

Soot's effect on the natural snowpack—a series of experiments (Soot on Snow, SoS)

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Main Idea: Deposit soot onto a natural snowpack in a controlled way and monitor the subsequent changes

Background: Soot and other light-absorbing impurities are known affect snow albedo, as well as the physical snow properties. Experimental work on the subject is still limited to a few studies with no published experiments on a natural snowpack. The Finnish Meteorological Institute organized a series of experiments to study these matters.

SoS2011, Nurmijärvi, southern Finland

Soot concentrations of 80 ppb (reference) and 20886 ppb (contaminated).

SoS2013, Sodankylä, northern Finland

Soot concentrations of 232, 489, 554, 1026, 6417 ppb for the different sooted spots made.

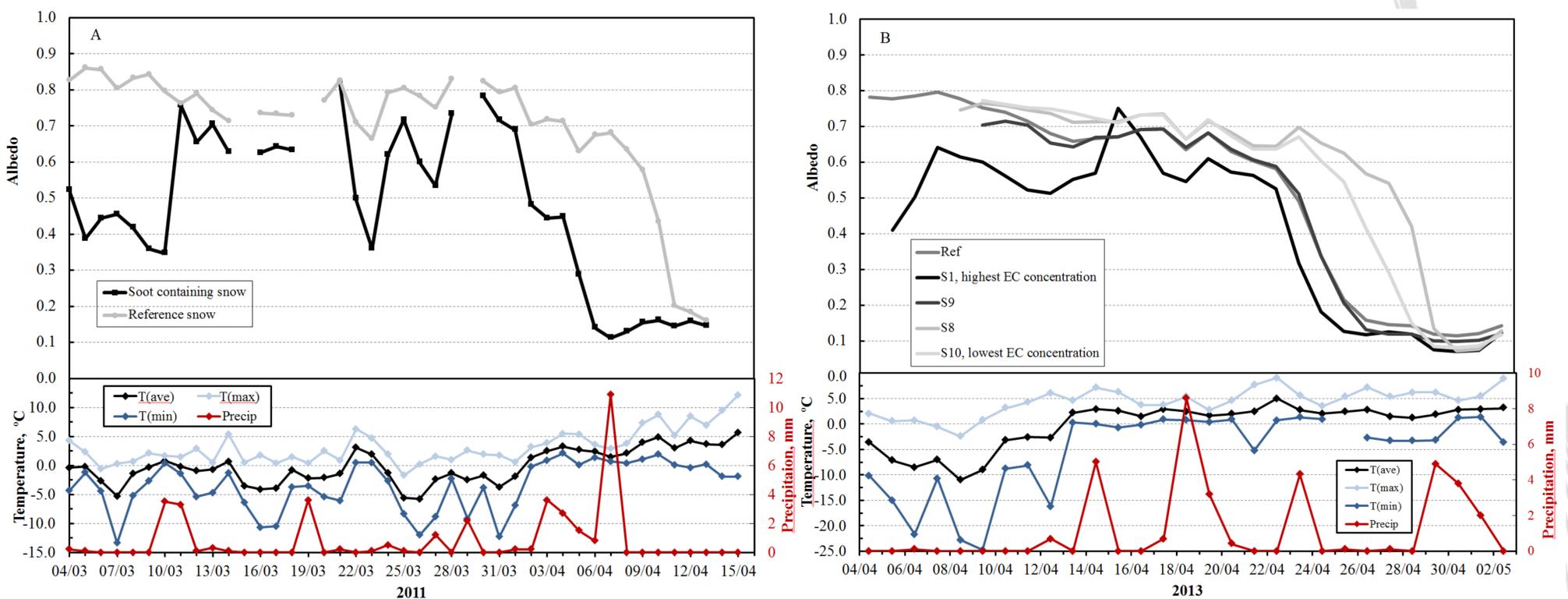


Figure 1. Time series of the broadband albedo (solar noon +/- hour), and the meteorological conditions during (A) SoS2011 and (B) SoS2013

Results and Conclusions

- Albedo is decreased with increasing soot concentration deposited onto the snow surface.
- Soot particles tend to stick at the snow surface, however, a fraction of them are flushed through the snowpack during melt (38 % were lost after 7 days), which has implications for global climate models where 100 % is assumed to stick to the surface.
- The soot particles were observed to sink into the snow surface immediately following being deposited (Peltoniemi et al. 2015).
- For soot concentrations <1000 ppb it is difficult to attribute soot's sole effect on the snowpack and its albedo in natural conditions.

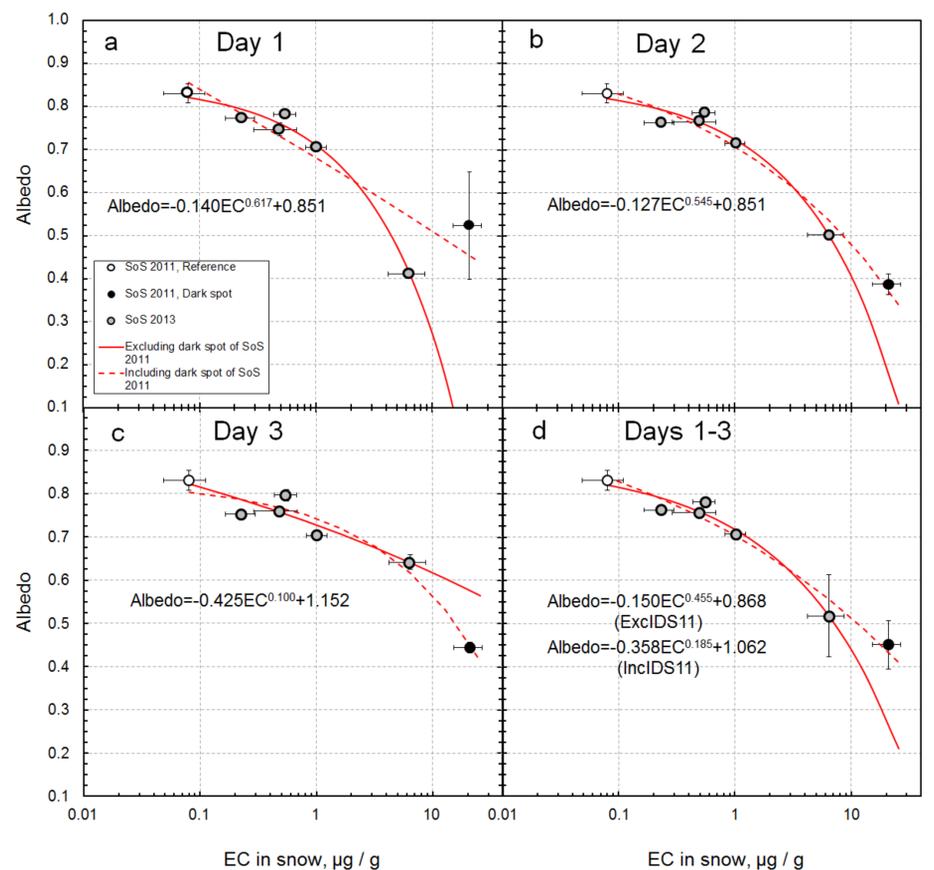


Figure 2. Albedo on 1-3 days after soot deposition vs. elemental carbon concentration in the surface snow layer. The lines represent fittings of $Albedo = bEC^c + d$ to the observations, including and excluding the the most contaminated snow from SoS2011.

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References

Peltoniemi et al. *The Cryosphere Discussions*, 9, 3075-3111, doi:10.5194/tcd-9-3075-2015, 2015.