FINNISH METEOROLOGICAL INSTITUTE

Challenges in the validation of satellite-based snow albedo retrievals

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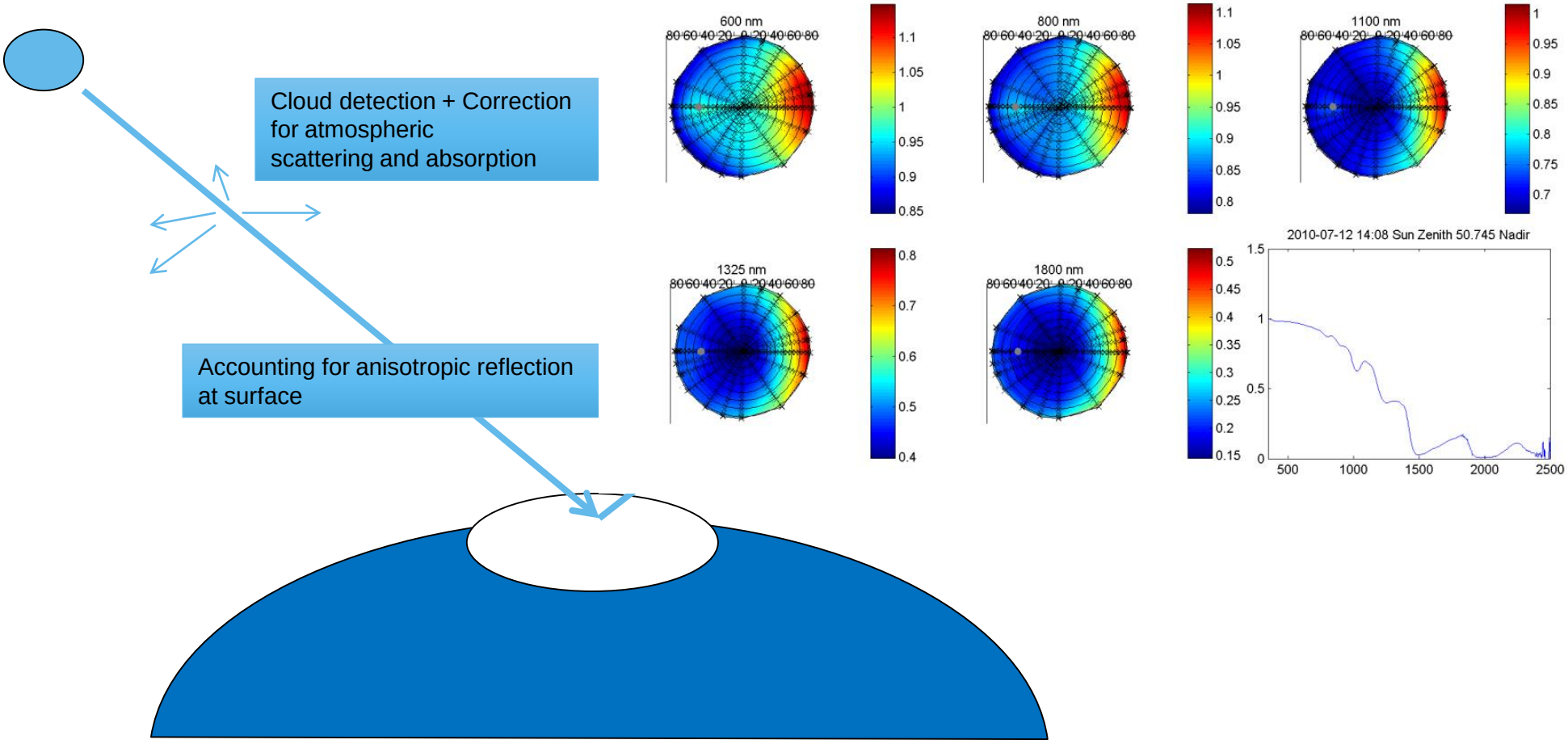
A look at the surface albedo retrieval process:



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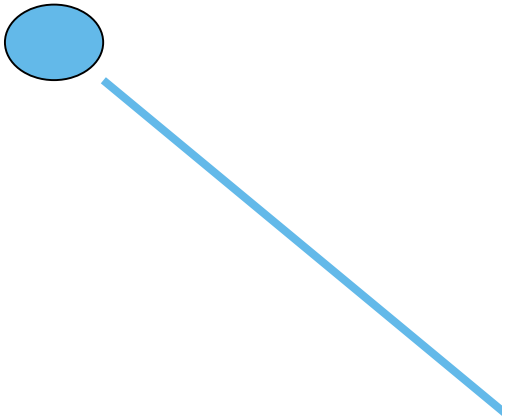
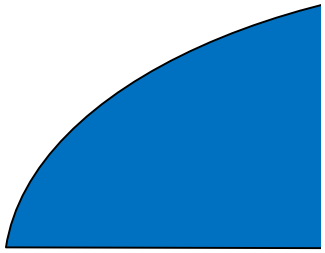
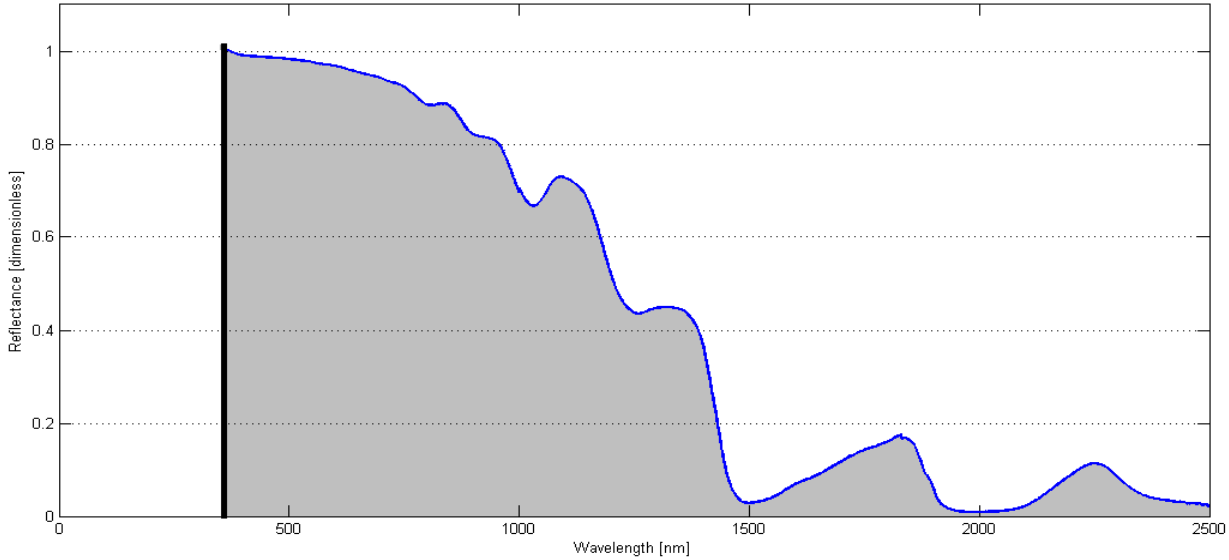


Narrow-to-broadband conversion of satellite-observed reflectances (or albedo)





Notable validation issues

- **Representativeness, representativeness, representativeness**
- Temporal coverage of in situ data
  - Satellite timeseries now span decades…
- (Long-term) spectral in situ measurements often missing
- For unmanned measurement sites, data quality needs special attention
- **Metadata helps to understand what I see in the in situ measurements!**

Representativeness of ground-level snow albedo measurements

” Close to Ideal”

”Nightmare”

Metadata helps – simple webcams are great!

PS. Skycams help too!
(If resources and conditions allow)

Winter 2009-2010: Video by R. Ylitalo / H. Suokanerva, FMI-ARC

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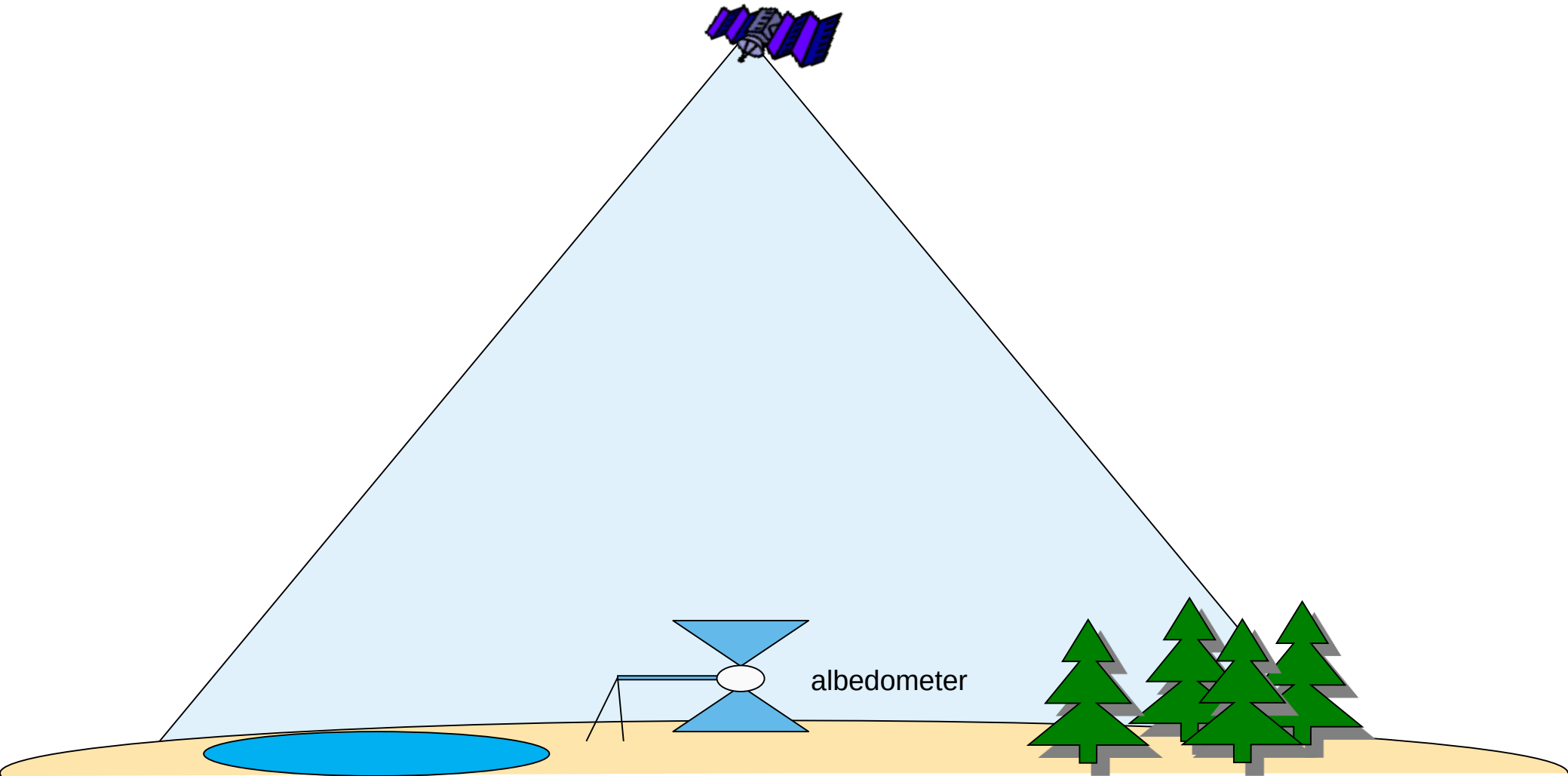
UAVs as a potential tool of the future in satellite validation?



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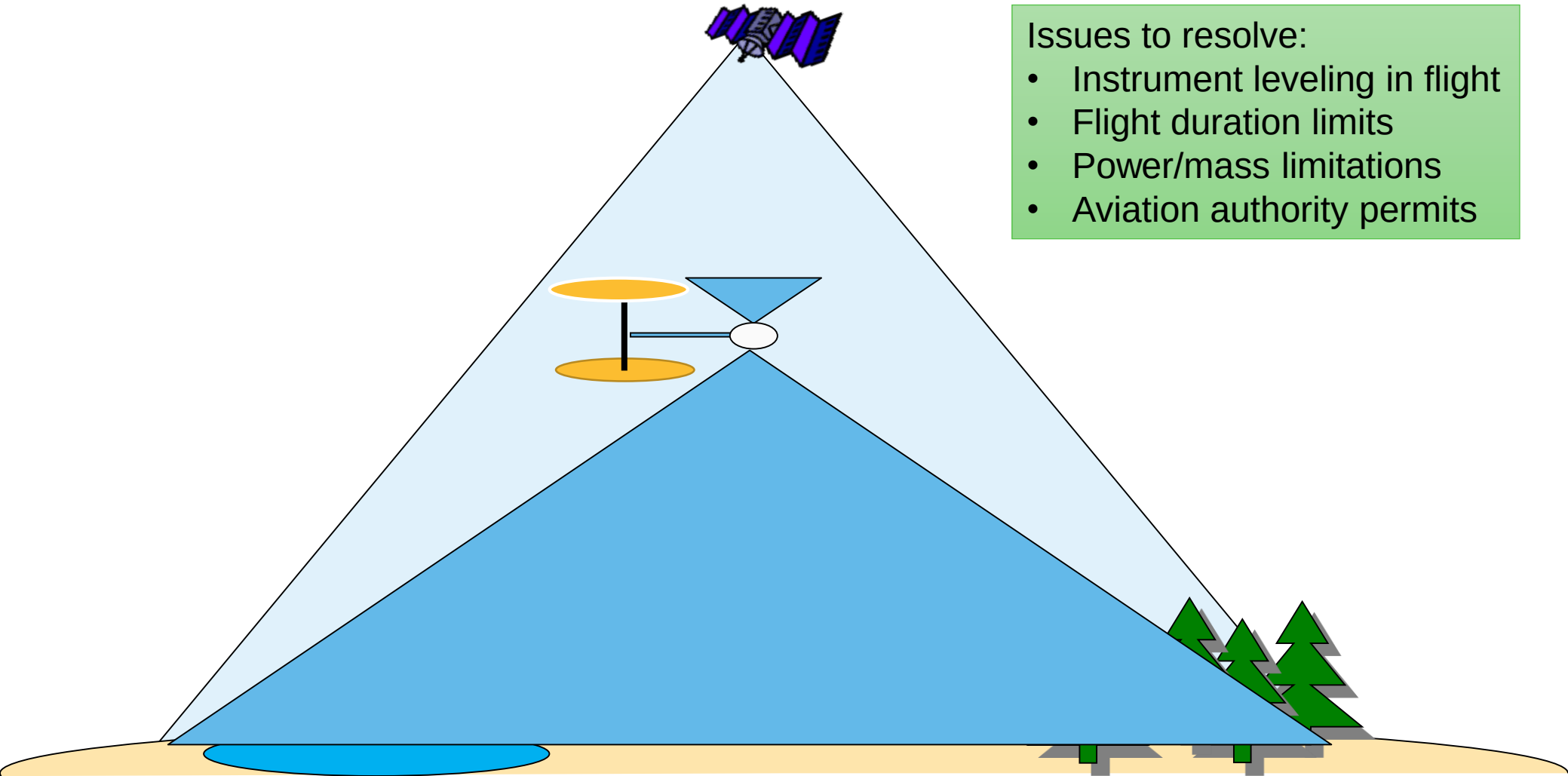
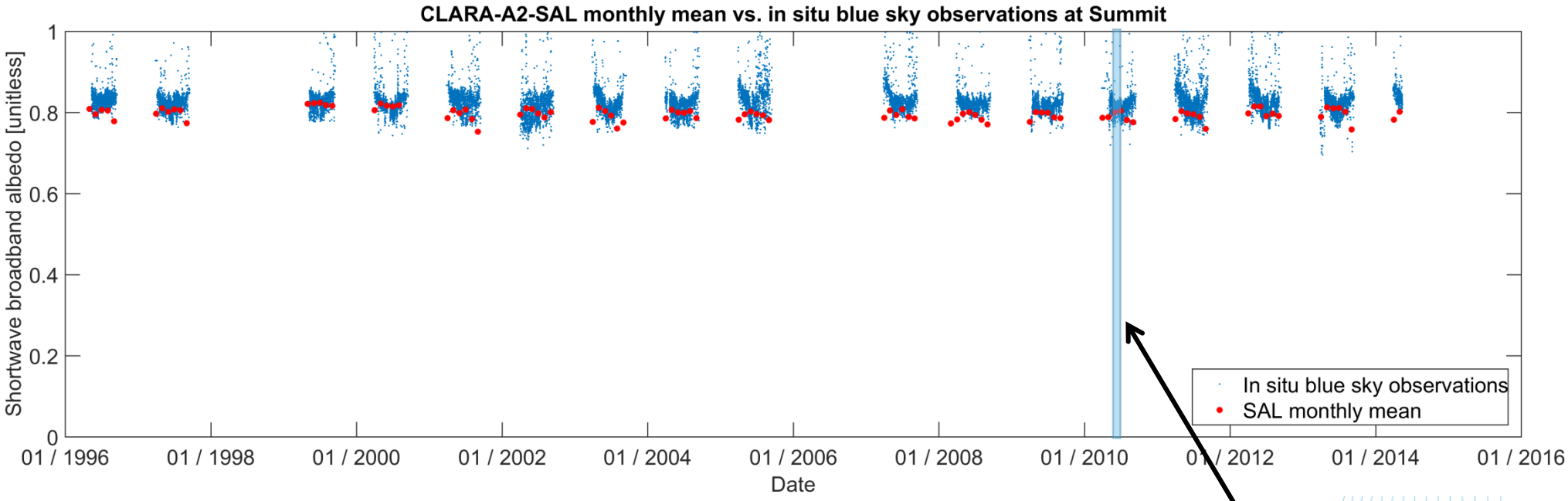


Issues to resolve:

- Instrument leveling in flight
- Flight duration limits
- Power/mass limitations
- Aviation authority permits

Temporal coverage



FMI RASCALS campaign at Summit, June-July 2010

Figure and data: Kati Anttila, FMI

Temporal coverage

- Intensive observation periods (=campaigns) provide very detailed characterization, but satellite retrievals must be validated over long timeframes to ensure algorithm and input stability and validity of obtained trends (if any)

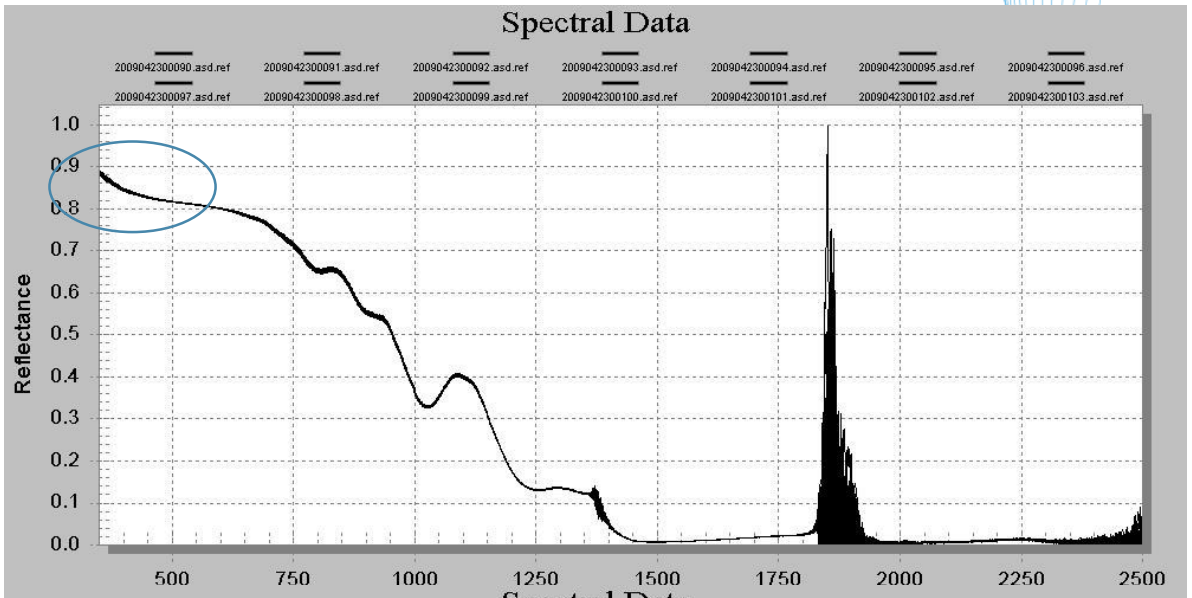
- Suggested solution:
  - See if long-term measurement sites and surrounding areas are good candidates for your measurement campaign?
  - Invest in developing automated sensor capabilities

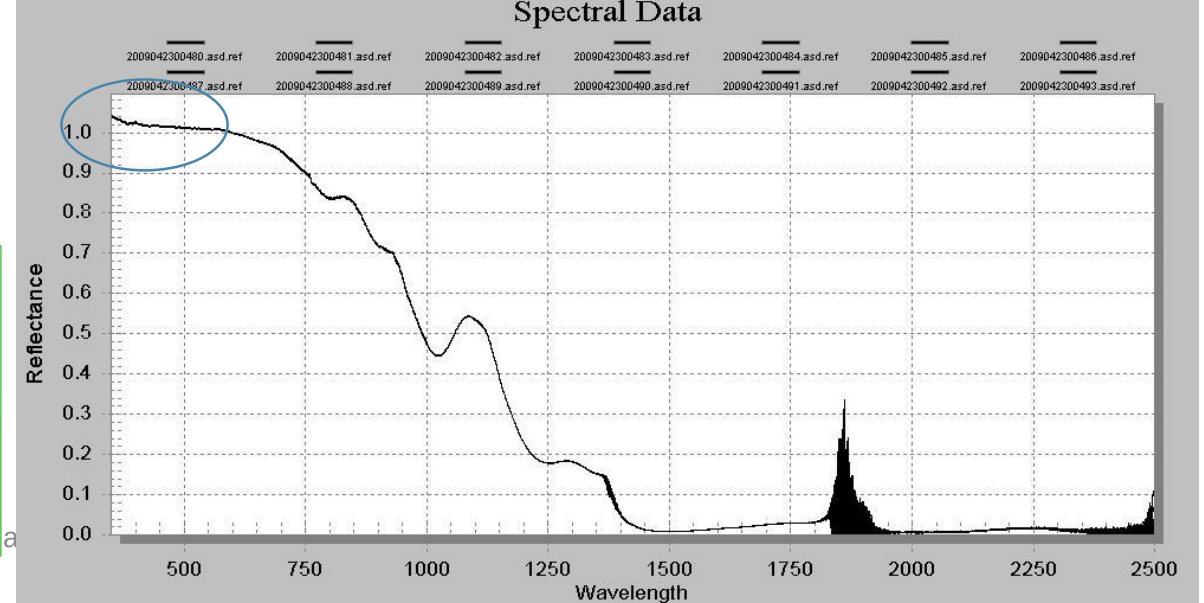
In situ (metadata) quality

Frosting

Tilt errors, see Bogren et al., 2016

Calibration woes…





Metadata / auxiliary data:
Weather?
Relevant physical quantities? (Yes, snow pits!)
(Operator condition?)

Finally: Spectral vs. broadband albedo

- Satellite data inherently spectral, but spectral albedo to date has been sparse or unavailable (spectral reflectance has been, but see previous slide for its problems).

- Based on presentations seen in this workshop, this is clearly now changing. So allow me to finish with a request;

Please strive for continuous, quality-monitored long-term spectral albedo measurement timeseries at sites where areal representativeness is considered. (Spectral BRDF would be great too).