Unraveling the Secrets of Arctic Clouds

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PSD Leads Major Advance

• An “end-to-end” story
• Instrument development
• Technique development
• First annual cycle
• Detailed process studies
• Advancing model capabilities
• Arctic clouds recognized as critical challenge
  ▪ phase partitioning
  ▪ persistence
Why Care About Phase?

Surface LW Radiation

Frequent liquid = Persistence

Models struggle with cloud phase
Detailed Cloud Processes

- High resolution dynamics and microphysics
- Liquid drives turbulent motions via radiation
- Ice forms in moisture-rich regions; fallout is critical
- Processes occur at <1km scales
Liquid water at heart of complex web of cloud-scale feedbacks
Strength of Observations + Models

Observational analyses

Multi-sensor measurements

Multi-scale modeling

Idealized LES

Building Conceptual Understanding

Improved Model Representation
Summary and Future

• End-to-end story: PSD as a leader
  Instruments > Techniques > Data sets >
  Process Studies > Model Development

• Arctic liquid clouds are now a major metric for models. Broad community engagement.

• Models still struggle with supercooled liquid

• Cloud cause and response to Arctic change

• Leadership in MOSAiC, YOPP, and more