

## Master thesis topic at Department of Arctic Technology

**Title:**

Dust on solar panels in Adventdalen

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UNIS has a focus on renewable energy, and current research activities include solar and wind. Dust impacts the efficiency of solar panels, by covering the panels itself, but possibly also by lowering the reflectivity of snow.

In Adventdalen, just outside Longyearbyen, it has been observed that dust affects solar panels. Adventdalen is a broad sandy valley close to Longyearbyen in Svalbard. There are some solar panel installations and a weather mast.

The task will be to investigate the “dust climate” in Adventdalen:

- How frequent and strong is dusting (and dedusting)?
- How does it affect solar panel productivity?
- What meteorological conditions lead to dusting?

To investigate this, fieldwork will be performed to collect dust from the solar panels in Adventdalen probably several times each week or at least after windy days over the summer. This could, e.g., be done by weighing the dust swiped off a panel.

The dust data can then be connected to the output of a solar cell, e.g., by calculating the power increase due to swiping. Additionally, data from a radiometer in Adventdalen and from solar cells from a less dusty location (Svalsat on a close-by plateau) can be used for comparison.

Dust events can be identified and connected to the meteorological conditions, e.g., the wind speed, wind direction or the antecedent precipitation, possibly also soil moisture etc. Having a better understanding of the weather conditions leading to dust on solar panel could help to predict and mitigate dust events. For example, dust storms are expected to occur during downslope windstorms in Adventdalen.

Some literature:

- An exemplary introduction to the problem: *The effect of dust on solar photovoltaic systems* (Mejia, Kleissl, Bosch 2014). *Energy Procedia* 49 (2014) 2370 – 2376. <http://dx.doi.org/10.1016/j.egypro.2014.03.251>
- An extensive review: *Energy yield loss caused by dust deposition on photovoltaic panels* (Sayyah, Horenstein, Mazumder 2014). *Solar Energy* 107 (2014) 576-604. <http://dx.doi.org/10.1016/j.solener.2014.05.030>
- Another review focussing more on technical aspects: *Power loss due to soiling on solar panel: A review* (Maghami et al. 2016). *Renewable and Sustainable Energy Reviews* 59 (2016) 1307–1316. <http://dx.doi.org/10.1016/j.rser.2016.01.044>
- A study of aerosols in windstorms in Svalbard including Adventdalen: *Aerosol distribution around Svalbard during intense easterly winds* (Dörnbrack, Stachlewska, Ritter, Neuber 2010). *Atmospheric Chemistry and Physics*. <https://doi.org/10.5194/acp-10-1473-2010>
- An article about snow-deposited dust in Svalbard: *High Latitude Dust Transport Altitude Pattern Revealed from Deposition on Snow, Svalbard* (Kavan, Láska, Nawrot, Wawrzyniak 2020). *Atmosphere* 2020, 11, 1318. <http://dx.doi.org/10.3390/atmos11121318>

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