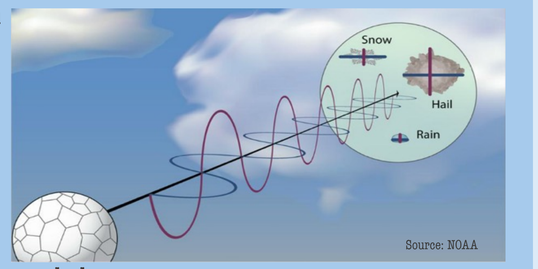
Microphysical Fingerprinting of Extreme Rainfall Over Taiwan's Central Mountain Range

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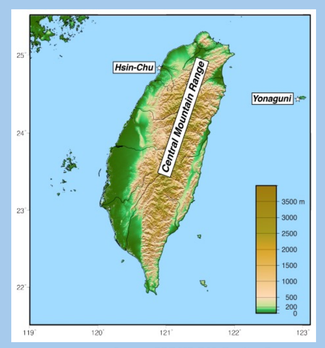
Background

The 2022 PRECIP field campaign took place in Taiwan, a mountainous island with abundant moisture and frequent heavy rain events. A dual-polarization radar (S-Pol) was deployed near Hsin-Chu to study microphysical processes leading to high intensity and long duration rainfall. Dual-pol radar collects measurements in the vertical and horizontal, allowing for inferences of particle size, shape and phase.



Driving Research Question

How does the terrain, and therefore the change in room for warm rain processes, affect the dominating microphysical processes in heavy precipitation events?

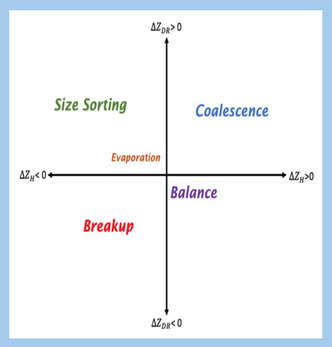


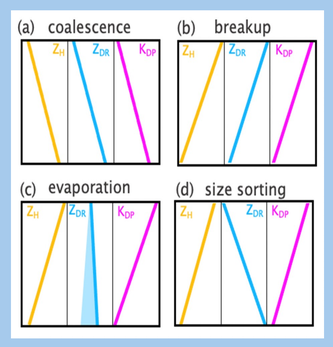
Source: PRECIP EOL Facility Request

Methods

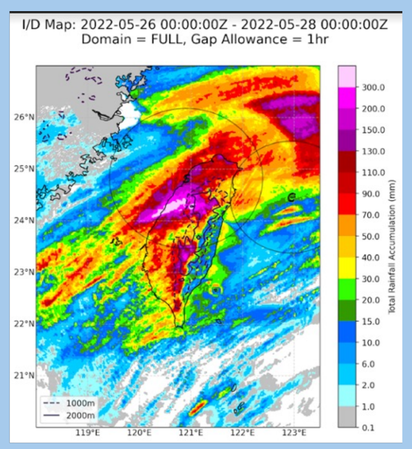
Fingerprinting (Kumjian et al. 2022) provides a method for inferring dominant microphysical processes from dual-pol radar. The steps taken to get to that point are as follows:

- Determine a time of high rainfall (Mei-Yu frontal period)
- Separate out three elevation groupings (0m – 500m, 500m – 1500m, and >1500m) to analyze separately
- Develop histograms displaying rain rates for each separate elevation groupings to visualize the range of rain rates
- Determine the 99th percentile of rain rates for each elevation grouping, to separate out the "extreme" rainfall
- Apply these constrictions to reflectivity (Z) and differential reflectivity (Z_{DR}) in order to build vertical profiles

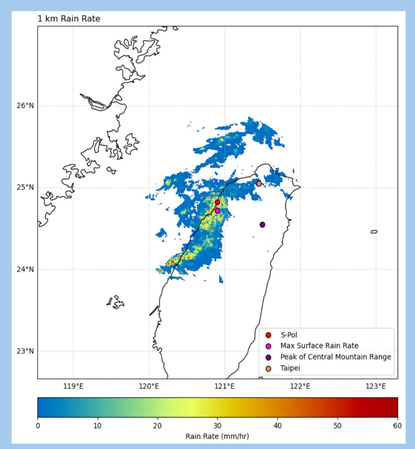




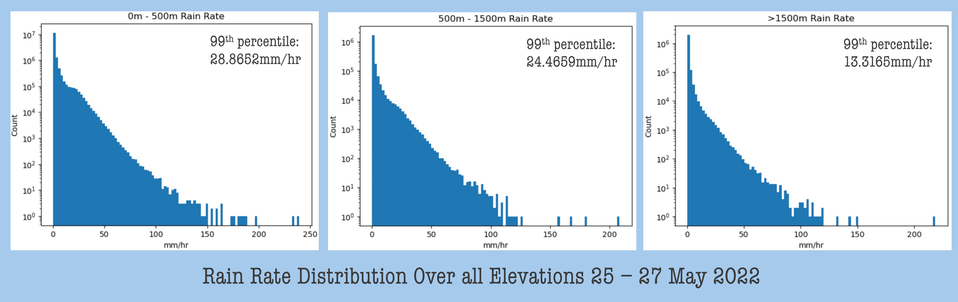
25-27 May 2022 PRECIP Rain Event



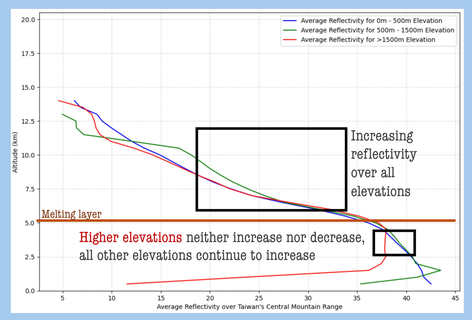
Total Rain Accumulation 26 – 27 May 2022



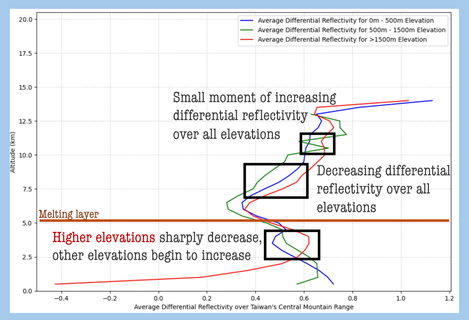
1km Rain Rate PPI, One Time, 27 May 2022



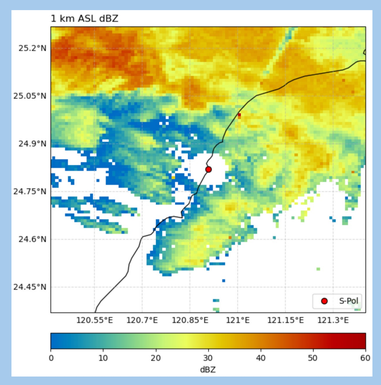
Rain Rate Distribution Over all Elevations 25 – 27 May 2022



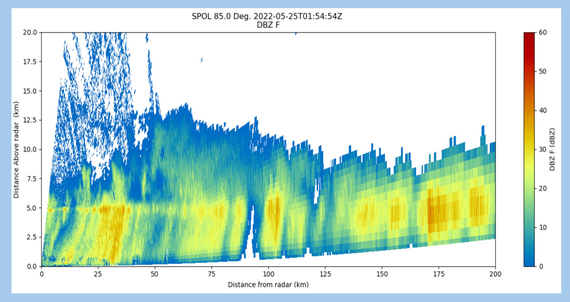
Reflectivity (Z) Vertical Profiles



Differential Reflectivity (Z_{DR}) Vertical Profiles

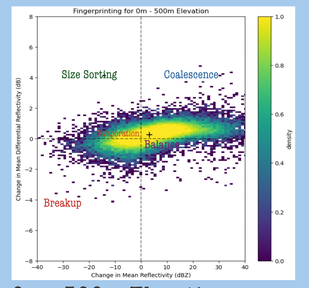


1km Reflectivity PPI, One Time, 25 May 2022



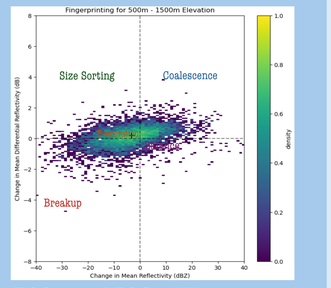
Reflectivity RHI, One Time, 25 May 2022

Results



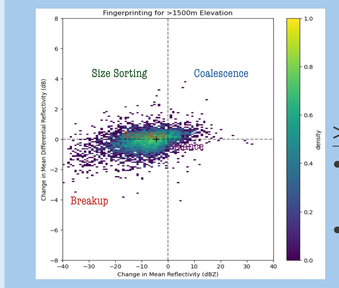
0m - 500m Elevation

- Most amount of points above threshold
- Shows a strong preference for **coalescence**



500m – 1500m Elevation

- Much fewer points above threshold
- Shows a shift towards size sorting, evaporation, and breakup



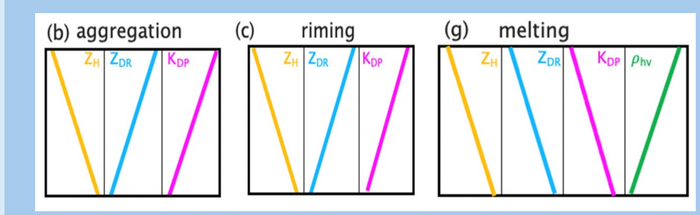
>1500m Elevation

- Fewest amount of points above threshold
- Shows a strong preference for **breakup**

Conclusions & Future Work

- The change in elevation groupings proves to have a difference in a dominating microphysical processes
- There is a reduction in space between the melting level and the surface with increasing elevation
- With reduced warm-cloud depth, less room for coalescence and thus breakup dominant in higher elevations
- The longer liquid hydrometeors spend in the air, the more likely they are to experience coalescence

This analysis focuses on warm-rain processes, but there are also expected differences in ice-phase microphysics between elevation. Aggregation and riming have similar fingerprints, however, so additional variables are needed to analyze ice microphysical processes leading to extreme rainfall in this dataset. Future work should emphasize a closer look into these ice-phase microphysics.



Acknowledgements

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