Wintertime Climate Variability in the Lake Michigan Region: Sensitivity of Snowfall to Temperature and Northern Hemisphere Teleconnection Patterns

Travis Elless, Tony Lyza, Sarah Mustered, Craig Clark

Departmental Affiliation: Geography/Meteorology
College of Arts and Sciences

Using available long-term stations, a wintertime climatology of temperature and snowfall since 1950 has been composited for the region near Lake Michigan. The seasonal snowfall characteristics of six sub-region composites were subsequently explored, using composites for three sub-regions to the west and east of Lake Michigan, respectively. While snowfall records can be problematic due to observer changes, data within a given sub-region mostly exhibit similar variability. Not surprisingly, locations to the east of Lake Michigan have higher average seasonal snowfall and greater snowfall variability than their upstream counterparts. The variations correlate fairly well among neighboring sub-regions, with the weakest relationship between northwest and southeast regions. There is a clear relationship between snowfall and temperature, with colder winters producing greater snowfall than milder winters. However, this sensitivity is strongest in the lake-effect prone regions to the east of the lake, with an effective de-correlation of snowfall and temperature in the northwest zone. As anticipated, El Niño winters are warmer and less snowy on average than neutral and La Niña winters. The North Atlantic Oscillation has the strongest relationship to snowfall in eastern regions, with a weaker correlation in the western zones. The Pacific North America and Pacific Decadal Oscillation indices do not have a clear relationship with snowfall or temperature in the eastern zones, but do exhibit a relationship to snowfall in the northwest zones. Principle Component Analysis was utilized to further explore the temporal variability, as well as generate a regional wintertime index. The leading PC exhibits substantial noise, super-imposed on a trend toward less cold and snowy winters. Snowfall trends were also examined for each sub-region, with a downward trend in recent decades most pronounced in the southeastern sub-region. This has been mostly driven by the tails of the snowfall season; an additional student group has been exploring the November data in detail.

Information about the Authors:
No information provided.

Faculty Sponsor: Dr. Craig Clark

Student Contact: travis.elless@valpo.edu