

The \$3.25 Billion Calgary, Alberta Hailstorm: a Meteorological Case Study and In-situ Observations from the Northern Hail Project

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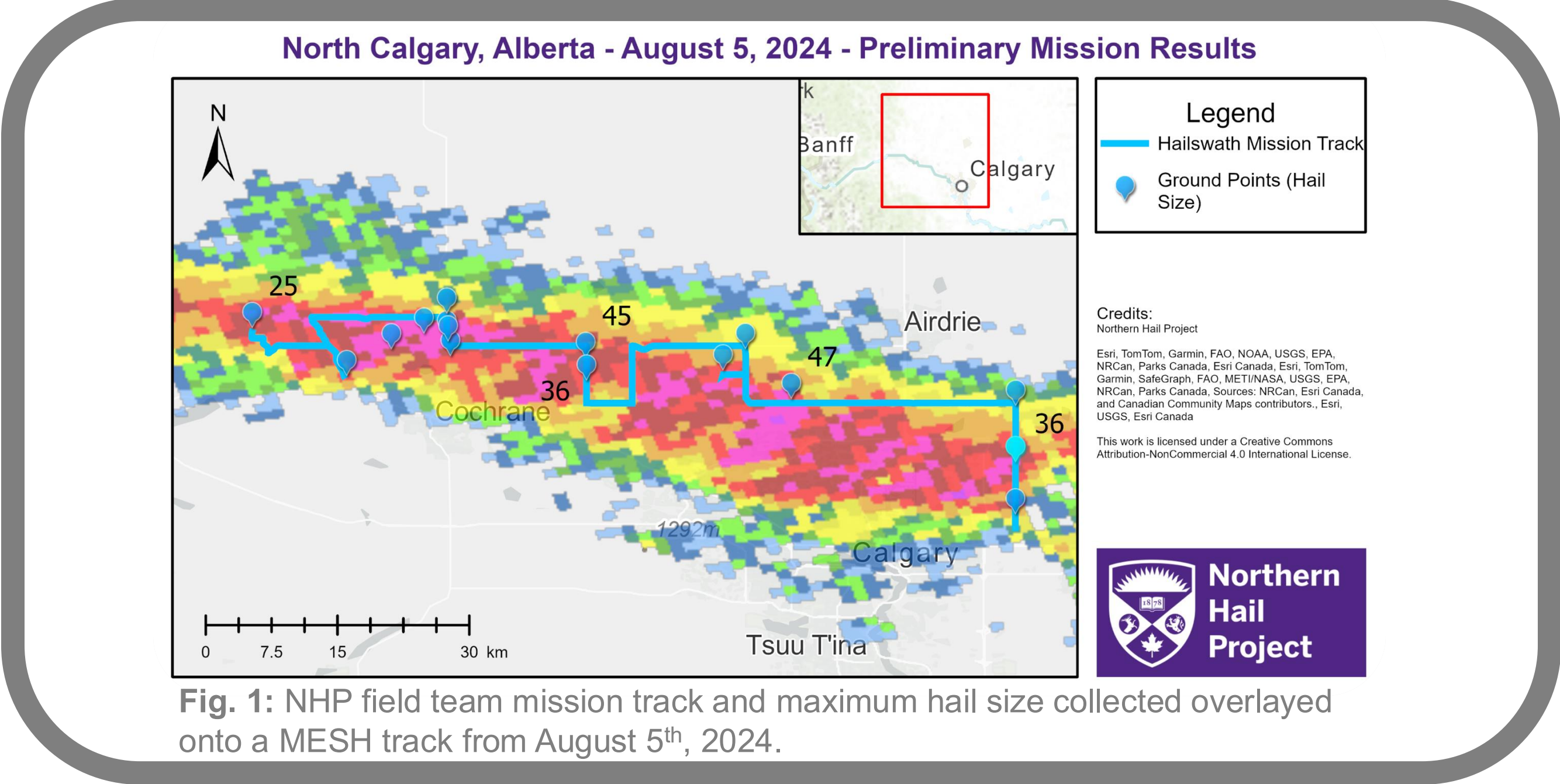
Background

- A destructive hailstorm hit the far north end of Calgary, Alberta, Canada on August 5th, 2024
- The storm resulted in \$3.3 billion CAD of insured losses, the second costliest natural hazard event in Canadian history¹
- Serious damage was also caused to buildings and aircraft fleets at the Calgary International Airport
- A spate of severe hailstorms has resulted in over \$6 billion CAD in insured losses in the Calgary area since 2020



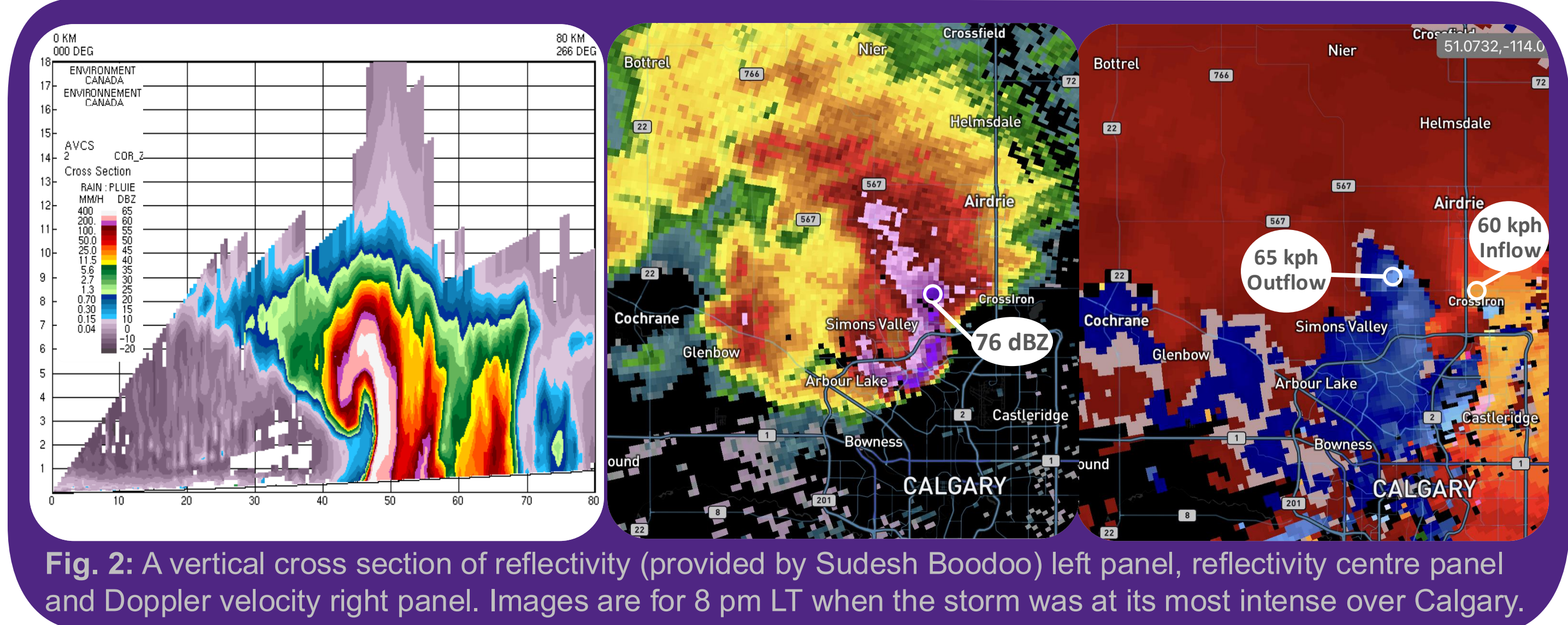
Hailswath and Observations

- The NHP field team collected data along the hailswath on the day of the event, before conducting a forensic damage survey (Fig. 1)
- Drifts of large hail were observed with hail up to 52 mm measured
- Data were also recorded at the NHP's hail-monitoring stations in Calgary. Over 50 mm of rain was measured at the airport
- Highest wind gusts were near 65 km h⁻¹



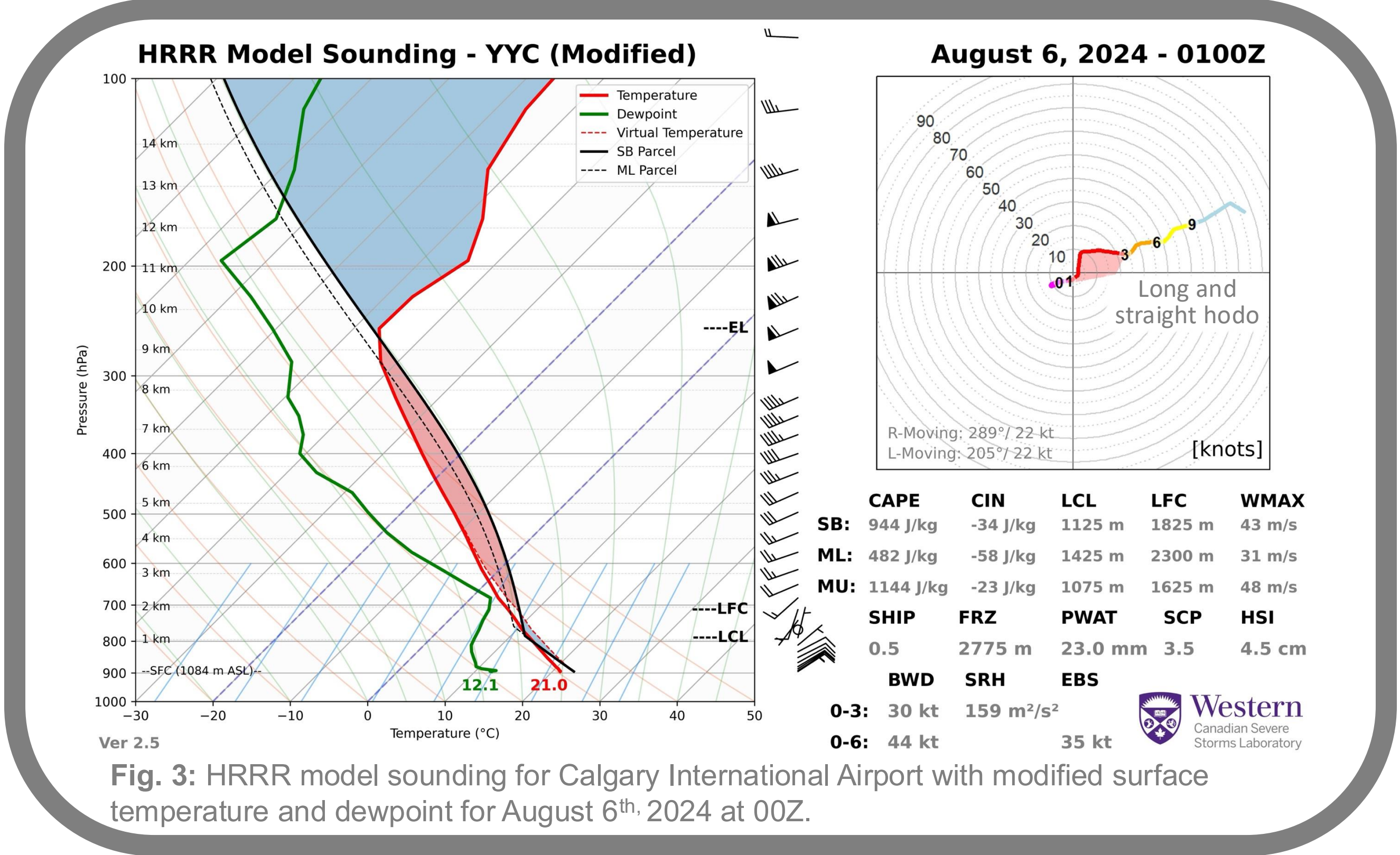
Radar Characteristics

- The storm formed northwest of the city and rapidly intensified into a supercell with a large bounded weak-echo region (Fig. 2)
- Near the city limits, the storm mode changed to resemble a bow echo with strong inflow >60 km h⁻¹ on the eastern flank and strong outflow (~65 km h⁻¹) in the precipitation core (Fig. 2)
- Maximum reflectivities were near 76 dBZ; dual-polarization data indicated presence of large hail (i.e., ZDR near 0.0 dB)



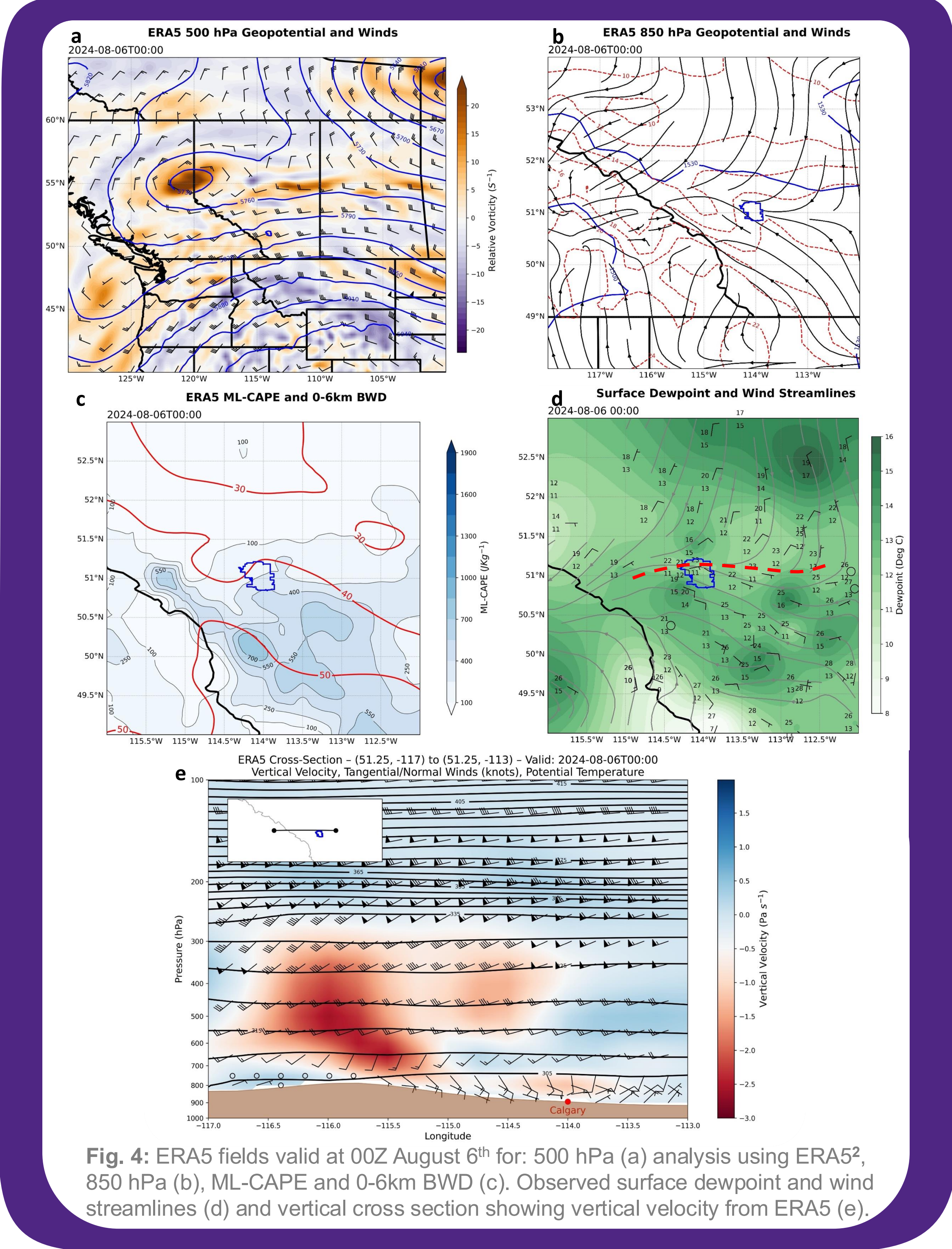
References

¹ Floyd, C. (2025, August 6). CAD 3.29 B - CatIQ Discloses Updated Industry Loss for the Calgary Hailstorm of August 5, 2024. CatIQ. <https://public.catiq.com/2025/08/06/cad-3-29-b-catiq-discloses-updated-industry-loss-for-the-calgary-hailstorm-of-august-5-2024/>
² Hersbach, H., et al. (2020). The ERA5 global reanalysis. Quarterly Journal of the Royal Meteorological Society, 146(730), 1999–2049. <https://doi.org/10.1002/qj.3803>



Atmospheric Conditions

- Conditions were favourable for severe thunderstorms, but there were no indications of a major event in the offing
- The modified NWP model profile (Fig. 3) had a modest SBCAPE of ~950 J kg⁻¹ and 0-6BWD near 45 kt
- An approaching upper-air trough, mountain-plain circulation and a low-level convergence zone (Fig. 4) resulted in enhanced lift that destabilized the atmosphere, while also initiating and organizing the hailstorm
- A jet of 75 kt between 10 and 11 km aided kinematics



Summary

- A trio of atmospheric conditions resulted in an otherwise unremarkable setup causing a dangerous, long-lived storm
- This event demonstrates that an extreme event does not necessarily require extreme antecedent conditions
- This case also highlights the importance of identifying conditions that can cause a hailstorm to produce large amounts of large, wind-driven hail
- Agreement between models on kinematics, not buoyancy