Optical Properties and Climate Forcing of Icelandic Dust

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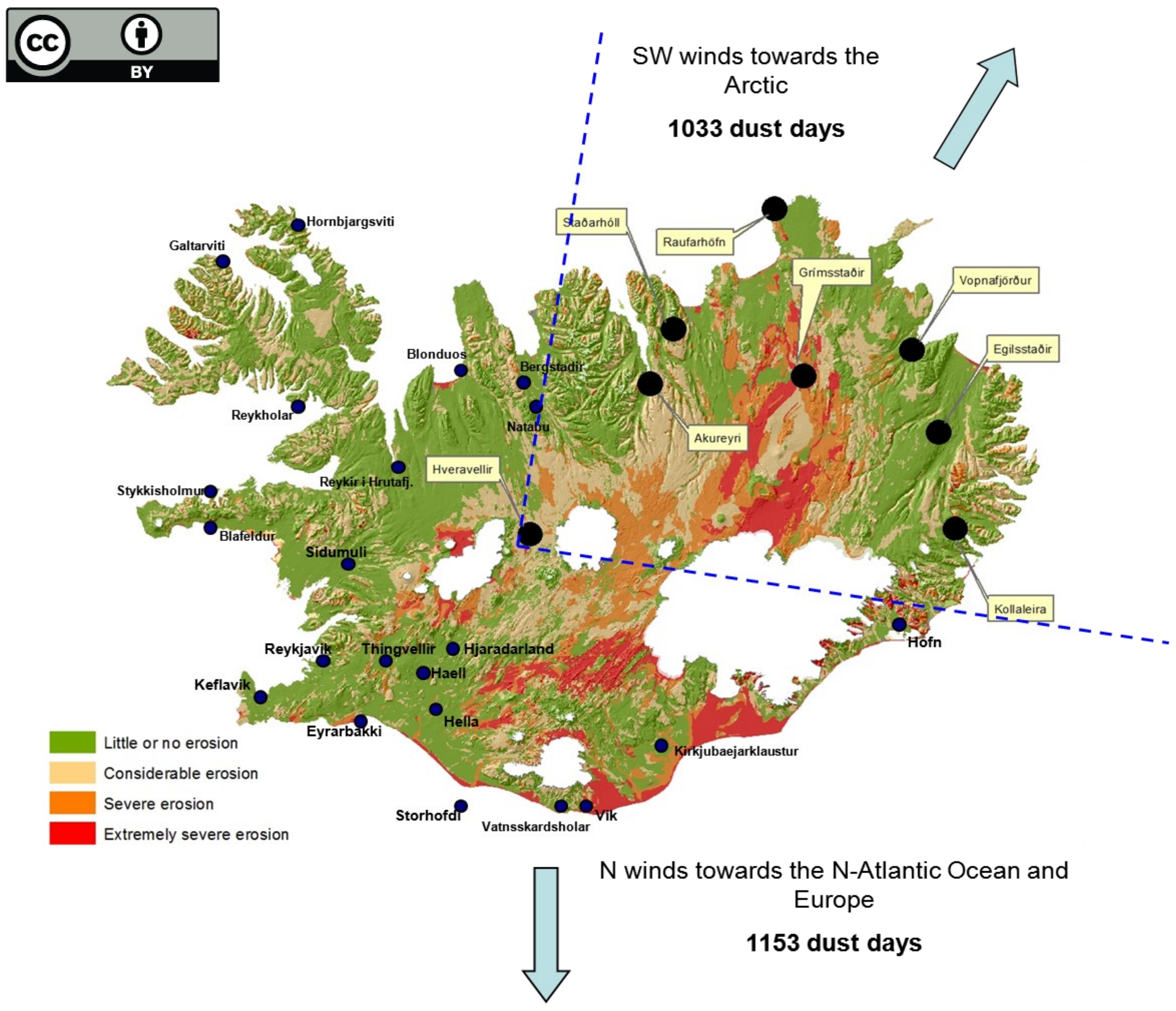


Fig. 1. A map of soil erosion and dust-day frequency (1949-2011) in Iceland.

Overview

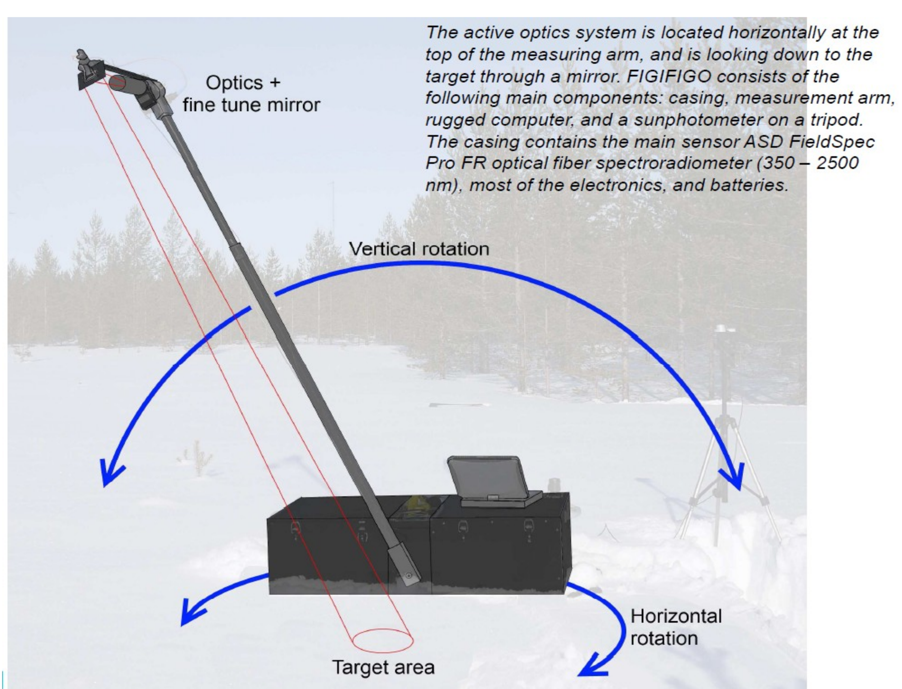
Iceland is an active source of dust from glaciogenic and volcanic sediments. The frequency of wind erosion events is <u>> 34 dust days annually</u> (Fig 1, Dagsson-Waldhauserova et al., 2013). Icelandic dust is of volcanic origin; it is very dark in colour and contains sharp-tipped shards with bubbles (Dagsson-Waldhauserova et al., 2014). Suspended glaciogenic dust consists of high number of close-to-ultrafine particles (0.3-0.337 µm). Such physical properties allow even large particles to be easily transported long distances.

SOS 2013

The Soot on the Snow (SoS-2013) experiment was carried out in Sodankylä (67°22'N, 26° 39'E, 179 m a.s.l.), north of the Arctic Circle, to study the effects of deposition of Black Carbon (BC), Icelandic volcanic sand and glaciogenic silt on the surface albedo and melt of seasonal snow.

Soot on Snow (SoS 2013) experiment with volcanic sand and glaciogenic silt from Iceland

METHODS: Laboratory and **snow** spectropolarimetric **measurements** with the Finnish Geodetic Institute Field Goniospectrometer FIGIFIGO (the albedo, hemispherical directional reflectance factor (HDRF), polarization, and other snow properties)



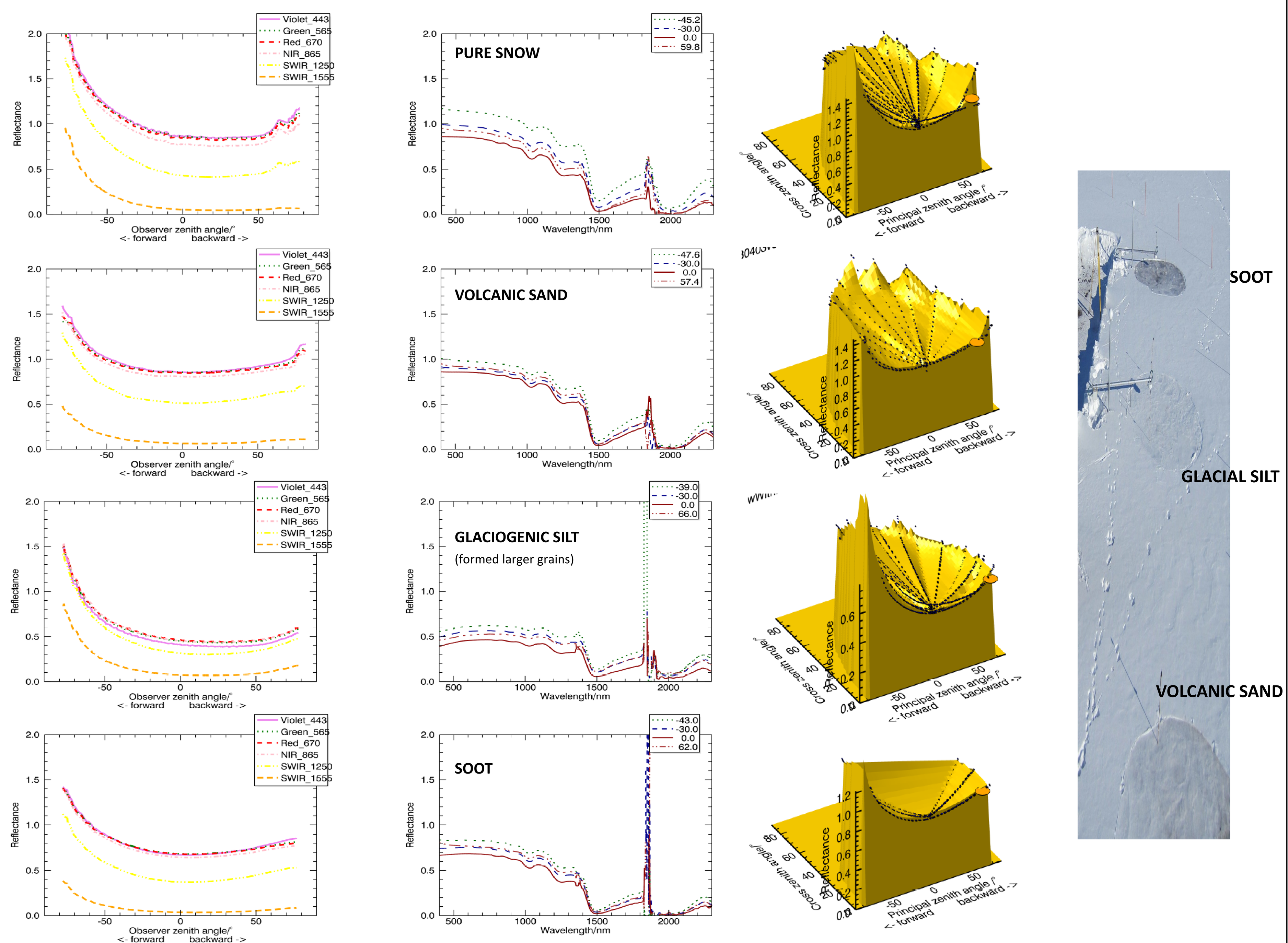
SAMPLES:

RESULTS:

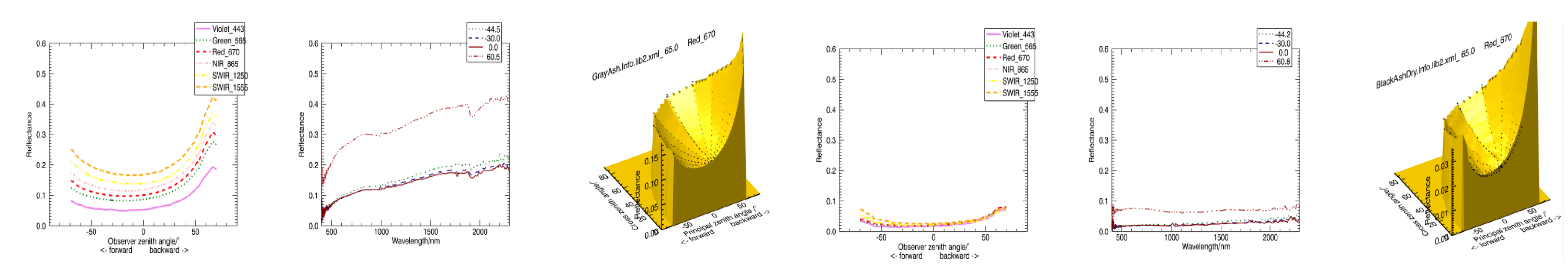
Deposition on snow >> Glaciogenic silt deposited on snow made the snow optically darker. The melting, metamorphose and diffusion processes were fast during the measurement. Sun heated the particles, snow melted around, and the particles diffused inside the snow. Smaller particles diffused faster than the larger. **Fine silt particles tended to form larger grains.**

Fig. 2. Melting, metamorphose and diffusion processes of the snow where glaciogenic silt was deposited. Left: Freshly deposited. Right: Several hours after dust depositions.

Fig. 3. Reflectance measurements during deposition on snow and in laboratory. Albedo changes due to deposition of Volcanic Sand, Glaciogenic Silt and Soot.



Laboratory albedo >> dry GLACIOGENIC SILT > dry VOLCANIC SAND



CONCLUSION

Larger volcanic sand particles had lower reflectance than fine silt particles both in laboratory and deposited on snow. Icelandic volcanic sand was of similar optical properties as black carbon both deposited on snow or in laboratory. This experiment showed that the Icelandic volcanic dust may both directly and indirectly act as *<u>a positive climate forcing agent</u>*. We suggest that Icelandic dust may be a contributor to the Arctic warming.

References

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