# EXAMINING THE IMPACT OF MICROPHYSICS PARAMETERS IN WRF SIMULATIONS OF A JANUARY 2019 VERMONT WINTER STORM

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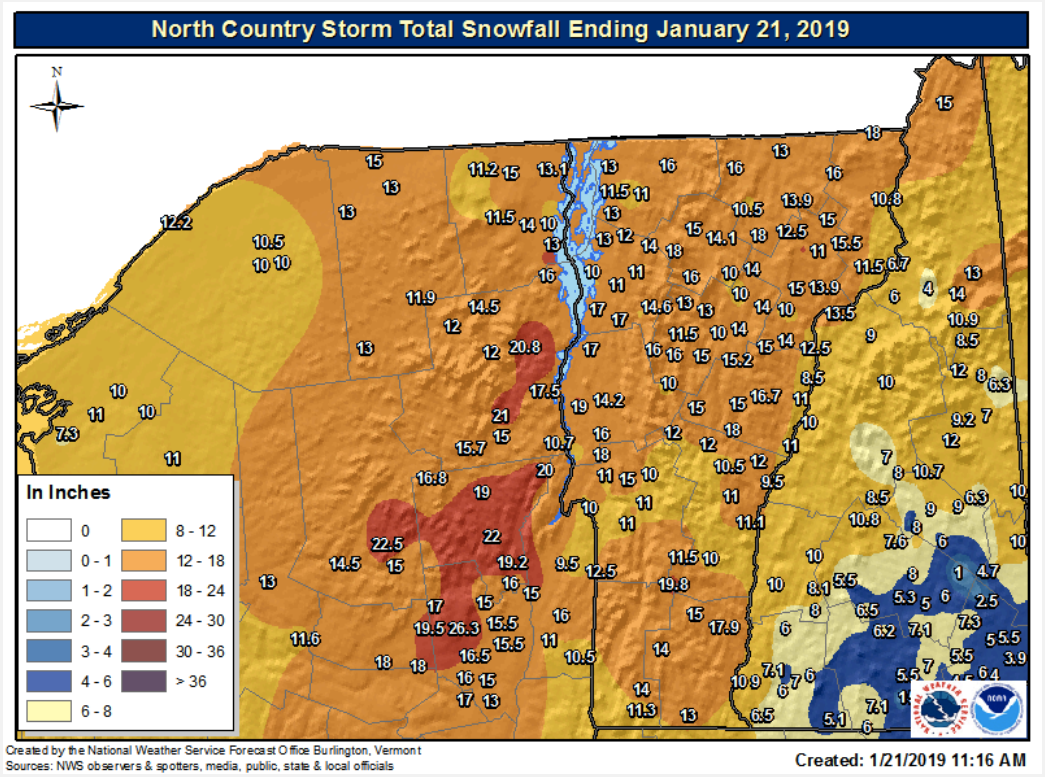
# THE JANUARY 20-21, 2019 WINTER STORM

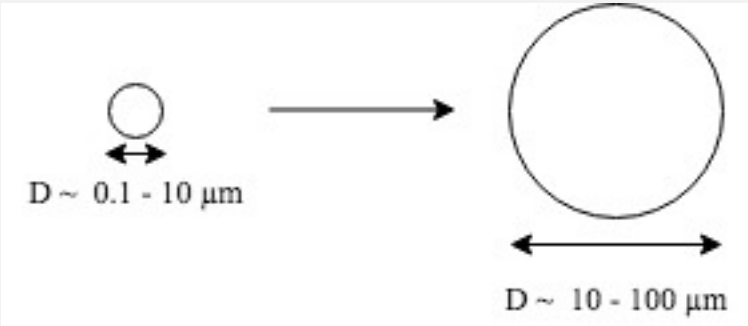
- Timing
- Temperatures < 0 °F
- 10:1 Snow : liquid ratio




NWS Burlington

# CLOUD MICROPHYSICS

- Study of tiny particles in clouds




Collision rate of cloud particles:

$$\tau^{-1}_{coal} \approx ( \pi \varrho_p \, g / 9\eta) \, N \, r_M^4$$

Particles grow, atmosphere becomes saturated, fall as precipitation

# CLOUD MICROPHYSICS MODELING

- Bulk microphysics schemes vs. bin microphysics schemes

| | Thompson | WDM6 | Eta (Ferrier) | Morrison 2 Moment |
|---|---|---|---|---|
| Moment | 1 | 2 | 1 | 2 |
| Mass Variables | Qc, Qr, Qi, Qs, Qg | Qc, Qr, Qi, Qs, Qg | Qc, Qr, Qs, Qt | Qc, Qr, Qi, Qs, Qg |
| Number Variables | Ni, Nr | Nn, Nc, Nr | | Nr, Ni, Ns, Ng |

Bulk scheme uses Gamma distribution as Particle size distribution:

$f(m) = N_0 m^{\nu} \exp(-\lambda m^{\mu})$

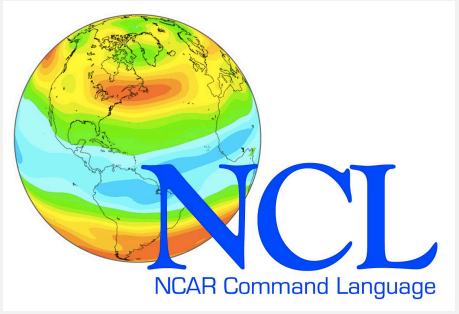
# OBJECTIVES

- Sensitivity test of microphysics parameterizations on Jan 2019 winter storm in VT
- Examine precipitation data at various sites for each simulation of the storm
- Compare results to real observations at sea level site (Middlebury) and mountain site (Rochester)
- Better understand the nature of cloud microphysics

# METHODS


NCAR


NCAR




NCAR Command Language

Wolfram

# RESULTS

- On this slide, I hope to display a data table that shows snowfall totals for each microphysics scheme at the two locations that I will be analyzing data, and I will show actual observations from the storm.

# ANALYSIS

- Here I will give a brief discussion of which microphysics scheme best predicts snowfall for the storm, and what that means for selecting MP parameterizations when weather modeling and how this can inform operational forecasting.
- I will also compare my results to similar studies of MP (McMillen and Steenburgh, 2015; Jankov, et al. 2011)

# FUTURE DIRECTIONS

- Analyze other microphysics parameterizations not chosen in this project
- Modify other aspects of the WRF physics (Cumulus physics, radiation, land surface physics, etc.)