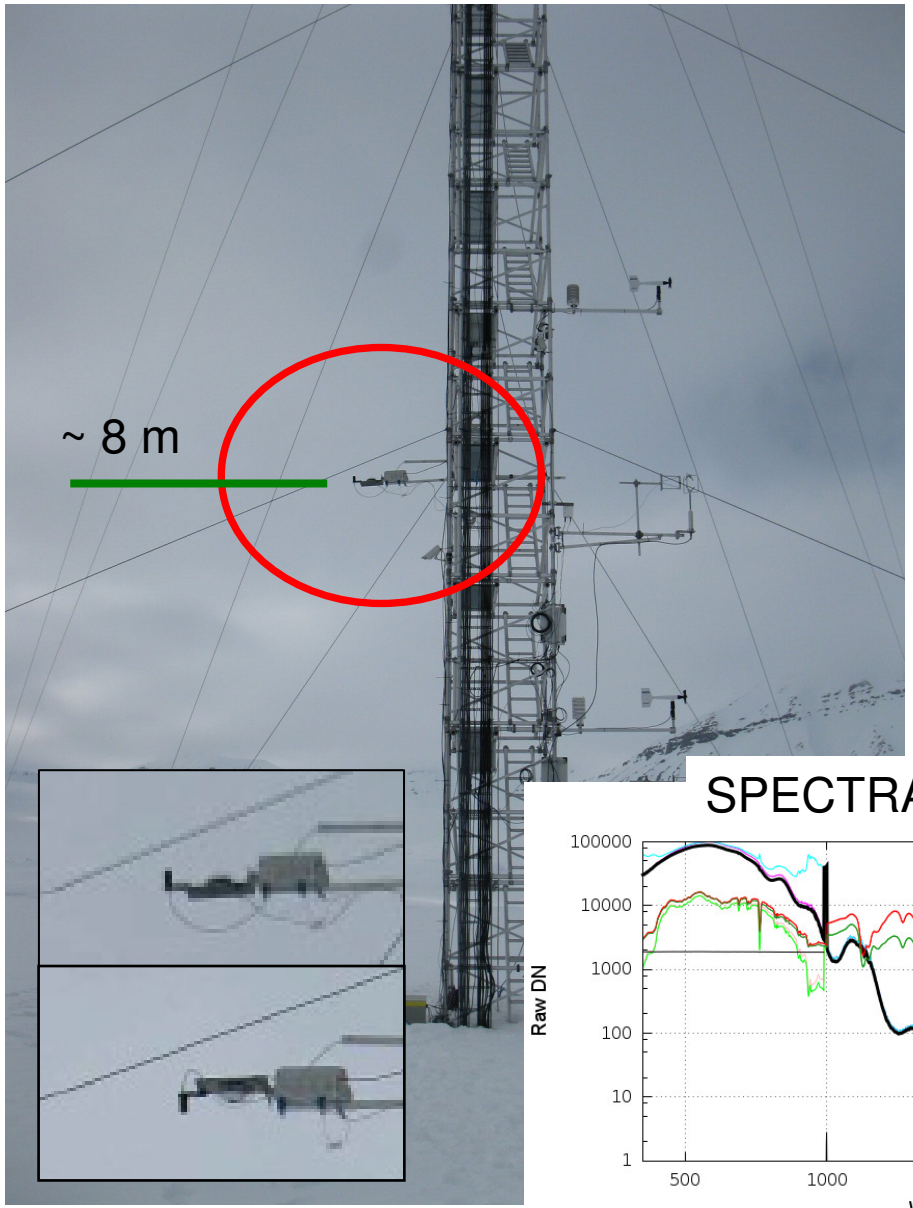


1nm
350-2500 nm

D-Link

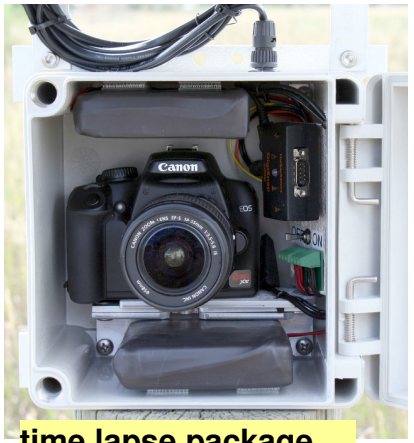
STUDY OF MELTING PROCESS IN THE ARCTIC

(SPECTRAL ALBEDO EVOLUTION DURING THE MELTING SEASON 2014 AT Ny Alesund)



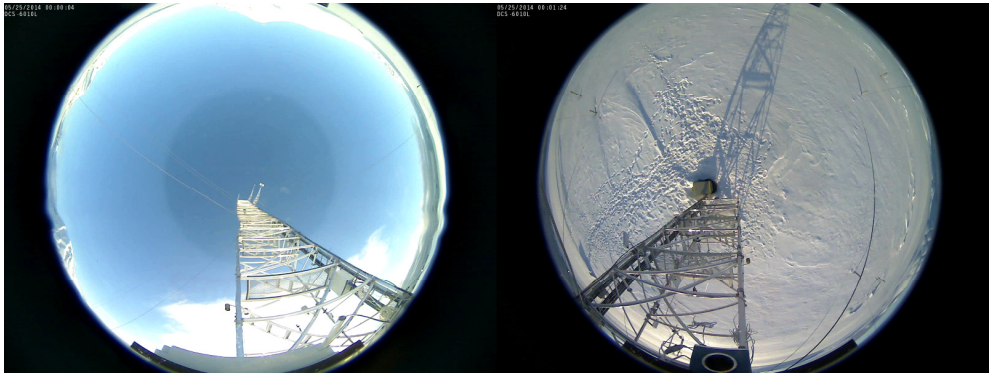
customized ASD FieldSpec 4 + web camera

SPECTRAL ALBEDO

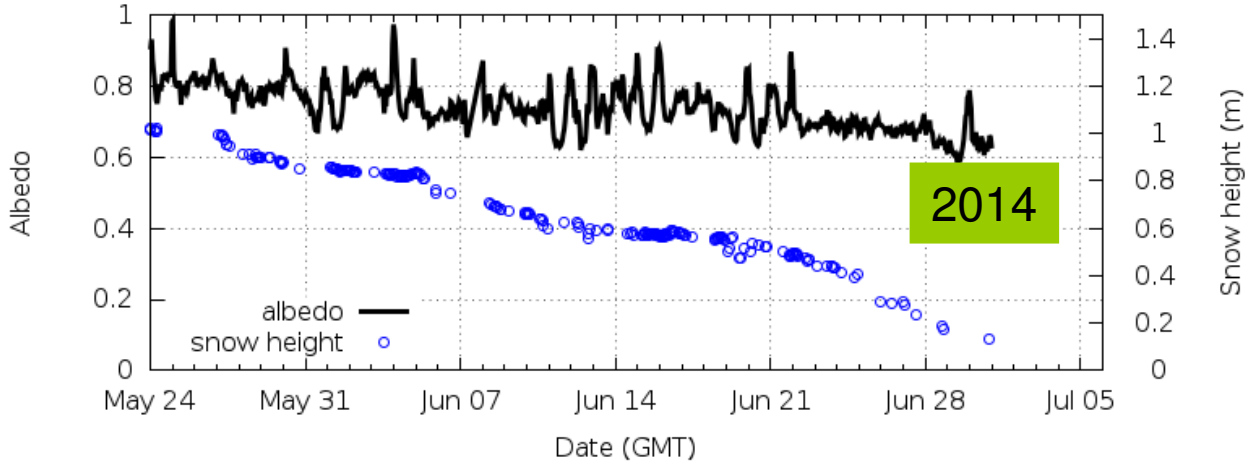


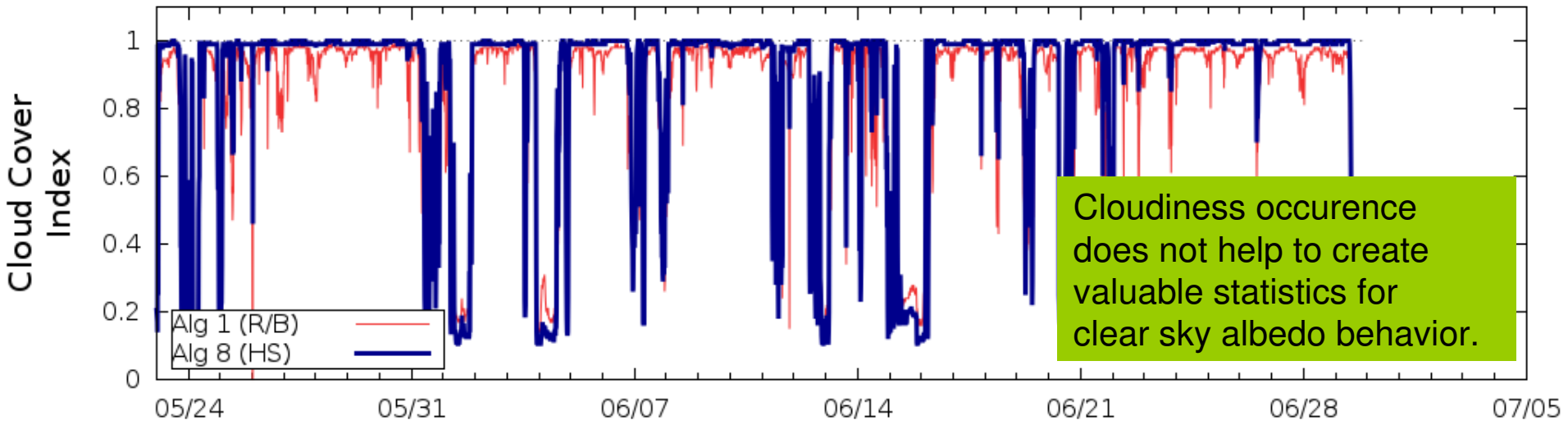
time lapse package

Timelapse example

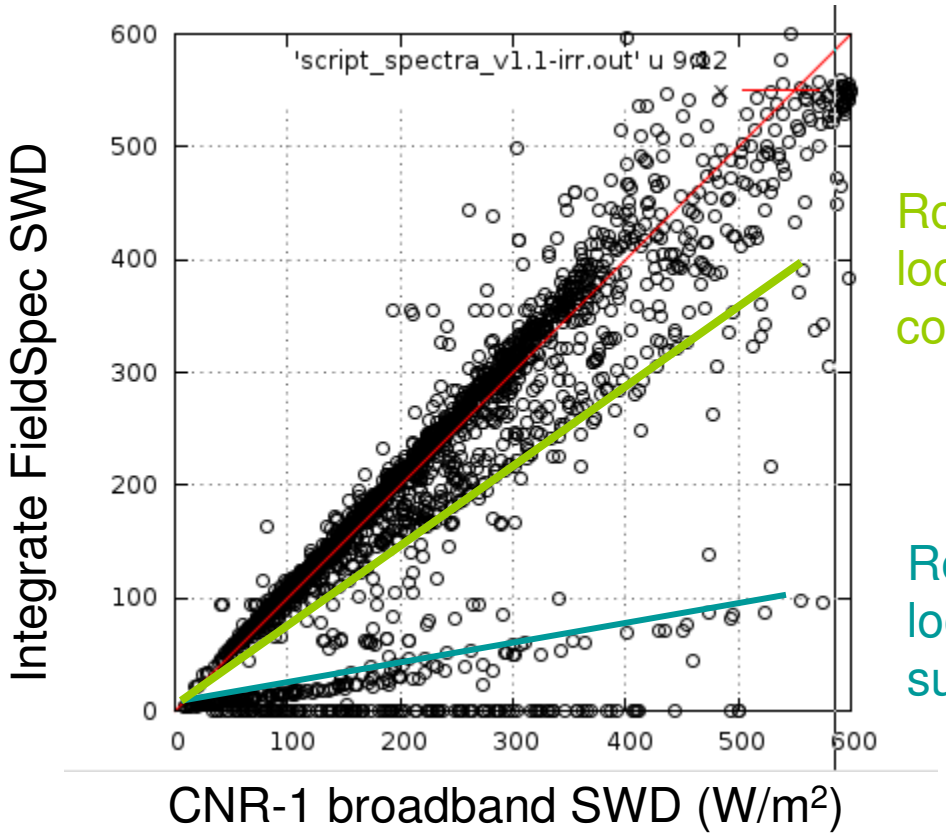


Broadband Snow albedo and snow height evolution during the 2014 melting season at Ny-Ålesund. Anomaly with respect 2010-2013 melting periods (+15-20 days).





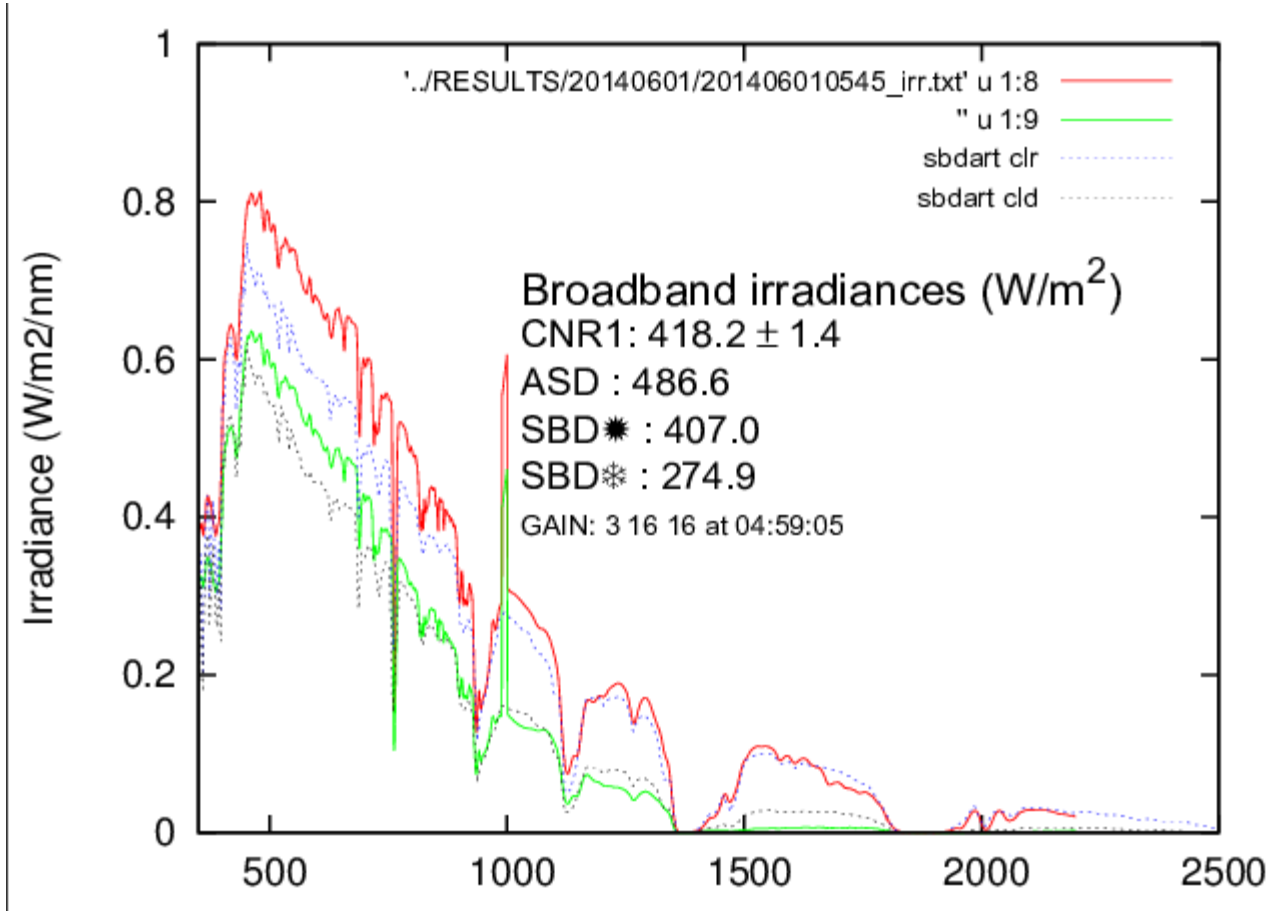
Broadband downwelling irradiance (SWD) as measured by the CNR-1 and as calculated by integrating spectrally the Fieldspec measurements



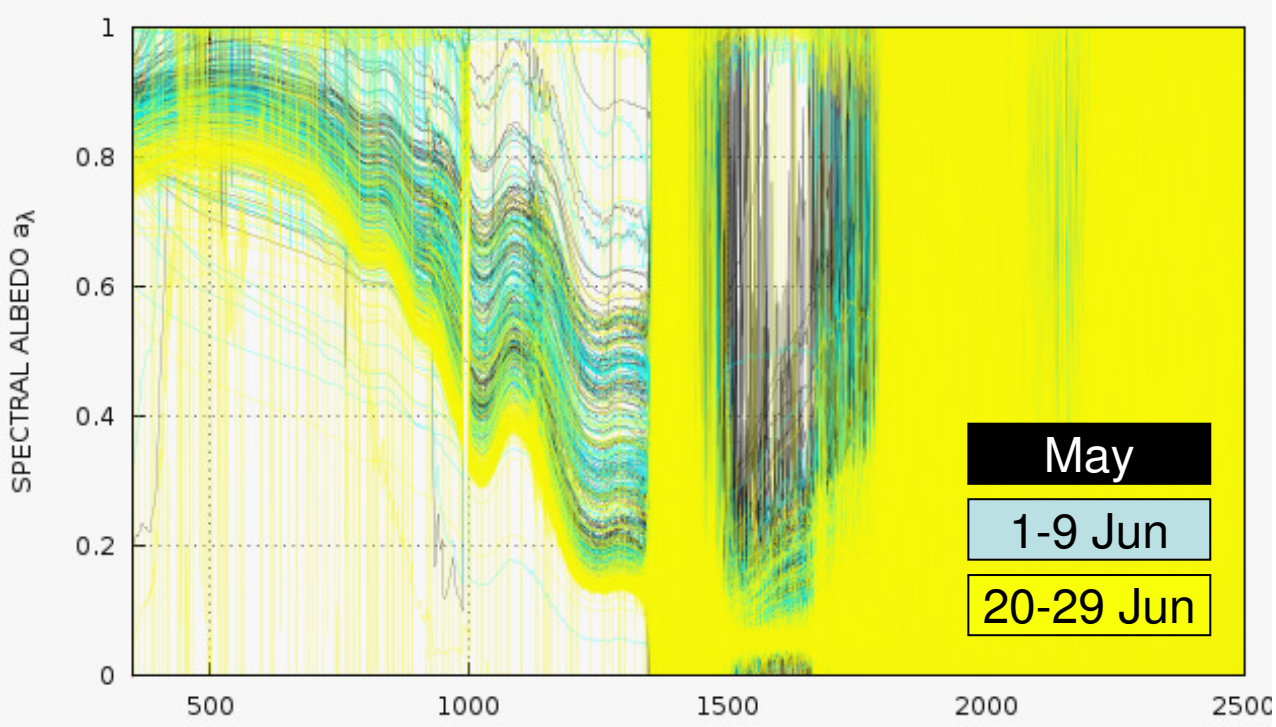
Rotating platform blocked looking down during snow-covered surface

Rotating platform blocked looking down during soil surface

Spectral irradiance as measured by FieldSpec3: downwelling (red) and reflected (green), along with SBDART simulations (uw=0.8 cm STP, uo3 = 0.350 cm STP) for clear sky, and a cloud sky with taq(0.55um) = 10.

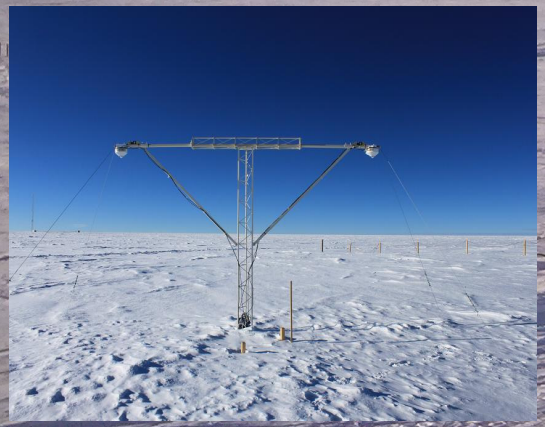


Bad Art now … hopefully some interesting scientific results soon!

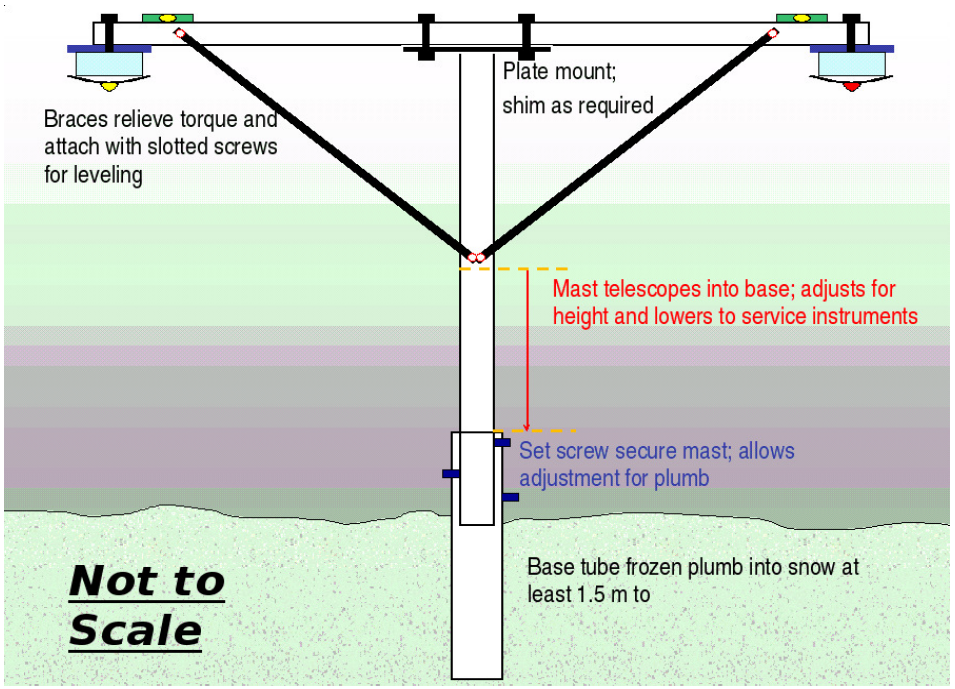


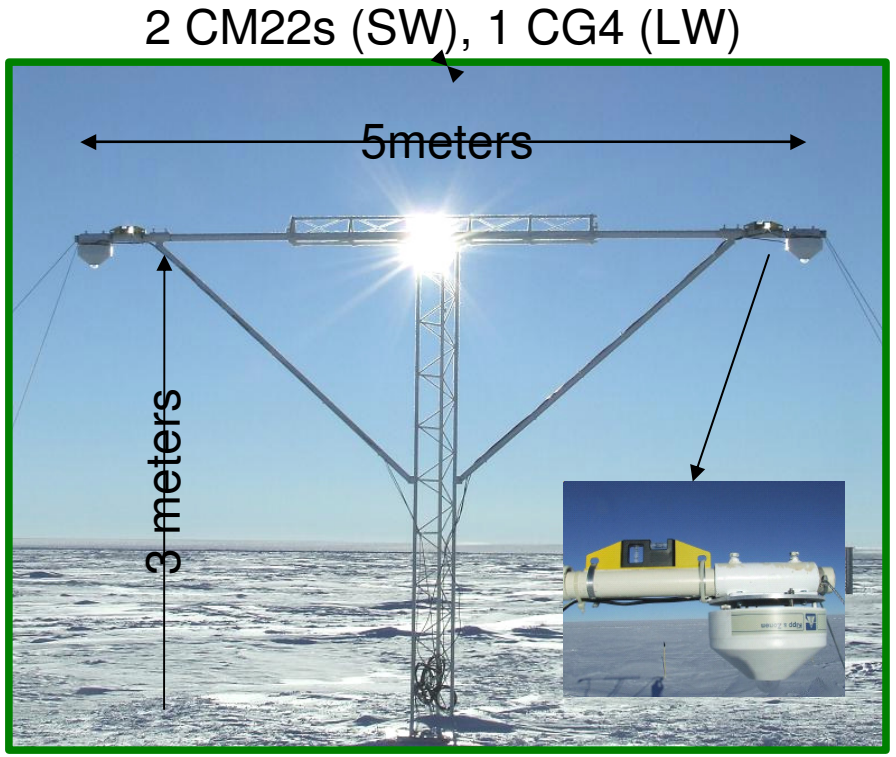
and Dome-C?

- **sTRRAP-b:** Study of Radiative Regimes over the Antarctic Plateau and beyond.

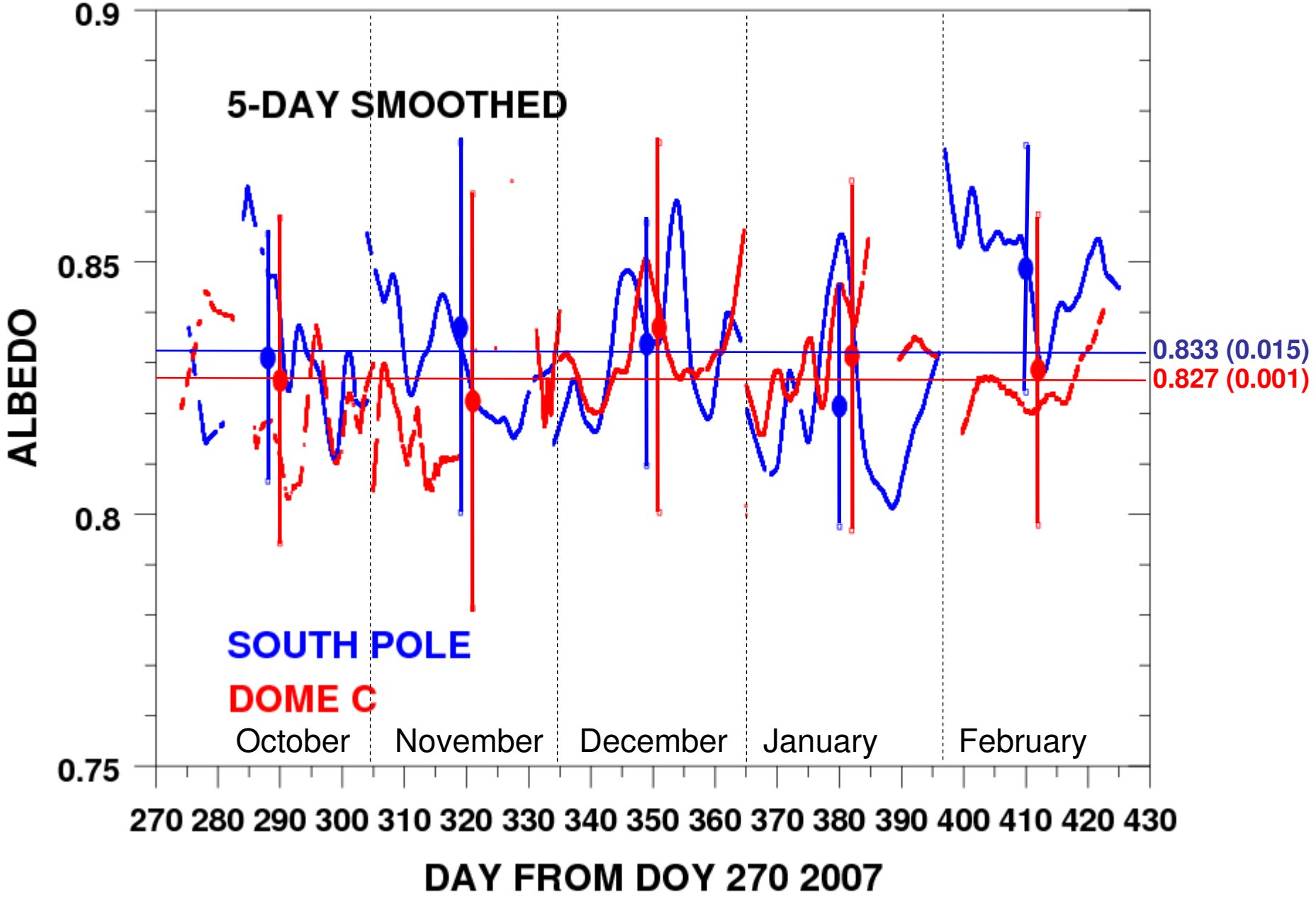


Albedo racks design at Dome-C
(suggested by Bob Stone and setup in 2007)

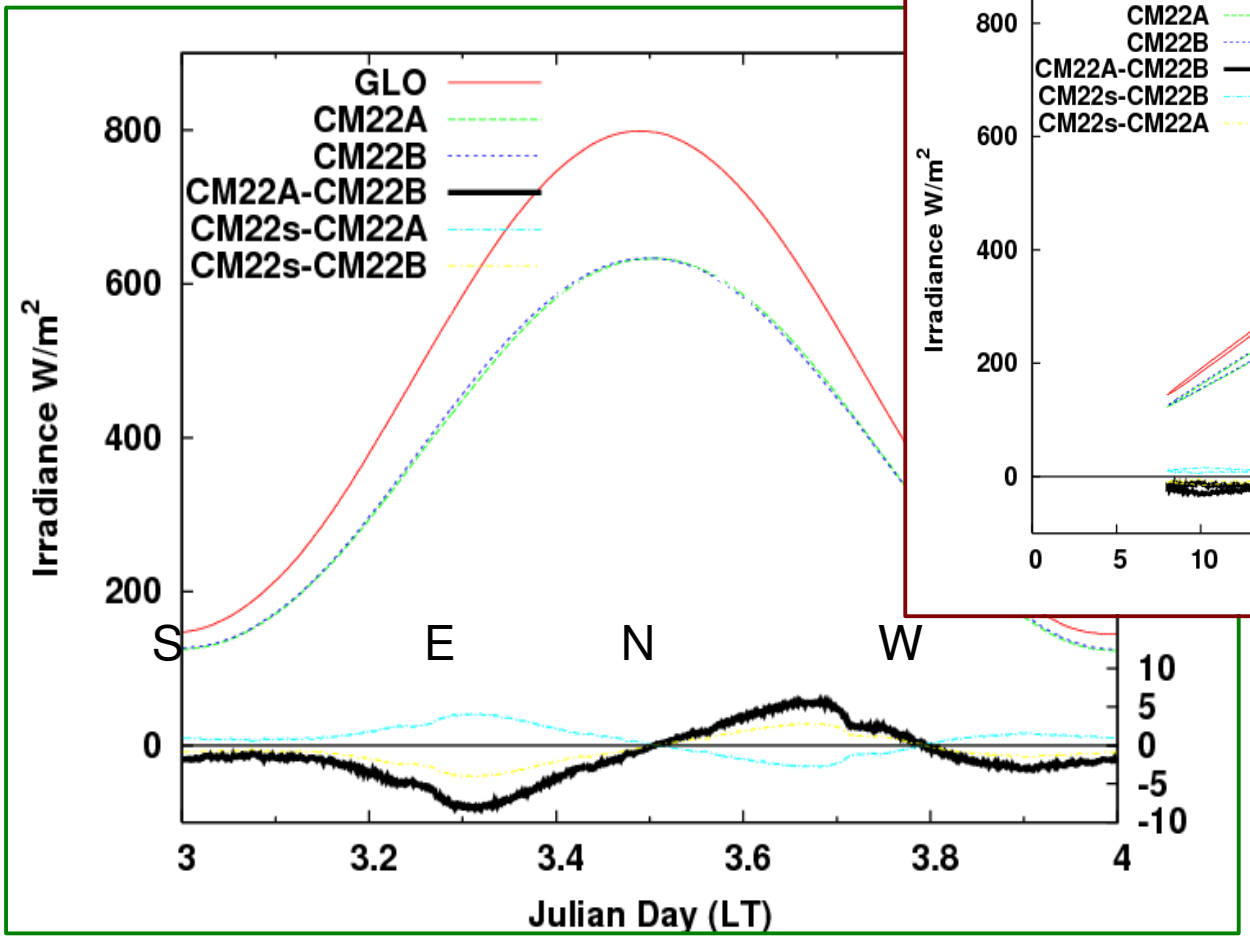


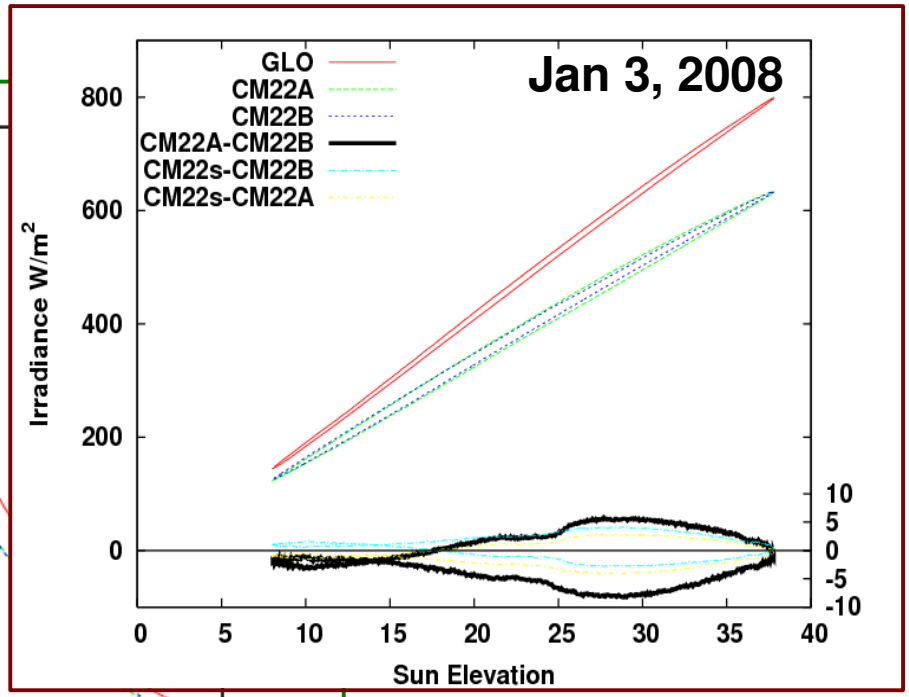


Austral summer 2007/2008 broadband albedo at Dome C and Pole are essentially equal, having a value of about 0.83 ± 0.03

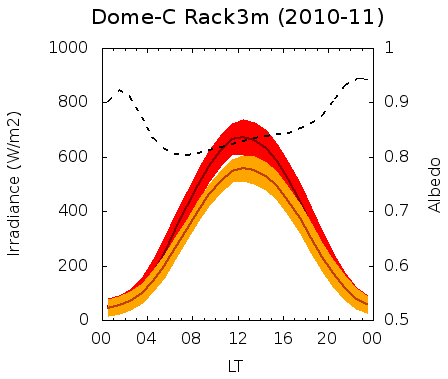


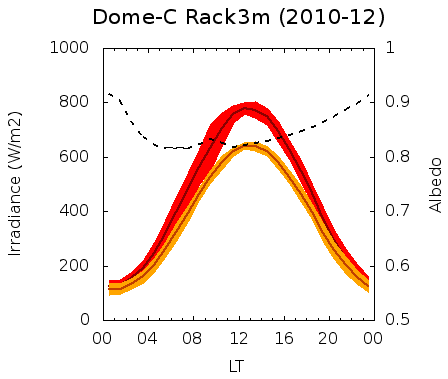
Asimmetry of CM22s measurements

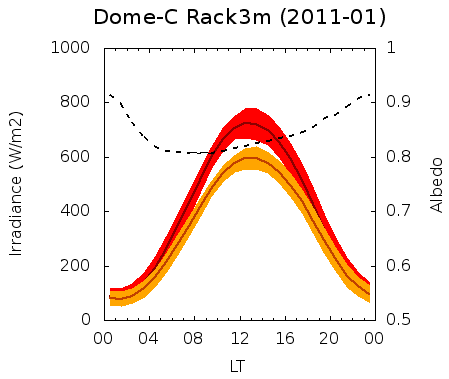


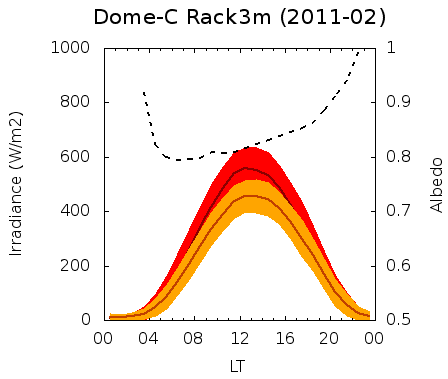


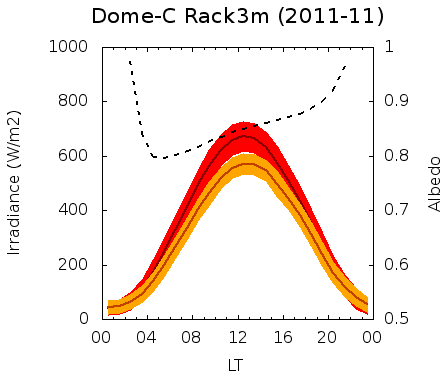
During clear sky days we observe a good simmetry in downwelling measurements with respect the Local noon


Dome-C Rack3m (2010-11)
Irradiance (W/m2)
Albedo
LT


Dome-C Rack3m (2010-12)
Irradiance (W/m2)
Albedo
LT


Dome-C Rack3m (2011-01)
Irradiance (W/m2)
Albedo
LT


Dome-C Rack3m (2011-02)
Irradiance (W/m2)
Albedo
LT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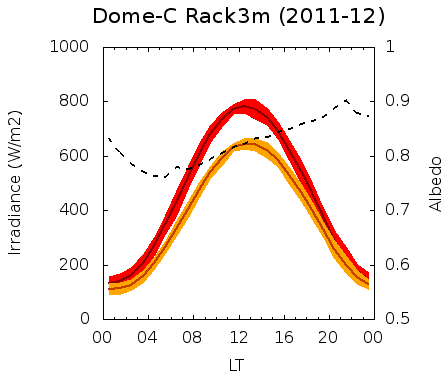
Irradiance (W/m2)
Albedo
LT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Irradiance (W/m2)
Albedo
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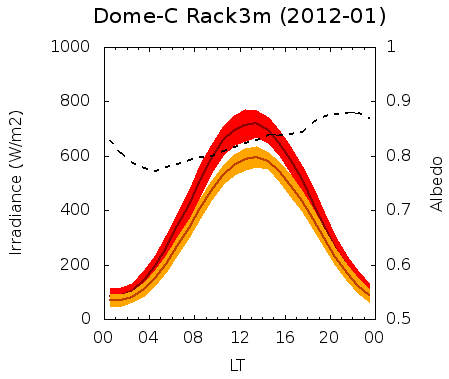
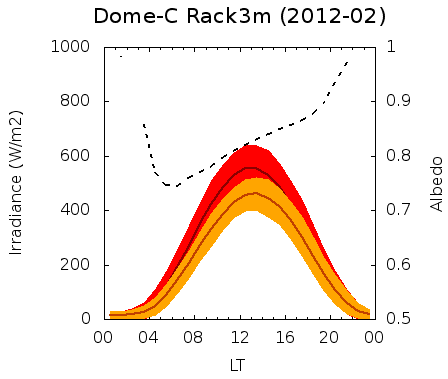
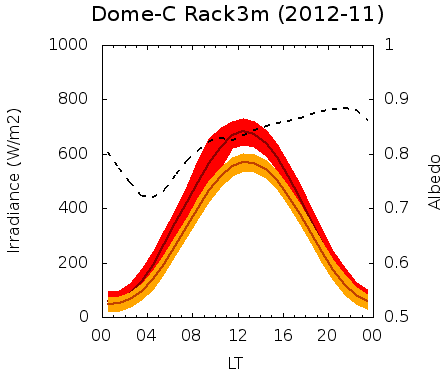

Dome-C Rack3m (2012-01)
Irradiance (W/m2)
Albedo
LT


Dome-C Rack3m (2012-02)
Irradiance (W/m2)
Albedo
LT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Irradiance (W/m2)
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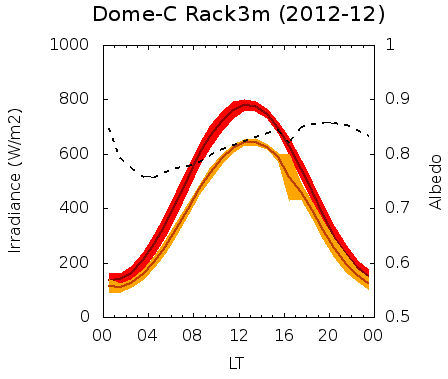
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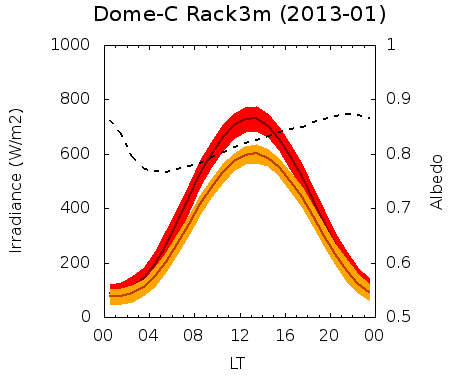
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Irradiance (W/m2)
Albedo
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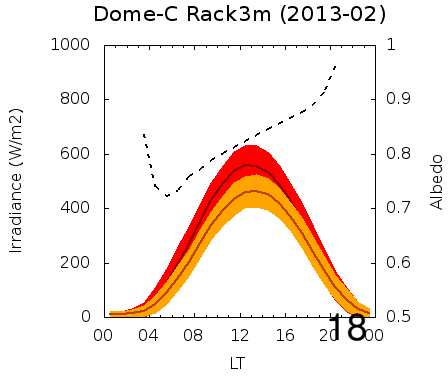
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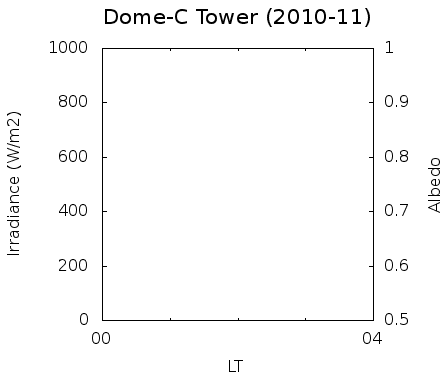
Irradiance (W/m2)
Albedo
LT


Dome-C Tower (2010-11)
Irradiance (W/m2)
Albedo
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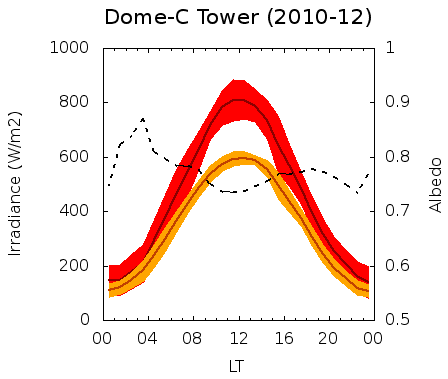
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Irradiance (W/m2)
Albedo
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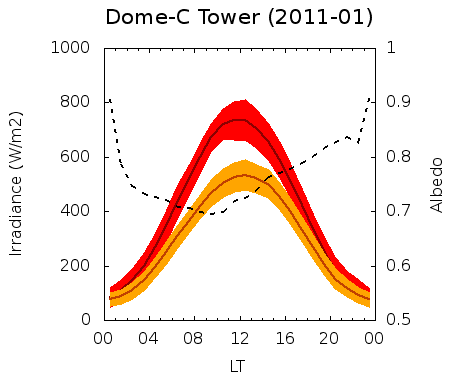
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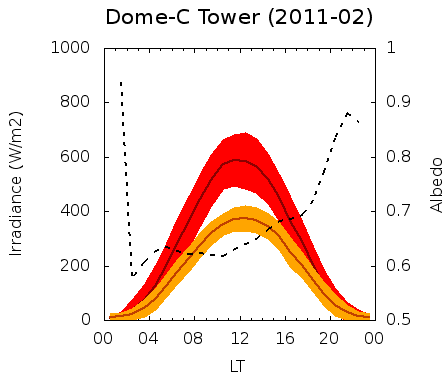
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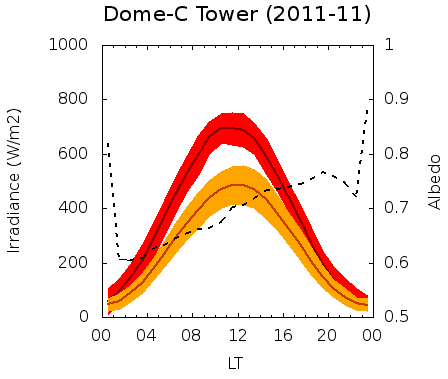
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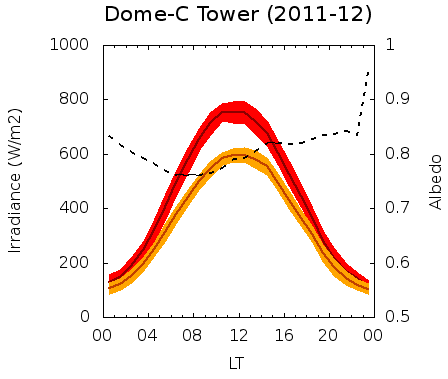
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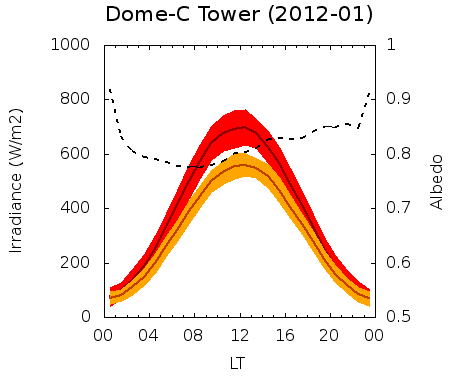
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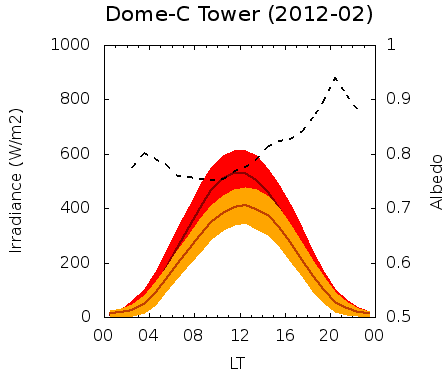
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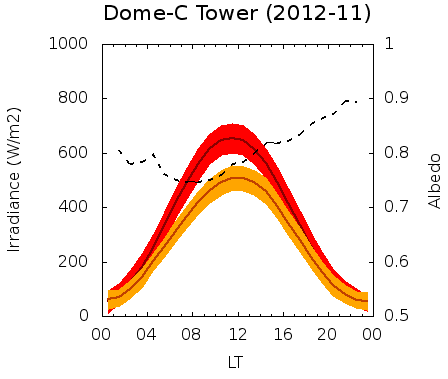
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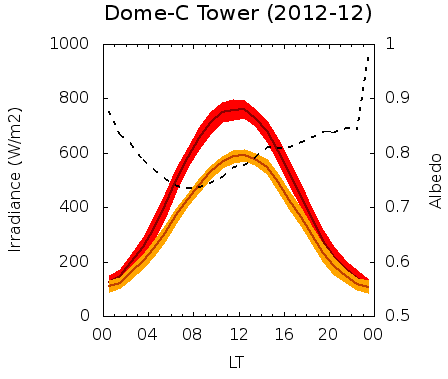
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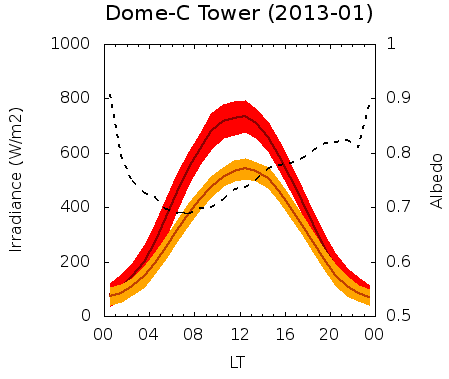
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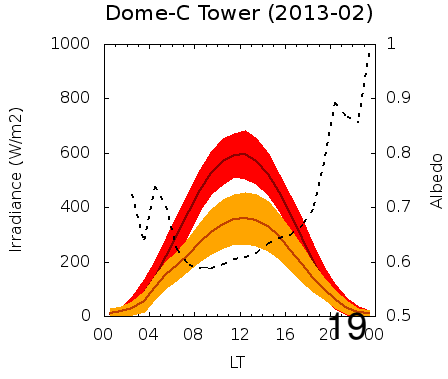
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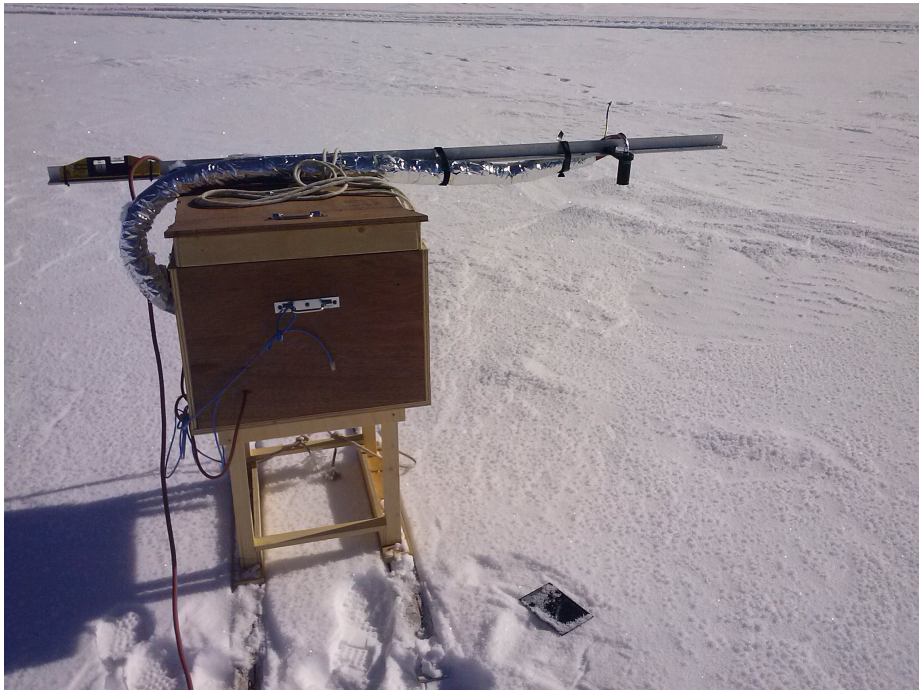
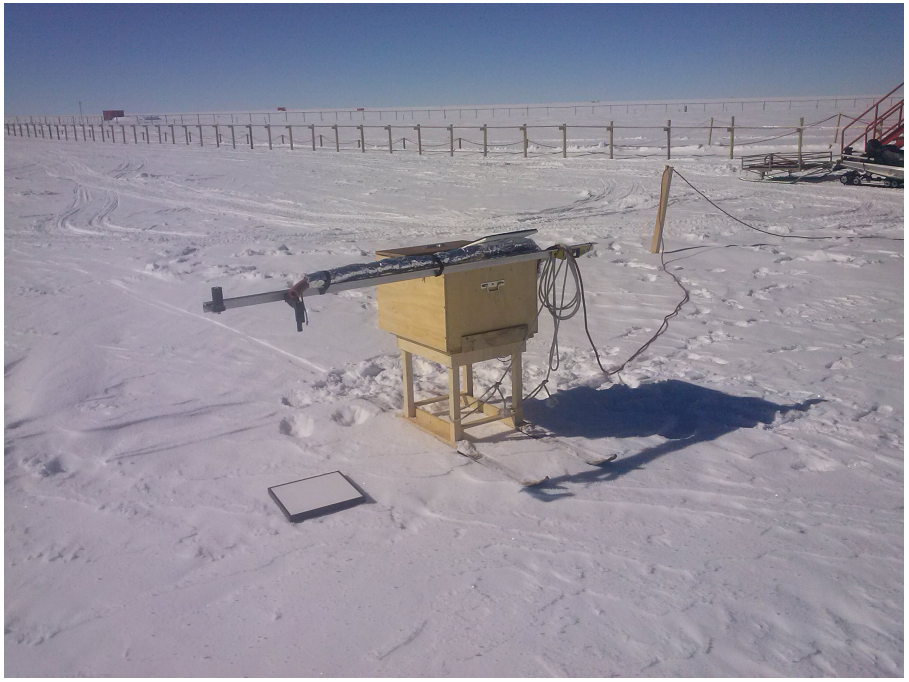
Snow shadows






17/03/2012

Thank you for your kind attention