Contrasting Ice Production Characteristics in Stratiform Mixed-phase Clouds over the North and South Poles

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Different Aerosol and Dynamical Environment

- NSA, a polluted and less dynamically active state.
- McMurdo, a pristine, colder, and more dynamically active state.
- Coincident lidar and cloud radar measurements for identifying stratiform mixed-phase clouds

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<thead>
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<tbody>
<tr>
<td>NSA</td>
<td>2011.07-2015.12</td>
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<td>Barrow</td>
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<td>AWARE</td>
<td>2015.12-2017.01</td>
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<tr>
<td>McMurdo</td>
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<td>(AWR)</td>
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<tr>
<td>CloudSat</td>
<td>2006.06-2010.06</td>
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<td>CALIPSO</td>
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Cloud radars and lidars at McMurdo
- Annual stratiform cloud occurrence of 30% at NSA and 24% at AWR.
- Maximum occurrences during Summer at both NSA and AWR.
Most stratiform clouds have cloud top temperatures (CTTs) in the range between -40 and 0 °C.
Ice Production Characteristics in Polar Stratiform Mixed-phase Clouds (SMCs)

- A-Train measurements over entire Arctic and Antarctic.
- $Z_{e\_layer}$ (mean $Z_e$ between cloud top and 500 m below) strongly depends on cloud top temperature (CTT).
- Strong seasonal variations of $Z_{e\_layer}$ over the Arctic.
A-Train measurements within a $5^\circ$ (Latitude) x $10^\circ$ (Longitude) box centered in NSA and McMurdo.

AWR has maximum $Z_{e\_layer}$ during austral Summer and minima during Winter.
Ice Production Characteristics in Polar SMCs

- Ground-based remote sensing measurements over NSA and McMurdo.
- Spring season has the smallest LWP at all CTTs and the largest IWP and $N_{\text{ice}}$ at CTT lower than $-15$ °C.
- Higher IWP and $N_{\text{ice}}$ during Spring season could be related to more dust events (Zhao, 2012).
- LFs are high (>0.8) most of the time, different than in convective clouds.
CloudSat DO-op mode: Relax the distance criteria to find closest 5 CALIOP profiles.
Global Cloud Thermodynamic Phase Distribution
Mass Liquid Water Fractions

![Graph showing Mass Liquid Water Fractions vs. CTT (°C)]