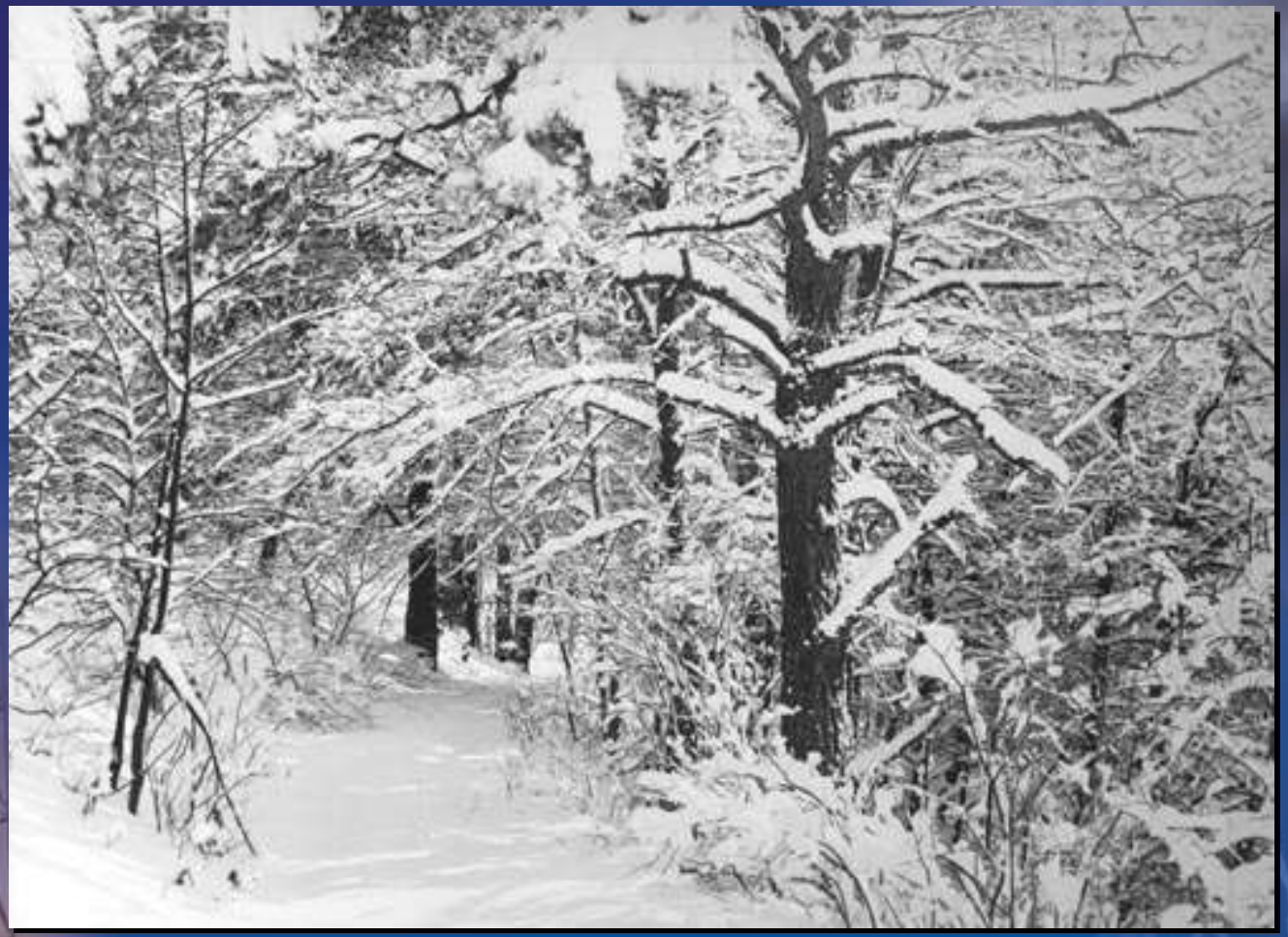
Explaining Northern Michigan Snow

(A "Big Picture" Viewpoint)



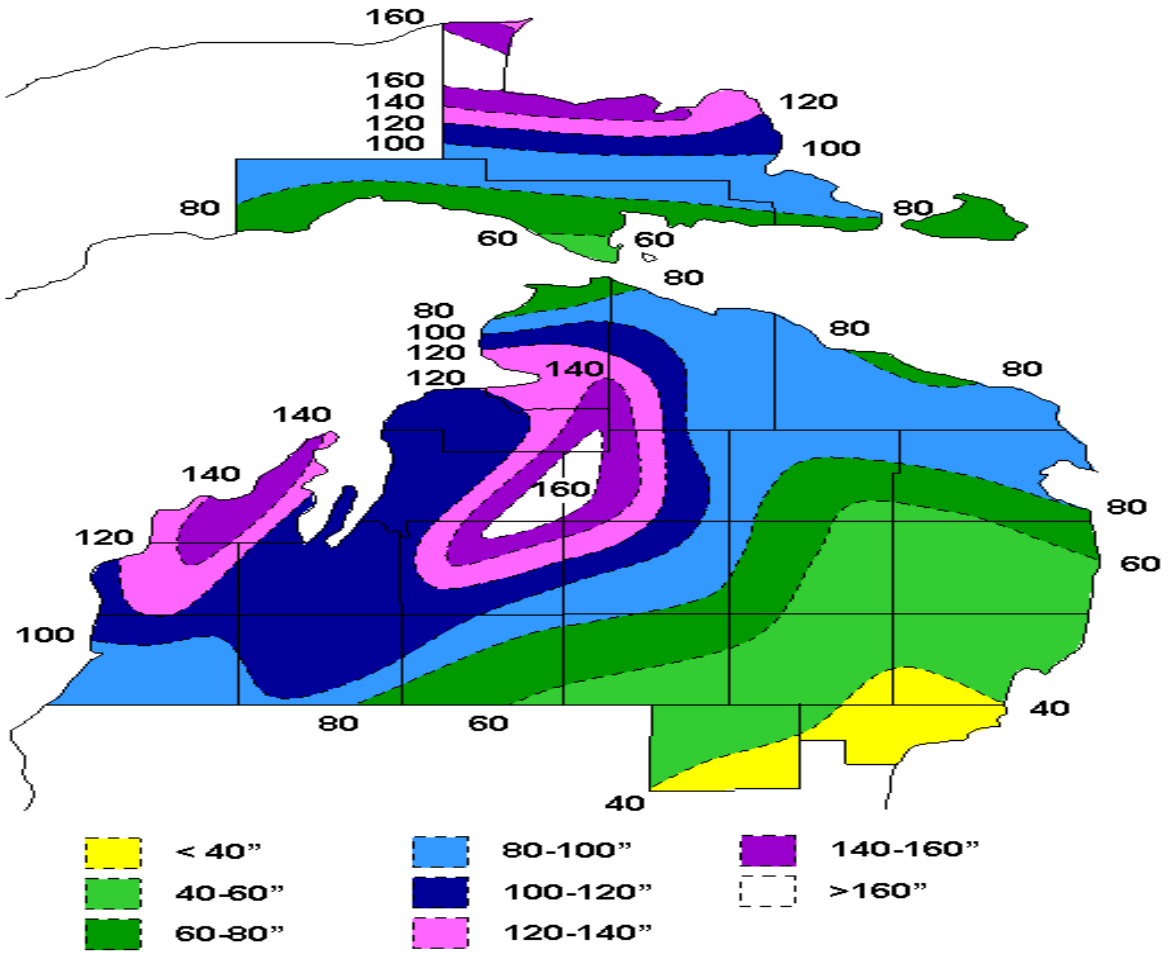
2010 Winter Talk Series

Background

- If you've attended our Winter Talk series in the past, there's a good chance you've seen us discuss the science of *lake effect snow*
- Lake effect snow is the single most important factor as to why some parts of Northern Michigan get so much more snow than others

Mean Annual Snowfall

NWS Gaylord Forecast Area



So: *why* does this map look like this?

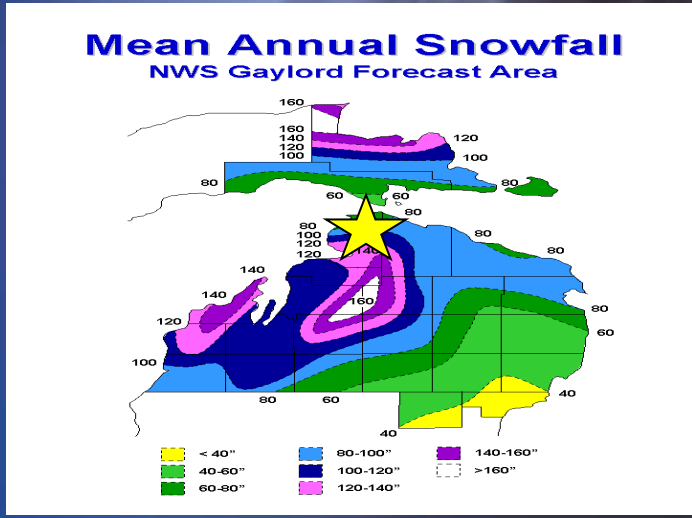
Not to give away the answers, but…

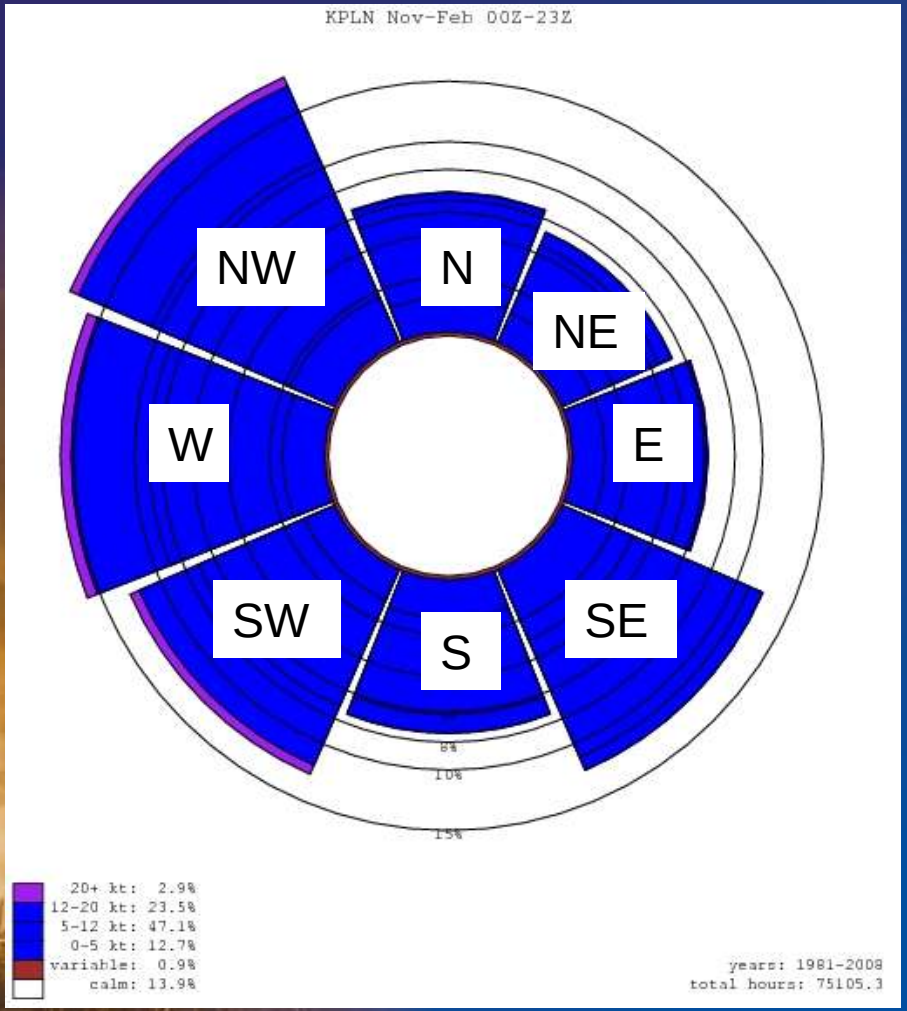
- Prevailing wind direction during cold air outbreaks
- “Fetch” and “effective fetch” lengths
- Elevation
- Proximity to a “warm” lake
- Ice cover

Prevailing Winds

- Lake effect snow will tend to develop over the Great Lakes, as long as the air is cold enough, and the water is warm enough
- Where the snow goes from there, depends on where the wind is blowing
- Thus, the “prevailing wind” – our most common wind direction – during periods of cold weather is crucial

Prevailing Winds



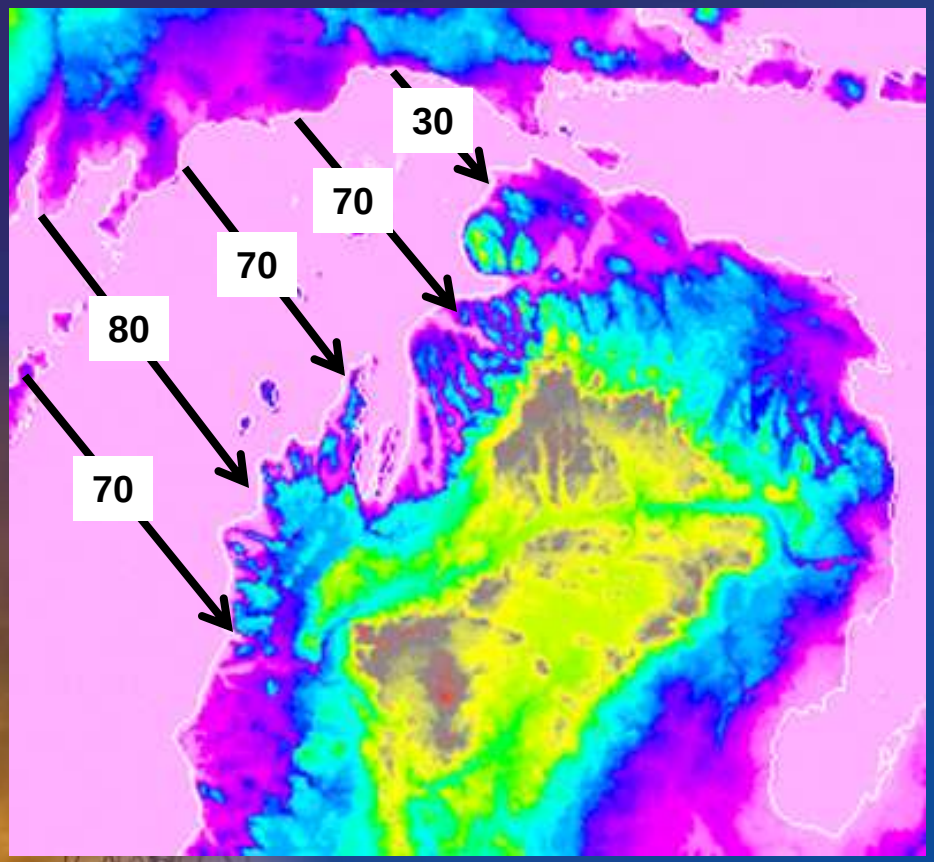


- **Wind Rose for Pellston, MI (Nov-Feb)**
- **Dominance of Northwesterly direction**
  - ***Particularly when cold air is arriving!***

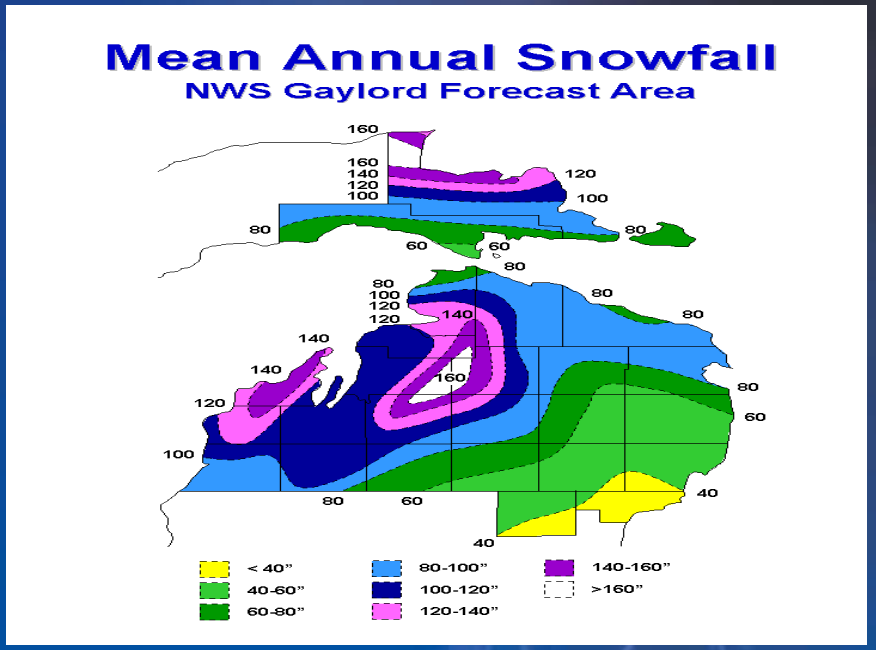
Prevailing Winds & Fetches

- A “fetch” is the distance over which air is moving over water, for a given wind direction
  - *Generally speaking, the longer the fetch, the more snow the lake will be capable of generating*
- Given that a northwest wind is our prevailing winter wind, what kind of fetch does that produce?

Prevailing Winds & Fetches



- The longest fetch, and heaviest snow, do NOT match up.

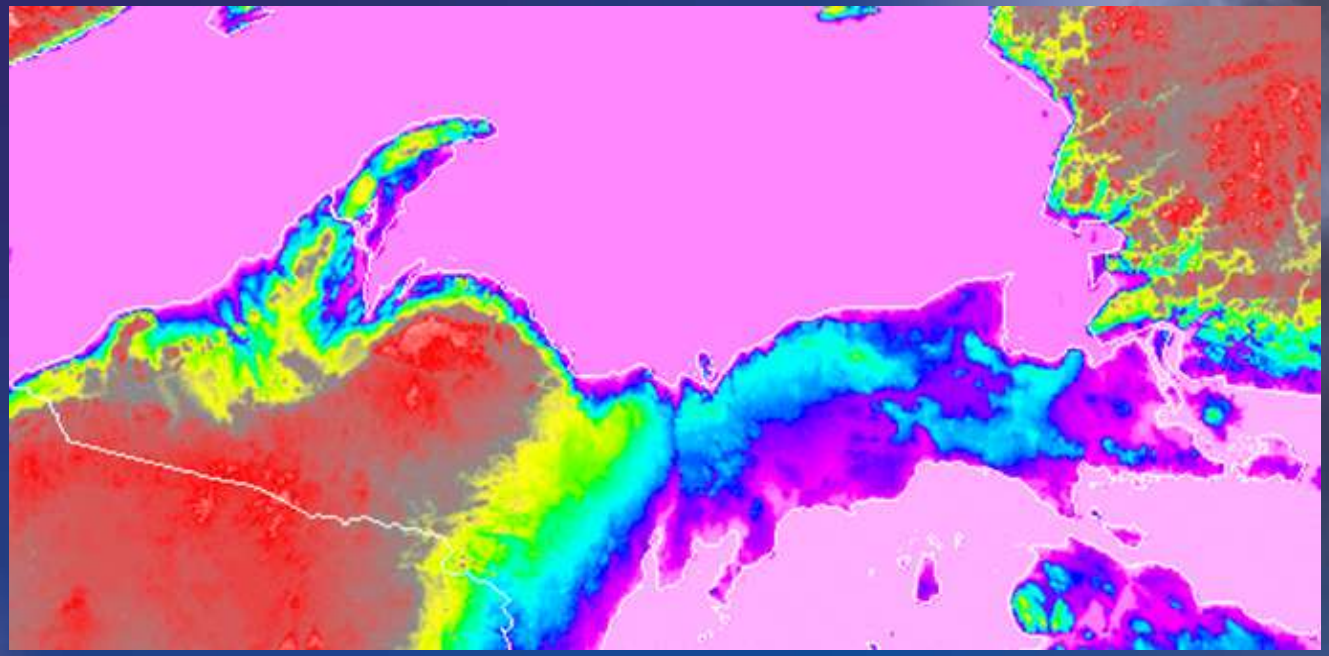


- So is there something we are we not accounting for?

Fetches & Effective Fetches

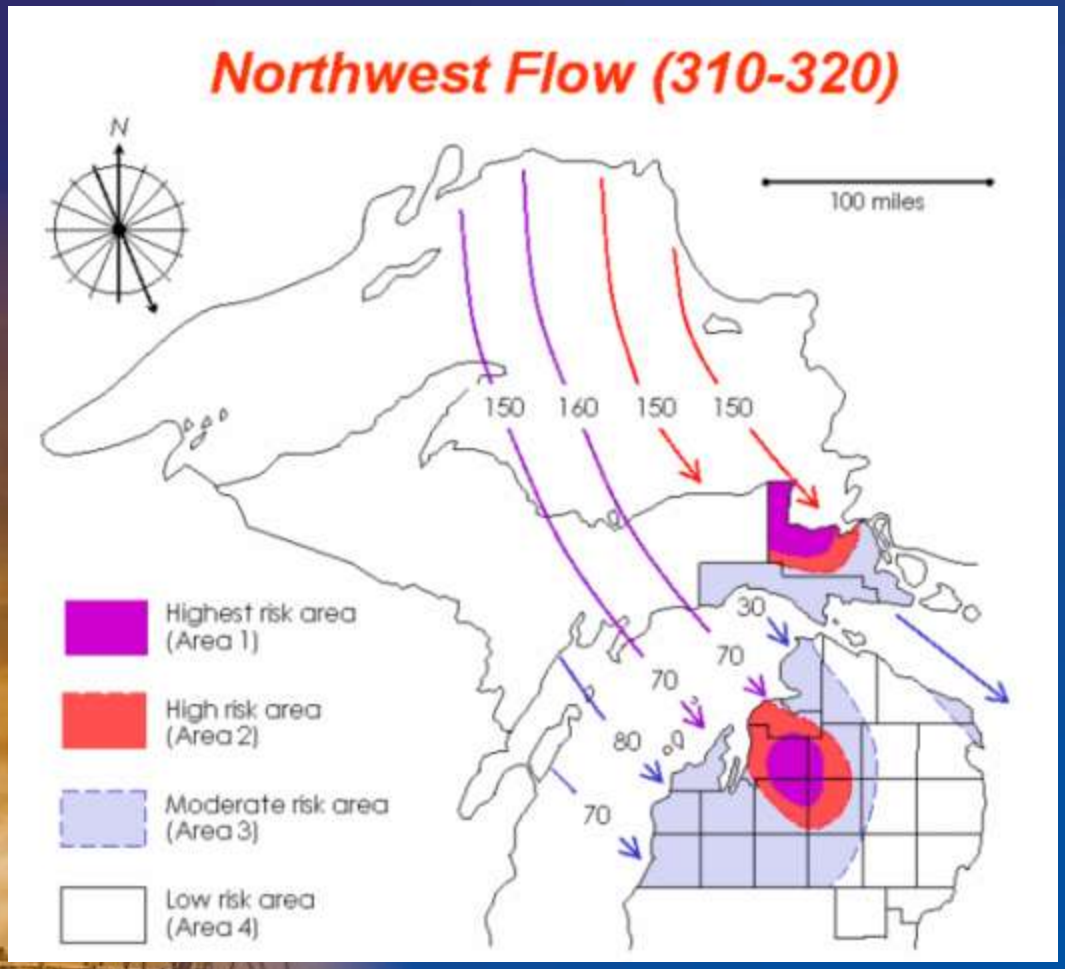
- Yes - there's another lake up there!
- An airmass will retain "lake effect characteristics" on a s*hort* trip over land, IF there is little terrain (hills/mountains) to cross
- If this is the case, the result is a longer "effective fetch" due to the air crossing <u>multiple</u> lakes

Fetches & Effective Fetches

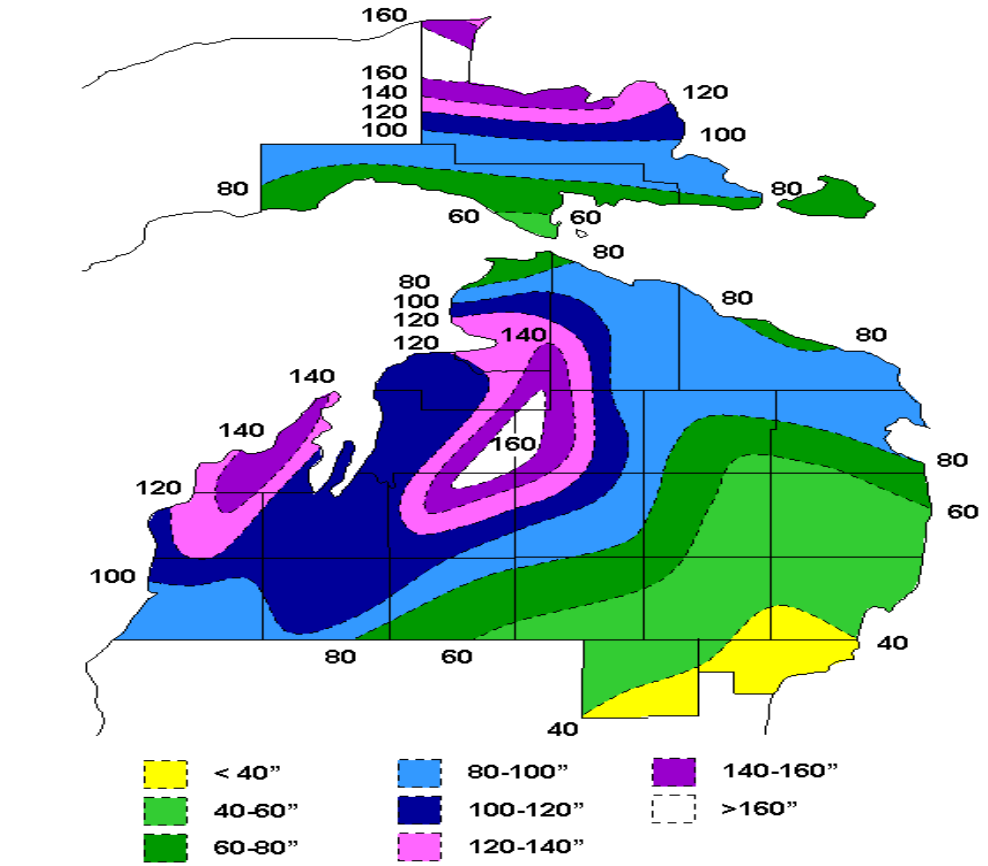


- As it turns out, the east half of the U.P. is narrow, and does not have many hills
- The west half is “thicker” and much hillier, and eliminates a Lake Superior contribution to an effective fetch

Fetches & Effective Fetches

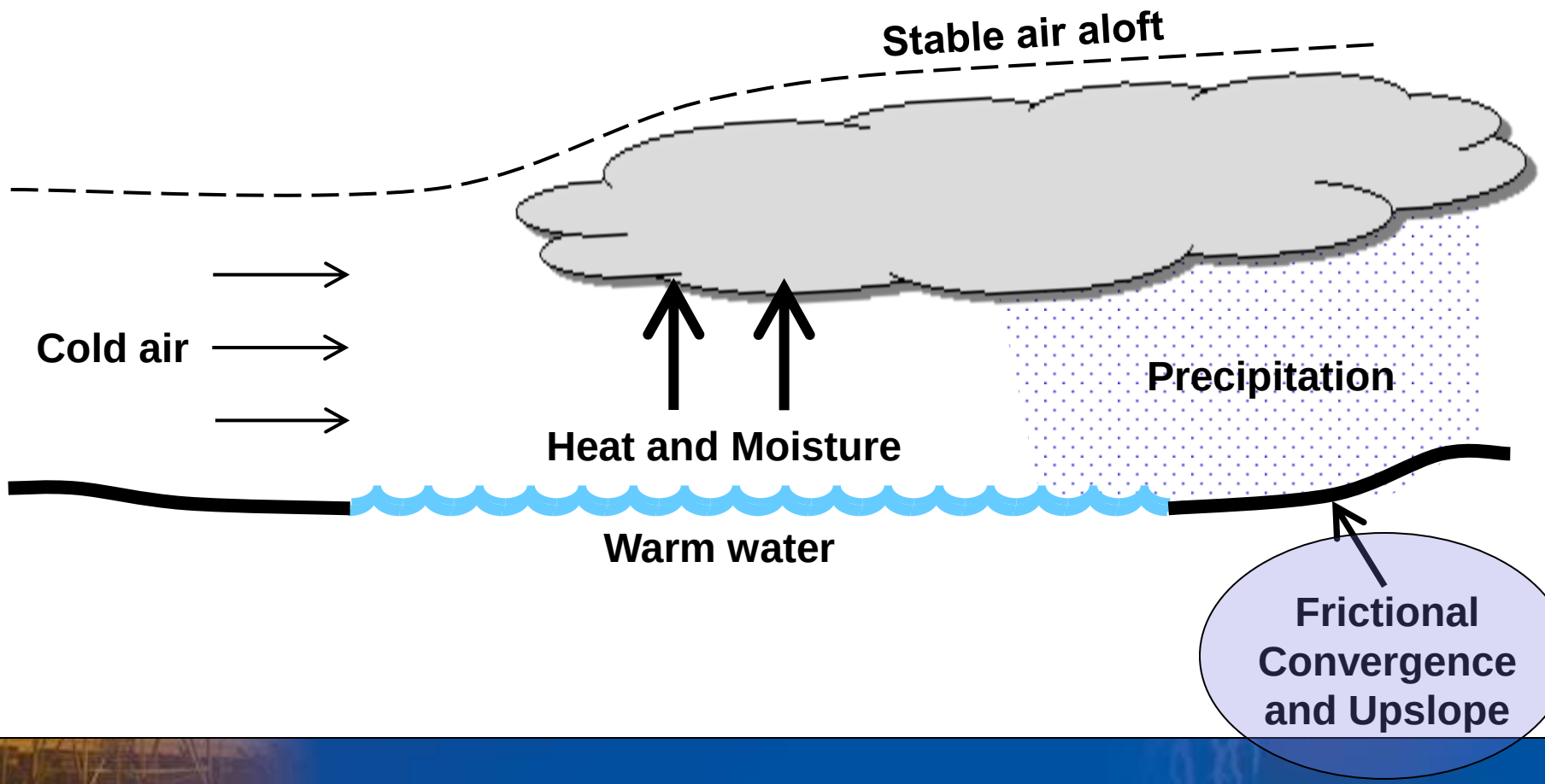


- Bingo!
  - The longest effective fetch, and heaviest snow, match up nicely.
    - In BOTH Peninsulas!

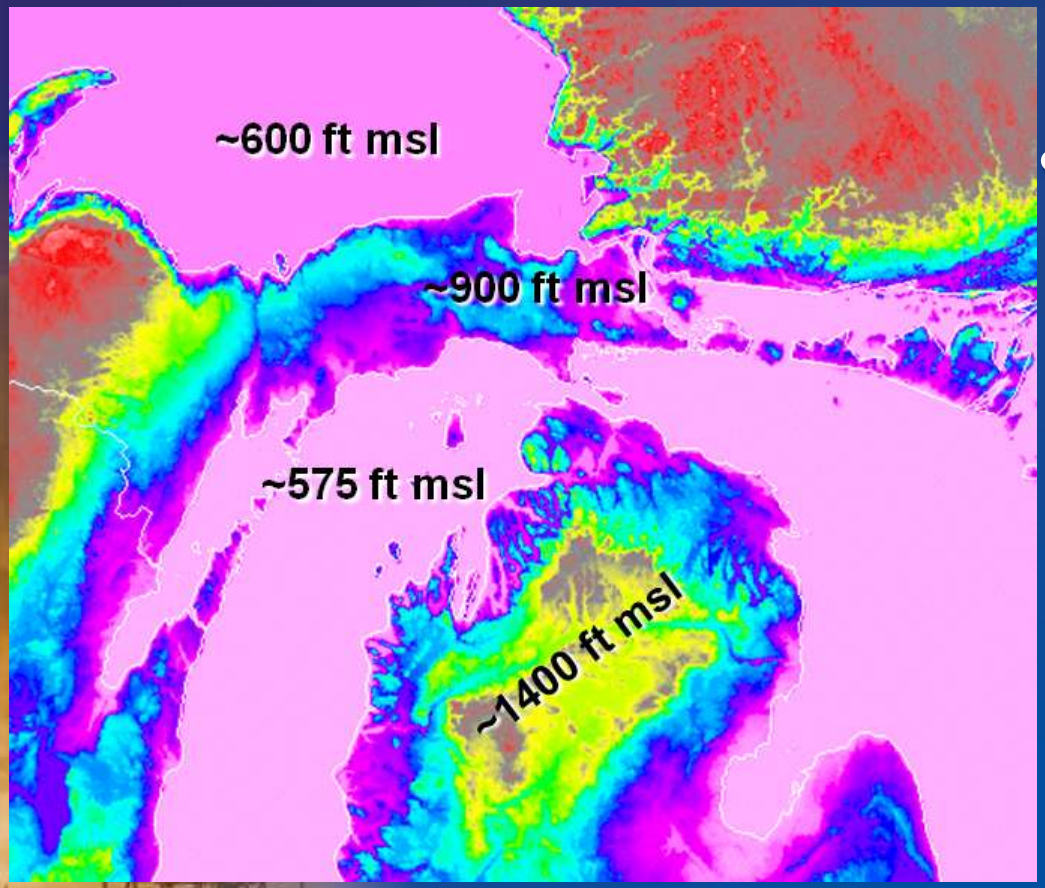


- But why is the heaviest snow <u>inland</u>?
  - It’s lake effect; shouldn’t it be near the lake?

Recall How Lake Effect Forms

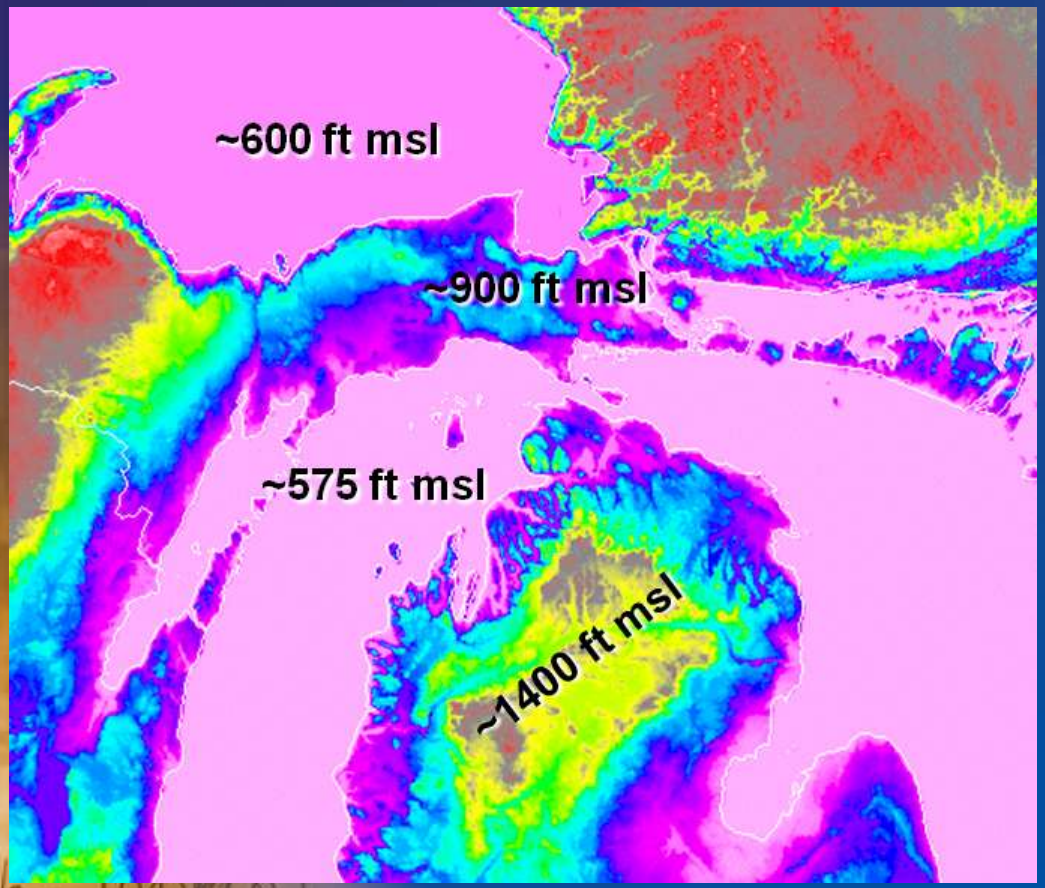


Elevation



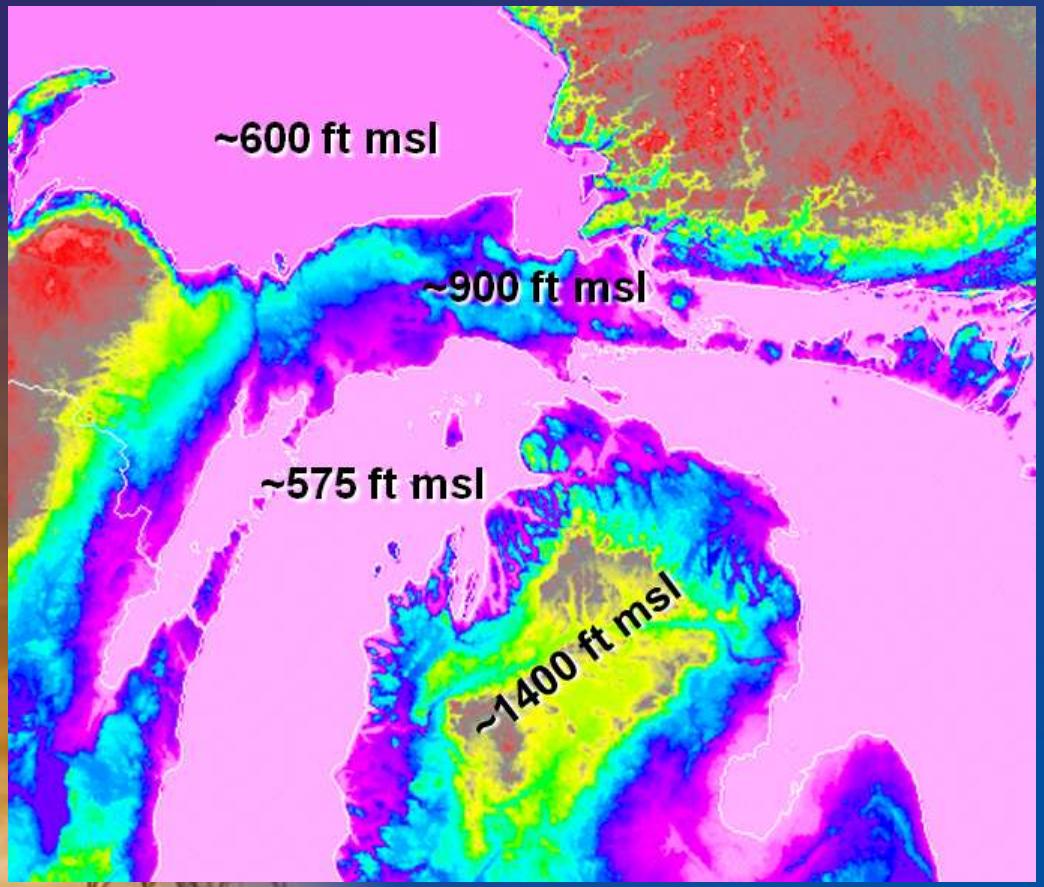
- Elevation plays 2 key roles
  - Forced Ascent
  - Colder Temperatures

Elevation – Forced Ascent



- Precipitation will be generated/enhanced when moist/unstable air is forced to ascend
  - They know all about this in the mountain states out west

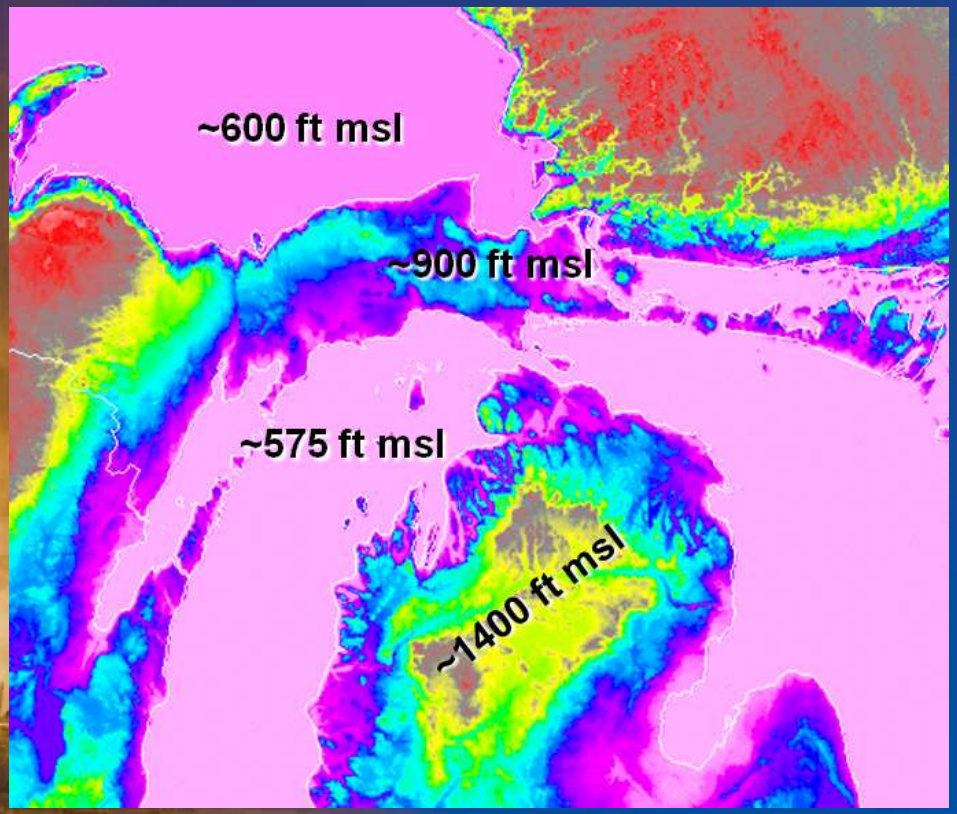
Elevation – Colder Temperatures

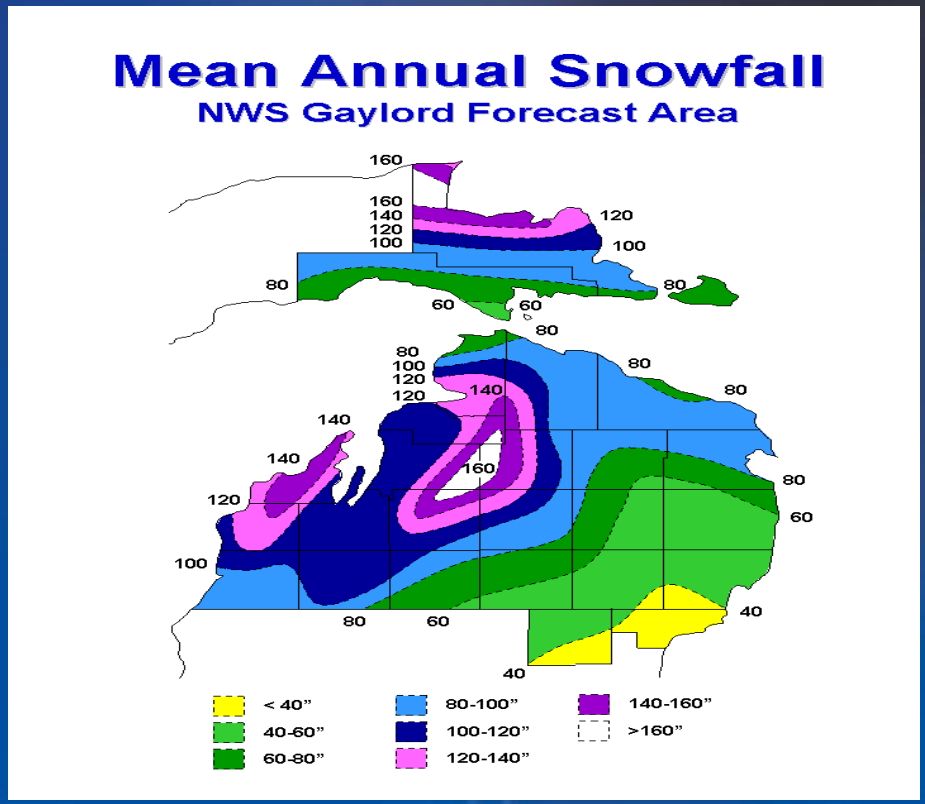


- Top of hills usually colder
- May make the difference between rain and snow

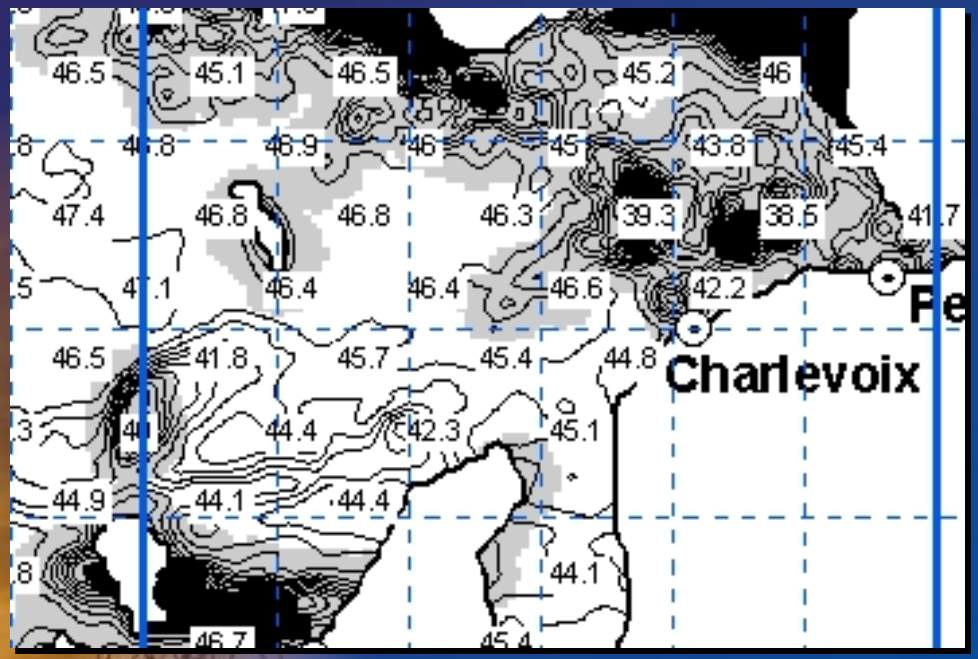
Elevation

- Conversely, precipitation will diminish/end as air is forced to move *downhill*
- So snow showers will weaken as they move toward NE Lower Michigan and Lake Huron





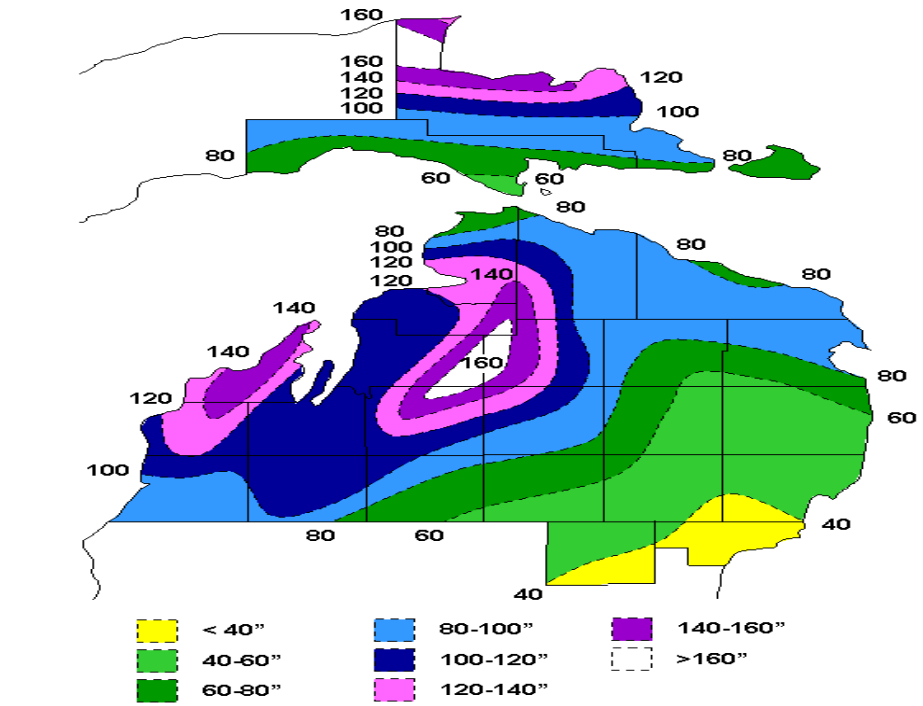
Elevation & “Warm” Lakes



Dec 1 2009

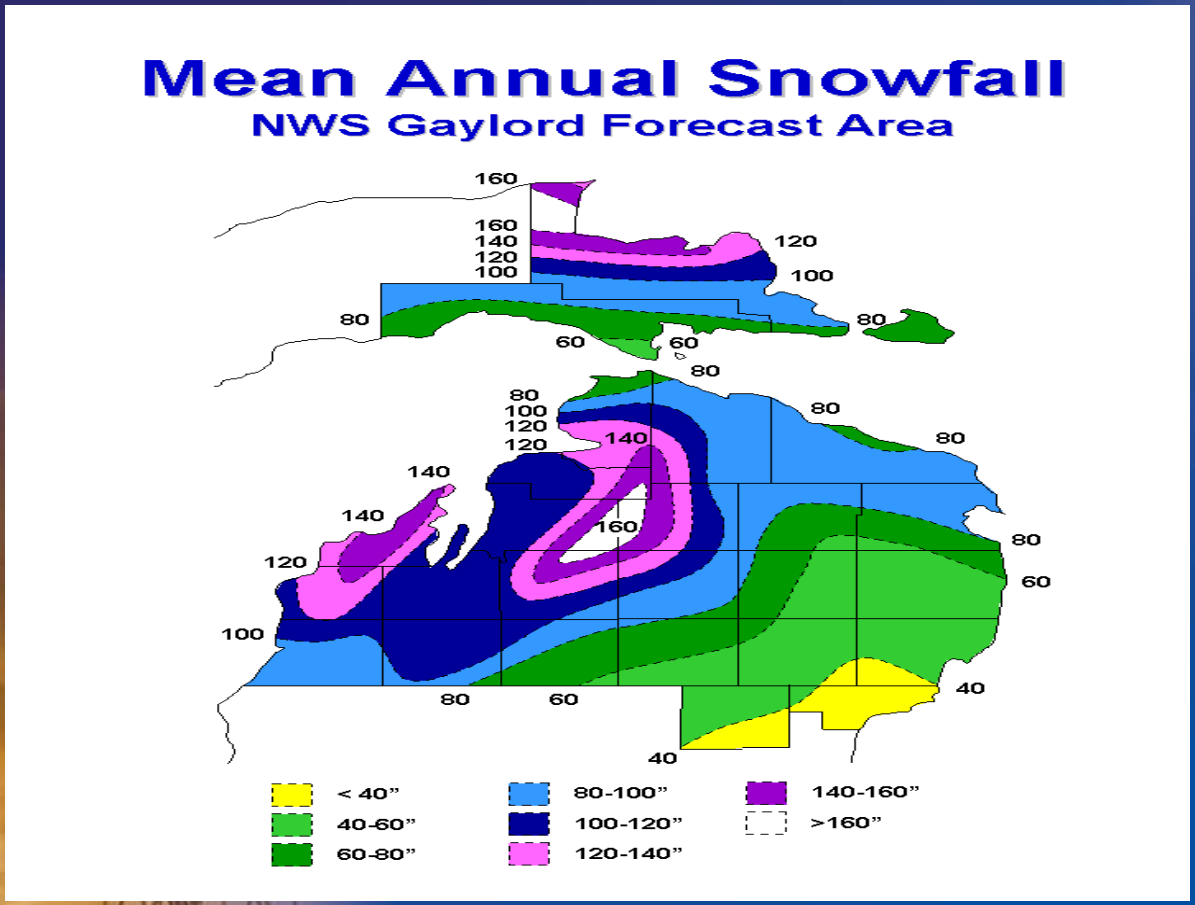
- Most common early in the snow season, when coastal areas will be warmed by the warm lake
  - It’s common to see rain in Charlevoix, and snow in Gaylord

Elevation & “Warm” Lakes



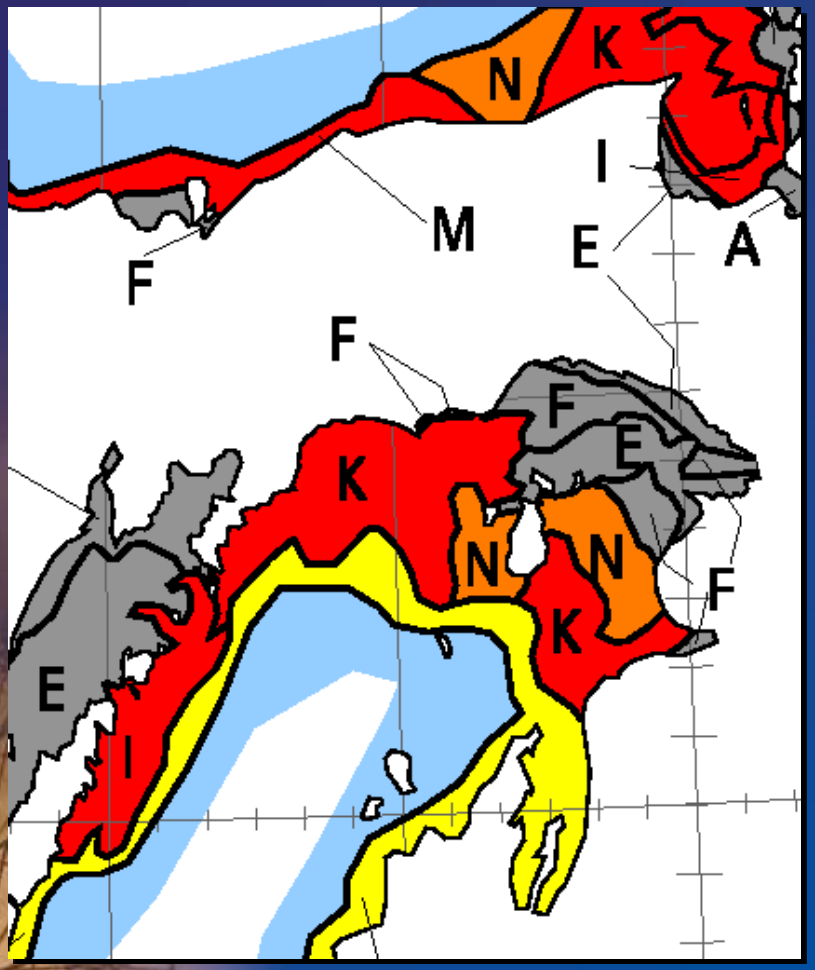
- Same rules apply to Eastern Upper
- But Superior is colder, and doesn’t hinder coastal snow as much as Lake Michigan

Elevation & “Warm” Lakes



- What about St Ignace?
  - Surrounded by water, but doesn’t get much snow
- The prevailing wind is the biggest reason…

Ice Cover



Jan 19 2009

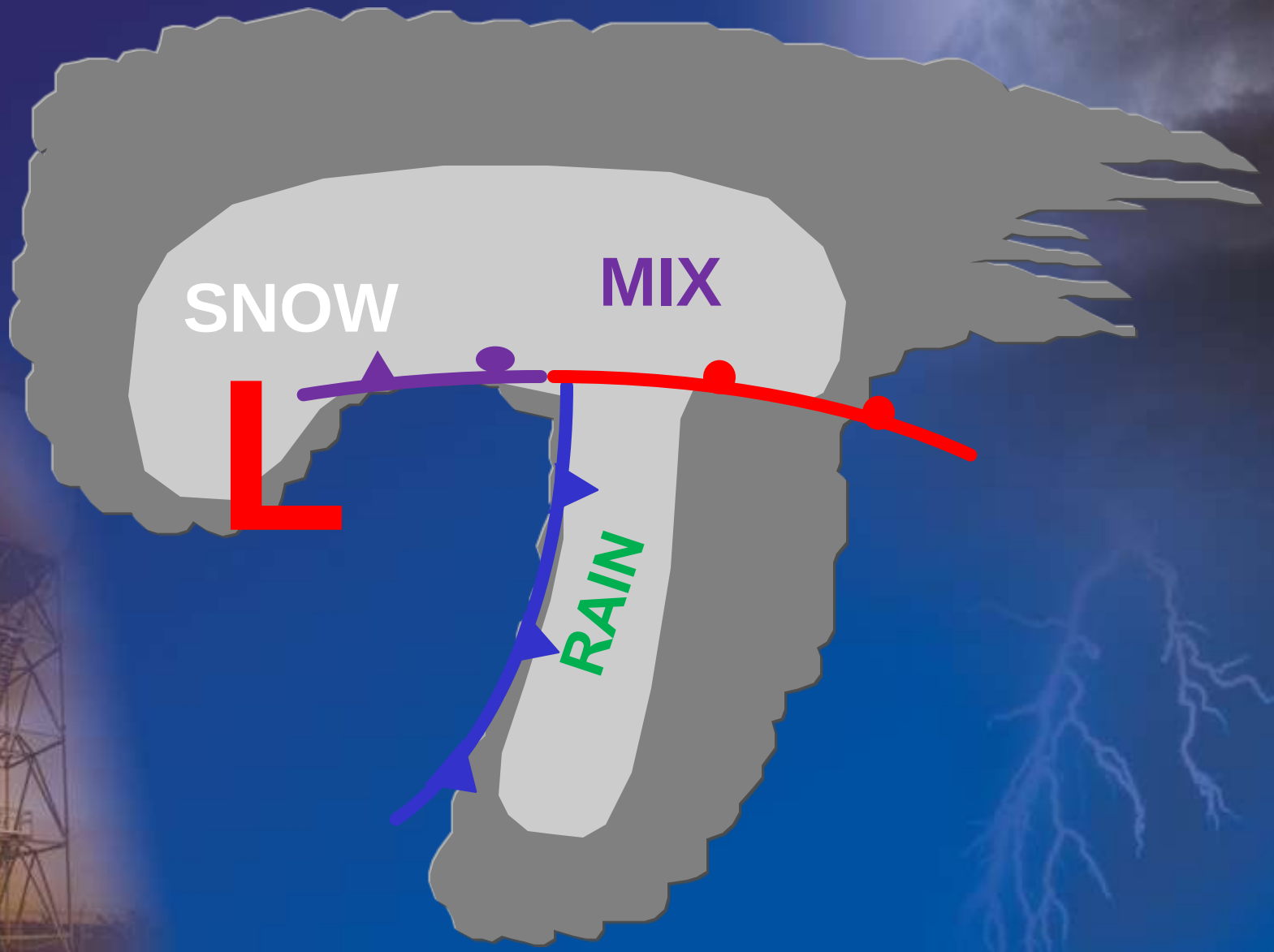
- Ice cover is another reason
- The Straits region freezes over quickly in a typical winter
- Ice-covered water does NOT generate significant lake effect snow

The Home Stretch…

- Okay, we now have a handle on lake effect snow and its distribution

- But, what about snow that doesn't originate from the lakes?

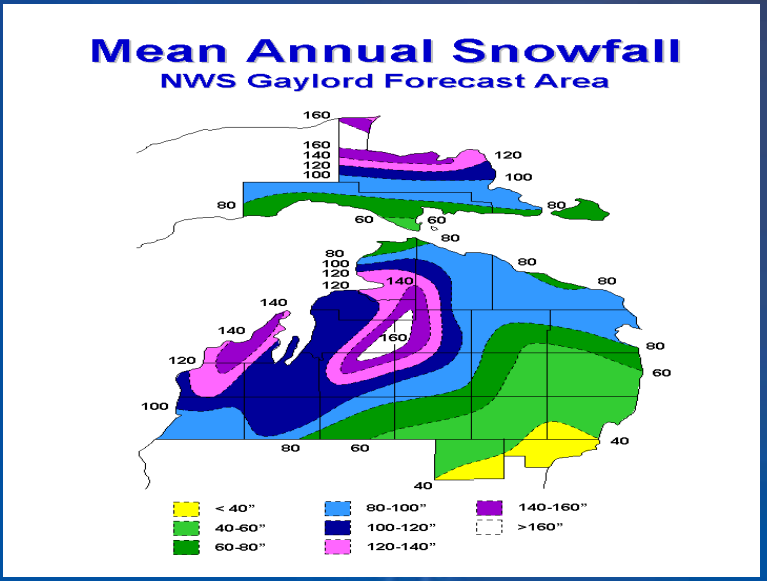
Typical Midlatitude Cyclone



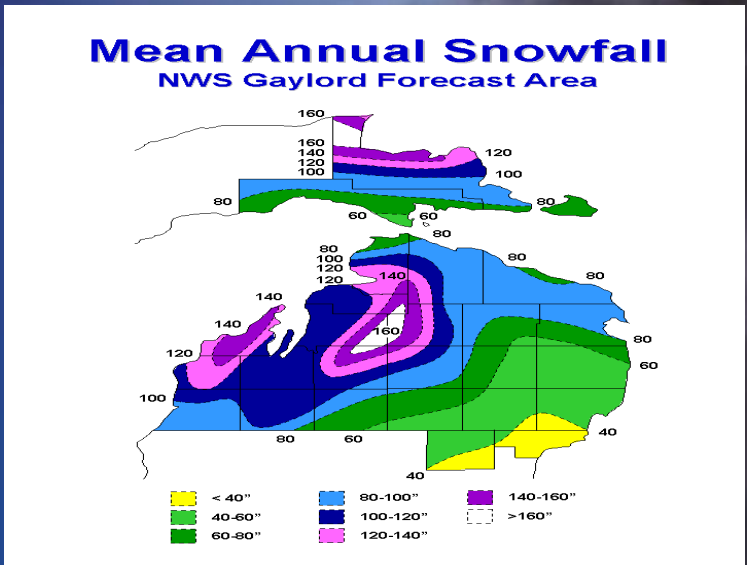
Typical Cyclone Tracks

Midlatitude Cyclone Snow

- Numerous storm tracks pass east or even well east of the region
- If we look at a county that sees relatively little lake effect (e.g. Arenac), we probably can assume a typical “synoptic snowfall”
- ~40 inches per year



In Summary



- Our snow comes from two sources
  - *Lake Effect*
  - *Mid latitude cyclones*
- Lake Effect depends on numerous microscale factors
  - *Fetch/effective fetch, elevation, lake temperature, ice cover, distance to shore, etc.*

Any Questions???