Landscape-precipitation feedback mediated by ice nuclei
an example from the Arctic

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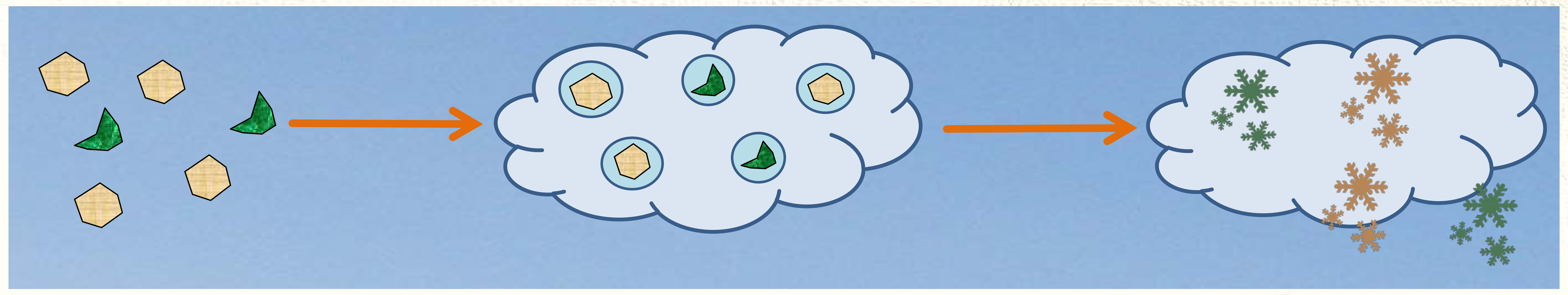


Ice nucleating particles (**IN**) are necessary for the formation of ice in clouds at temperatures warmer than -36 °C.

Those of **biological origin** can be active at temperatures up to -2 °C.

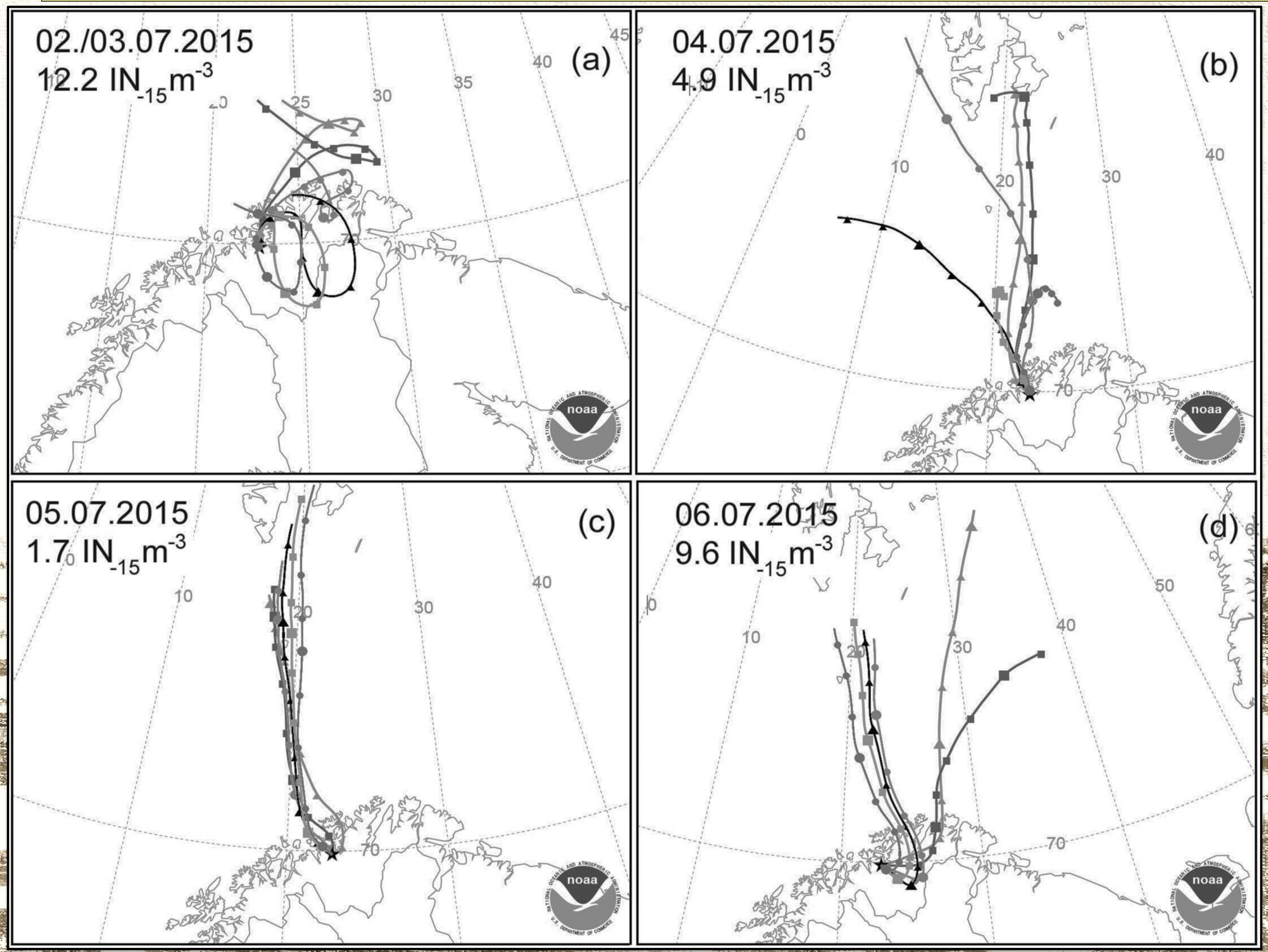
In the Arctic precipitation is IN-limited. This results in the persistence of thin clouds that cause surface warming in summer.

The Arctic is a perfect region to study the **interactions among IN, cloud properties and precipitation.**

Several sources of biological IN in the Arctic: oceans, freshwaters as well as decaying leaf litter.

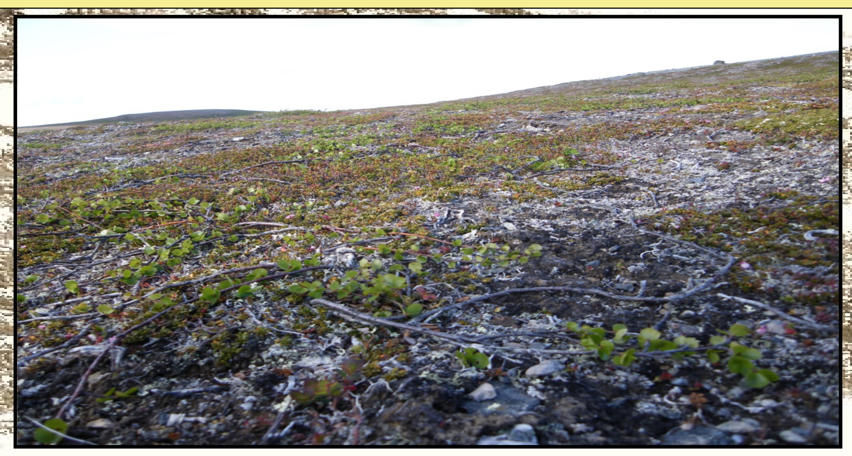
At the origin of such aerosolised biological material is the **activity of microorganisms** producing proteins and carbohydrates that catalyse the formation of ice. This is beneficial to survive at cold temperatures and access new sources of food.

Air masses passing over land are enriched in IN



With $2 \cdot 10^2$ IN active at -15 °C (IN_{-15}) per µg of particles smaller than 5 µm, **leaf litter is the best candidate to explain the observed data.**

Only 5 in 10000 IN_{-15} need to become airborne to account for the observed concentrations in the air.



Snow cover decreases due to climate change and vegetation becomes more productive in the Arctic.

Therefore, leaf-derived IN may be more abundant in the future:

- **How will this affect clouds, precipitation and the radiative budget in the Arctic?**

Samples were collected at Haldde Observatory (Norway, 900 m a.s.l.).

Air samples were collected on PM_{10} filters. On average 24 m^3 of air were collected on each filter; each sampling lasted around 24 hours. Litter samples were collected around the Observatory.

The concentration of IN in the air and in the litter was determined with the immersion freezing apparatus LINDA.

Meteorological observations were done on site, HYSPLIT model was used in backwards mode to determine the trajectories of air masses before arrival at Haldde.

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Clues that decaying leaves enrich Arctic air with ice nucleating particles

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