Properties of super-cooled liquid water topped sub-arctic clouds and precipitation during PaCE-2015

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Background
• Super-cooled liquid water topped clouds are frequently observed over Finland
• These clouds
  • are long-lived
  • can have significant radiative impact
  • produce precipitation (ice/freezing rain)
  • cause significant icing
  • can be difficult for NWP models to forecast.

Motivation
• Improve super-cooled liquid water layer detection based on cloud radar velocity profiles

CASE 1: November 19th, 2015

A) Mira 36 Cloud radar data
B) PollyXT lidar data
C) Cloudnet target classification
D) Radiosonde profile

Improving detection of multiple super-cooled liquid water layers
• Identify highly-turbulent supercooled liquid layer at 2 - 2.5 km using Doppler velocity and dissipation rate profile (Fig. A).
• This layer missed in standard Cloudnet classification because Doppler lidar attenuated by lower liquid layer (Fig. C).
• The liquid water layer around 2 - 2.5 km could occasionally be detected in PollyXT lidar range-corrected signal (1064 nm) and volume depolarization ratio profiles (Fig. B).
• Detection of upper super-cooled liquid water layer indicated by stars (Fig. C).
• RH and temperature profiles (Fig. D) measured earlier the day suggest that similar cloud conditions occurred throughout the day (remote-sensors were started after midday) below 3 km.

CASE 2: October 8th, 2015

Sublimation region and rate
• Cloudnet target classification updated with sublimation region for ice below super-cooled liquid water cloud (Fig. E).
• New product includes estimation of average sublimation rate per profile (Fig. F) ready for comparison with NWP.

CAMPAIGN: PaCE 2017
• 3 months starting on 1st September, 2017
• Focus on combining in-situ and remote-sensing
• TNA is available
• Contributions to both in-situ and remote-sensing are very welcome; e.g. MWR, Polly-lidar, UAVs.

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