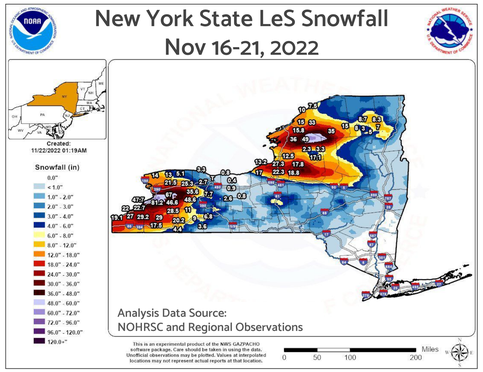
The Influence of Orographic Features on Lake Effect Snow

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CASE STUDY:

- Nov 16-20, 2022
- Buffalo Area
- Tug Hill Plateau



OBJECTIVES:

Assessing terrain's influence on:

1. flow
2. precipitation (amount and distribution)

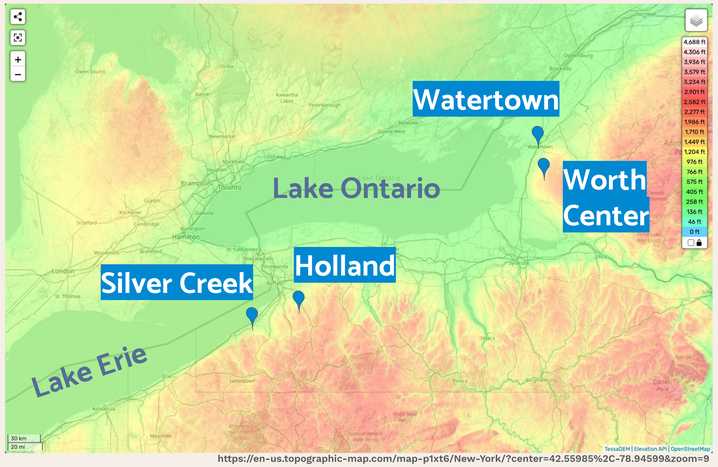
DATA:

- Weather Research and Forecasting Model (WRF)
- 2022 November 18 00:00 – 20 23:45
  - 15 minute intervals

Two runs:

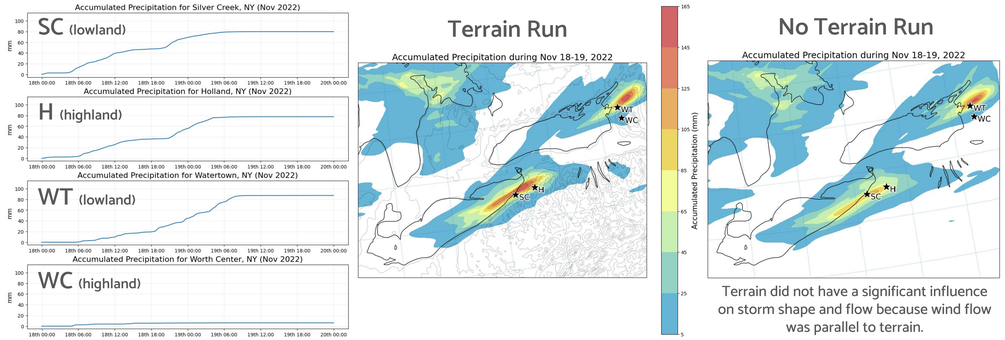
- 100% terrain as baseline
- 0% terrain (i.e. no terrain in the model)

CITIES FOR ANALYSIS:



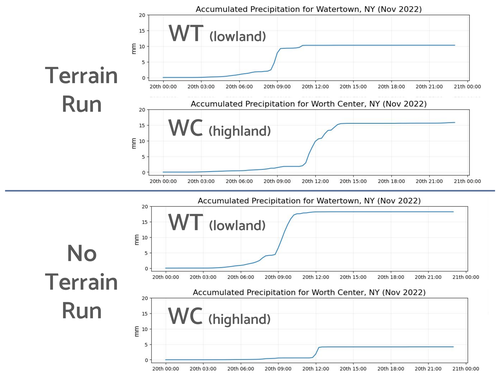
Lake Erie Sites	Lake Ontario Sites
- Silver Creek (SC)	- Watertown (WT)
- 218 m	- 146 m
- Holland (H)	- Worth Center (WC)
- 493 m	- 452 m

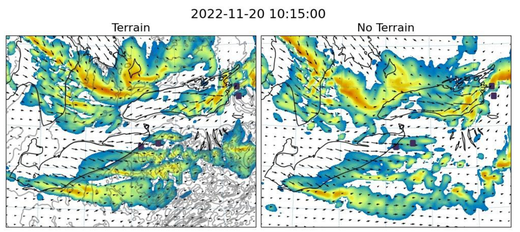
18th - 19th: Southwesterly wind dominated regime (All LLAP)



Terrain did not have a significant influence on storm shape and flow because wind flow was parallel to terrain.

20th: Northwesterly wind dominated regime (Ontario Sites Broad Coverage)





Snow persisted on Worth Center since terrain slowed down storm motion and with orographic lift from the terrain.

Low snow accumulations on Watertown and Worth Center since the storm was unimpeded by lack of terrain and quickly moved out of study area.

SUMMARY:

- Mode plays an important role in how terrain impacts precipitation outcomes as it influences wind flow and how it is positioned when approaching terrain
- Long Lake Axis Parallel Mode and Adjacent Terrain
  - → LLAP has convergence at the center of the lake causing wind flow along and away from terrain with weak cross-barrier wind flow.
  - → Weak cross barrier flow = weak orographic lift which leads to a lower orographic ratio (the ratio of highland precip. to lowland precip.)
- Broad Coverage Mode and Terrain-ward Wind
  - → Broad Coverage mode storms have more spread out convection and with terrain-ward wind, the cross-barrier wind flow is stronger.
  - → Stronger cross barrier wind flow = stronger orographic lift → higher orographic ratio (more precipitation on highland areas than lowland areas)
- Aligned with Campbell et al. 2016 and Veals et al. 2018!

LIMITATIONS:

- Conclusions are for this storm and region
  - More studies need to be done to for a broader conclusion

FUTURE QUESTIONS:

- Compare with different terrain height differences and locations
- Compare with other storms and regions
- Look at intersection of other LeS factors and terrain

References:

Campbell, L. S., W. J. Steenburgh, P. G. Veals, T. W. Letcher, and J. R. Minder, 2016: Lake-Effect Mode and Precipitation Enhancement over the Tug Hill Plateau during OWLeS IOP2b. https://doi.org/10.1175/MWR-D-15-0412.1.

Gowan, T. M., W. J. Steenburgh, and J. R. Minder, 2022: Orographic Effects on Landfalling Lake-Effect Systems. https://doi.org/10.1175/MWR-D-21-0314.1.

Veals, P. G., W. J. Steenburgh, and L. S. Campbell, 2018: Factors Affecting the Inland and Orographic Enhancement of Lake-Effect Precipitation over the Tug Hill Plateau. https://doi.org/10.1175/MWR-D-17-0385.1.

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