Motivation and Methodology

Criteria for a storm to be included in this study:
- Produce at least 12 m of snow in 24 h
- Purely lake-effect (not associated with large scale snowstorms)
- Occur within Buffalo County Warning Area off of Lake Erie

Mission Categories (1998-2011)
- All (31 cases)
  - Time of year
    - Jan., Feb., March, April (13 cases)
    - May, June, July, August (10 cases)
    - Sept., Oct., Nov., Dec. (8 cases)
- Phase of AO at Onset
  - Pos. AO (22)
  - Neg. AO (9)
  - No AO (10)

Background

Madden-Julian Oscillation (MJO)
- Describes an eastward moving "pulse" of equatorial convection.
- A typical cycle lasts 30-60 days
- Influences the weather in the tropics and the midlatitudes

Adapted from Figure 2b of Kiladis (2005)

Arctic Oscillation (AO)
- 500-hPa height (m) and anomaly pattern for the positive and negative phase of the AO. The blue (red) indicates positive (negative) height anomalies
- 300-hPa streamfunction (contoured every 10 x 10^3 m^2 s^-1) total wind (vectors in m s^-1)
- MJO-filtered Outgoing Longwave Radiation (OLR) anomaly (shaded < -16 W m^-2)

MJO convection at the equator is associated with anticyclonic circulation at upper levels to the north and south of the convection

Composite Analysis of Lake-Effect Snowstorm Cases that Last > 42 h

500-hPa geopotential height (dam), wind (kts) and standardized height anomalies. The red (blue) indicates anomalously high (low) heights

Significance of MJO on NE US.
- AO favors a negative tendency when MJO is in phases 6 and 7
- MJO in phases 8 and 7 and influences midlatitude temperature and height anomalies in a way that resembles the negative phase of the AO

The MJO phase space diagrams describe the location of the MJO, which begins in Phase 1 and travels counterclockwise around the phase space ending at Phase 8. Plotted on the left is the location and strength of the MJO 8 days prior to onset for the cases that lasted > 42 h. On the right, all 31 cases included in this study are plotted. In green are cases that lasted 24-42 h and in purple are cases that lasted >42 h. The shorter cases have a clumping around phase 5, although there are many outliers indicating that there is less confidence in this signal.