Lake Erie: Climate Trends & Future Projections

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Climate variability: refers to fluctuations in climate on time scales of seasons to decades.

Climate change: refers to a long-term and persistent shift in climate (several decades or more).
Lake Erie Basin Temperature

Warmest year: 52.1°F (1998)
Temperature Projections

- **Seasonal differences:**
  - Greatest warming expected in summer
  - Least warming expected in spring

Source: NOAA Technical Report, Regional Climate Trends and Scenarios for the U.S. National Climate Assessment
Impacts of Warmer Temperatures on Great Lakes

Surface water temperatures increase
- By mid-century, water temperature projections:
  - High emissions scenario: 2.7-7°F
  - Low emissions scenario: 2.9-5.8°F

Reducing extent and duration of Great Lakes winter ice cover

Deeper and stronger thermal stratification
- Spatial and temporal shifts in seasonal timing

Lake Erie Basin Precipitation

Wettest: 52.2” (2011)
Driest: 24.1” (1963)

Total Annual Precipitation
1981-2010 normal: 38.09”
1901-1930 normal: 33.57”

Driest: 24.1” (1963)
Heavy Precipitation

Change in large storm event (1”+) frequency

**Sandusky, Ohio**
(western Lake Erie basin)

**Erie, PA**
(eastern Lake Erie basin)
Drought

April 1930-March 1931

Negative (red): dry/drought conditions
Positive (blue): wet conditions
Precipitation Projections

- Average annual precipitation may not change drastically
  - Possibly 3 to 6% greater than today
- Seasonal differences
  - Winter: +10 to 15%
  - Summer: -5 to 10%

Source: NOAA Technical Report, Regional Climate Trends and Scenarios for the U.S. National Climate Assessment
Extreme Precipitation in the Future

- By mid-century, the number of days with more than 1” of precipitation may be 10-30% more frequent than today in the Lake Erie basin.

Impacts of Change in Precipitation on Great Lakes

Increased winter and spring precipitation may increase sediment and nutrient loadings
- Increased algal blooms
- Lower overall lake water quality

Changes in coastal wave power and direction
- Result of increased storm magnitude and frequency
- Increases risk for coastal flooding and accelerate beach, shore, and bluff erosion

Lake Erie Water Levels

Data source: National Ocean Service & Canadian Hydrographic Service
Future Water Level Projections

- Lofgren et al. (2011)
  - Base case: 174.36 meters
  - Future: models range from -1.37 meters to +0.26 meters

Hayhoe et al. 2009

Angel & Kunkel (2010)
Lake Erie Ice Cover

Data source: National Ice Center & Canadian Ice Service
Future Ice Cover Projections

- Climate models predict ice cover on the Great Lakes will continue to decrease.
- Ice coverage also heavily influenced by natural climate patterns like ENSO (El Niño Southern Oscillation).
Thank you!!!

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