Introduction

- NASA Global Precipitation Measurement (GPM) mission Olympic Mountain Experiment (OLYMPEX) winter of 2015-16
- Ground and airborne in situ and remote sensing measurements
- NASA S-band dual-pol radar (NPOL) used to analyze evolution of hydrometeor profiles as precipitation moved from the ocean and over mountainous terrain

GPM radiometer-based precipitation retrieval algorithms over land rely strongly on ice-scattering signals. Hence, we use NPOL to evaluate the relative contributions of ice and liquid-phase orographic precipitation processes in the vertical column to the precipitation estimated at the surface. Attention is focused on the precipitation ice and liquid water paths (IWP, LWP, respectively).

Methodology

Calculating water paths with an RHI

1. Use hydrometeor ID to discriminate between ice types and liquid
2. Calculate mass content values for ice and liquid (M_{ic}, respectively) by relating reflectivity (Z) and differential reflectivity (Z_{DR}) to M_{ic} through relationships derived specifically from OLYMPEX (ice: Heymsfield et al. 2017; liquid: 2D Video Disdrometer data)
3. Grid the newly calculated mass content variables with resolution 1000 m x 500 m (x- and z-direction)
4. Integrate gridded mass content values to acquire path

Conclusions

- Persistent trends in ice and liquid water path due to the orographic enhancement of ice and liquid through:
  - Collision-coalescence process
  - Seeder-feeder mechanism (enhanced ice process leads to more and larger snow melting and feeding into collision-coalescence below)
- Low-level flow important to the trends observed, for GPM algorithms
  - Use of cyclone sectors could be subjective
  - Objective metric such as Froude number, Rossby number, Rossby radius of deformation, and other parameters related to flow and stability can be calculated in models, incorporated into algorithms

Ongoing Work

- Complete analysis on primary cases with GPM overpass events
- Evaluate application of stability, upstream flow parameters and classifying cases by regimes based on these parameters
- Analysis of supplementary cases (smaller rainfall events, no overpass)
- Comparison of NPOL to GPM data (radiometer, radar)
- Limitations
  - Contamination of NPOL data by mountains
  - HID uncertainty, especially in ice (melting layer)

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