### Relationships Between Snow Cover Ablation, Global-Scale Atmospheric Forcings and Winter Season Chesapeake Bay Hydrology

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#### Research Questions
1) How important is snow cover ablation to the flood hydroclimatology of the Chesapeake Bay?  
2) What are the global and synoptic scale forcings that are related to Chesapeake Bay flooding events?  
3) What are the “pathways” for these relationships.

#### Methodology
1) Examine the record of major flooding events in the Chesapeake Bay Basin to ascertain the role of snow cover ablation on the flood hydroclimatology (using gridded snow cover data).  
2) Explore relationships between global-scale forcing mechanisms and ablation associated flooding events (using NCEP reanalysis data).  
3) Examine connections between global-scale forcings and synoptic types (using TSI).

#### Results (cont.)
Although correlations between the Arctic Oscillation and snow depth are not large, nearly all large basin-wide mean snow depth seasons are associated with a negative phase of this major mode of atmospheric variability.

By what “pathway” does the NAO effect snow cover, frequency of ablation events and damaging fluxes of nutrients and sediments into the Chesapeake Bay? Are there changes in the frequency of synoptic types between large and small mean snow depth seasons?

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**Fluxes of nutrients and sediments**

The Chesapeake Bay watershed covers an area of approximately 166,000 km² in the Mid-Atlantic Region of the United States. It is the United States largest estuary and the watershed is home to nearly 17 million inhabitants. The basin frequently experiences significant ephemeral snow cover during the winter season, resulting in large runoff events to the Bay.

**Figure 1:** MODIS Image of the Chesapeake Bay

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**Results**

- **Mean flow to the Chesapeake in quite variable on an interannual basis.** Since the long-term drought conditions of the 1960s, interannual variability has increased, with several very large mean flow years.
- **The variability of the annual maximum flow to the Bay has also increased since the 1960s.** Extreme events are apparent during these years, two related to snow cover ablation.
- **Ablation values**
  - **Temporal Synoptic Index (TSI)**
  - **North Atlantic Oscillation (NAO)**
  - **Arctic Oscillation (AO)**

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**References**

[See references and acknowledgments for a detailed list of sources and contributors.]

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**Figure 2:** Diagram of relationships between snow cover ablation, global-scale atmospheric forcings, and winter season Chesapeake Bay hydrology.