Using Model Sensitivity Studies to Improve Understanding of Ice Formation in Antarctic Clouds

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On 9 December 2015, measurements of clouds over coastal Antarctica and the Weddell Sea were collected during the Microphysics of Antarctic Clouds (MAC) field campaign. The clouds measured were single-layer stratus clouds composed primarily of supercooled water. When ice was observed, it occurred in patches instead of being distributed throughout the clouds.

The exact cause of these ice patches is uncertain, but it is thought that secondary ice production could be enhancing the impact of isolated ice-nucleating particles (INPs). The number of INPs in the Antarctic atmosphere is relatively low, so primary ice nucleation alone cannot explain the amount of ice observed in the clouds, particularly at temperatures higher than -10 C as was observed in many of the clouds in this campaign.

Measurements from MAC were used as the starting point for model sensitivity studies to investigate what ice formation mechanisms may be active in the Antarctic and the conditions required for those processes to be initiated. The model used was the Met Office NERC Cloud (MONC) model using the Cloud AeroSol Interactions Microphysics (CASIM) scheme. Some of the variables to be tested in the sensitivity studies include: aerosol activation schemes; ice nucleation parameterizations; secondary ice production processes; the number of ice nucleating particles present.