Summary: Girard et al:

Anthropogenic acid aerosols have a weak ability to nucleate ice and this has a strong impact on the behavior of lower atmospheric ice crystals.

→Increases cloud ice particle sizes and reduces number concentrations

→**Short term increase in precipitation (crystal fallout)**

→Increases lower troposphere dehydration rate

→Surface cooling anomaly
(as much as -9 W/m^2 locally)

→ **Long term decrease in precipitation**

Summary: Garrett et al:

Where thin water clouds and pollution are coincident, there is an increase in cloud longwave emissivity resulting from elevated haze levels.

→IN are smaller, LW increases

→ **Short term precipitation decreases (less crystal fallout)**

→ **Long term precipitation might increase**

→Aerosol-cloud emissivity feedbacks are poorly understood but are likely to be positive.

**Both studies could benefit from an enhancement in observations leading to a better understanding of the vertical, spatial, and temporal distribution of aerosol and IN.

It is also important to understand the role of chemical composition and IN formation as it applies to the Arctic atmosphere.

Summary: Hansen et al:

The absorbing BC is deposited to surface via wet and dry deposition.

→ It can decrease the snow and ice albedo

→ SW warming(+0.3 W/m^2 in Northern Hemisphere)

(For a given forcing, it is twice as effective as CO2 in changing global surface temperature)

→Potentially, precipitation might increase

Summary: Lohmann et al:

Anthropogenic aerosol can alter microphysical properties of Arctic clouds (riming↑, autoconversion and accretion drizzle by snow↓), and consequently modify surface precipitation.

→ The amount of snow and overall precipitation reaching surface depends on the snow shape. Tenfold increase in aerosol concentration:

aggregates: ↑ by 40%(S) ↓7%(P)

planar crystals: ↓ by 30% ↓50%(P)

→ Potentially, LW might increase (more water vapor in the Atmosphere)

- The effect of polluted aerosol on precipitation and radiation are not well understood due to complex feedbacks between aerosols, clouds, radiation, snow/sea ice and vertical and horizontal transport