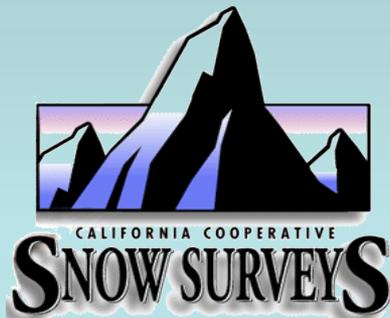


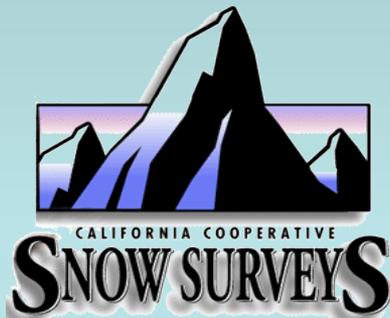
What affects our precip...and why?

Steve Nemeth
California Dept of Water Resources
November 04, 2015



What affects our precip?

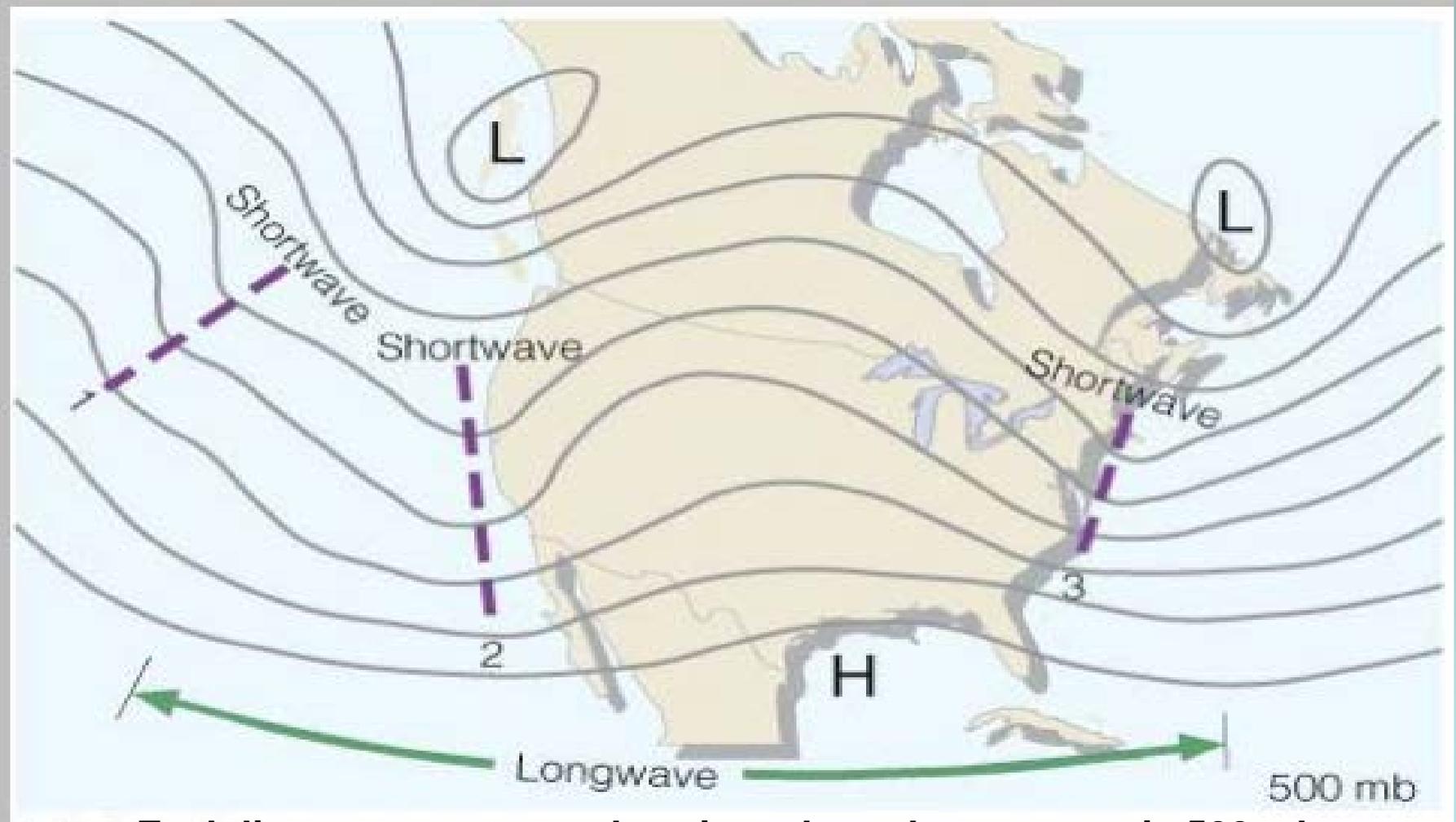
Other than the phenomenon at the equator



Acronyms affect our weather

- **LW - Long Waves**
- **PNA - Pacific North American Index**
- **PDO - Pacific Decadal Oscillation**
- **MJO - Madden Julian Oscillation**
- **AO - Arctic Oscillation**
- **SOI – Southern Oscillation Index**

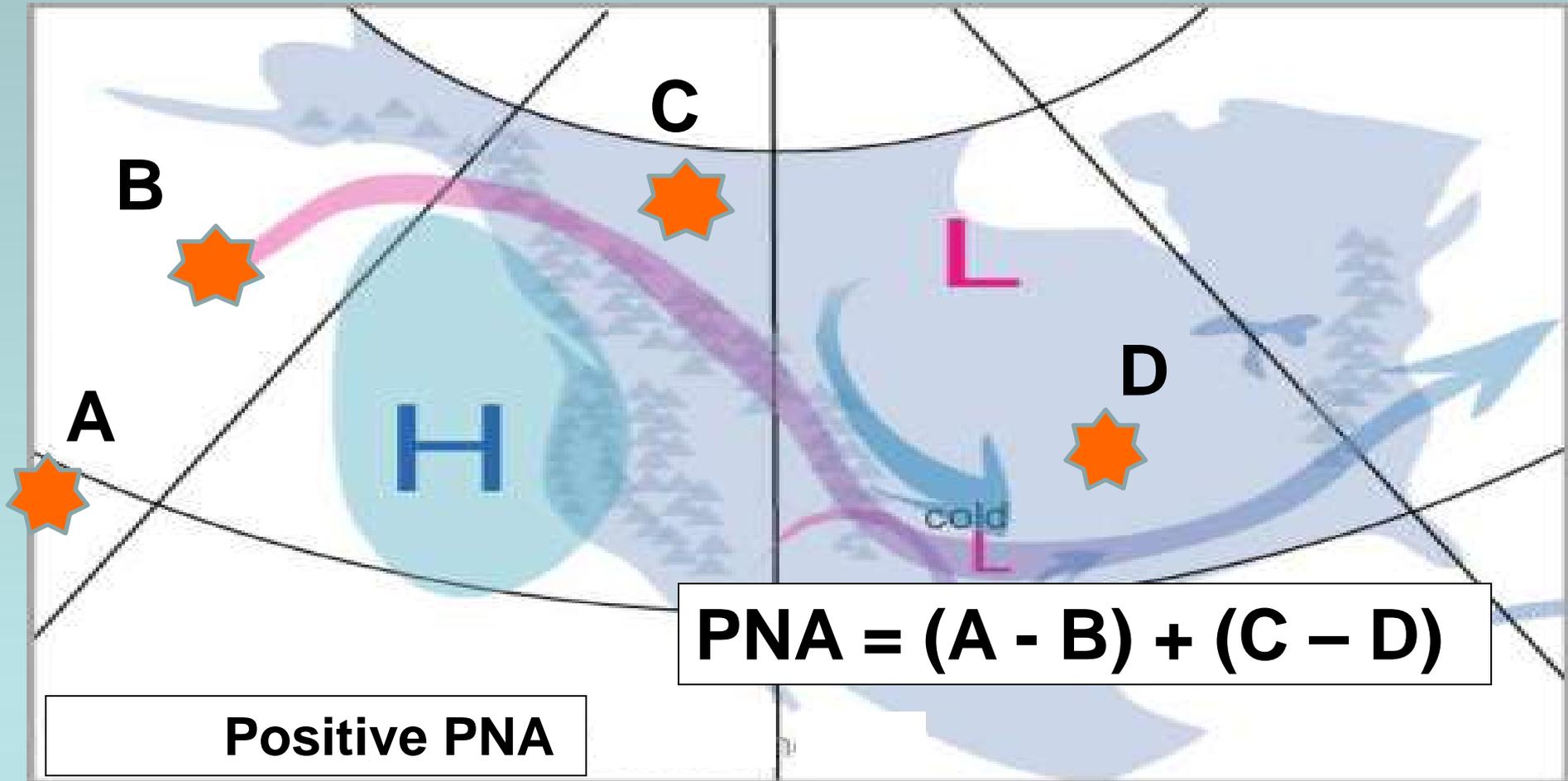
Nature's need to **balance mass and heat** creates the LW's. There are usually 4-6 LW's. Short waves move around the LW's.



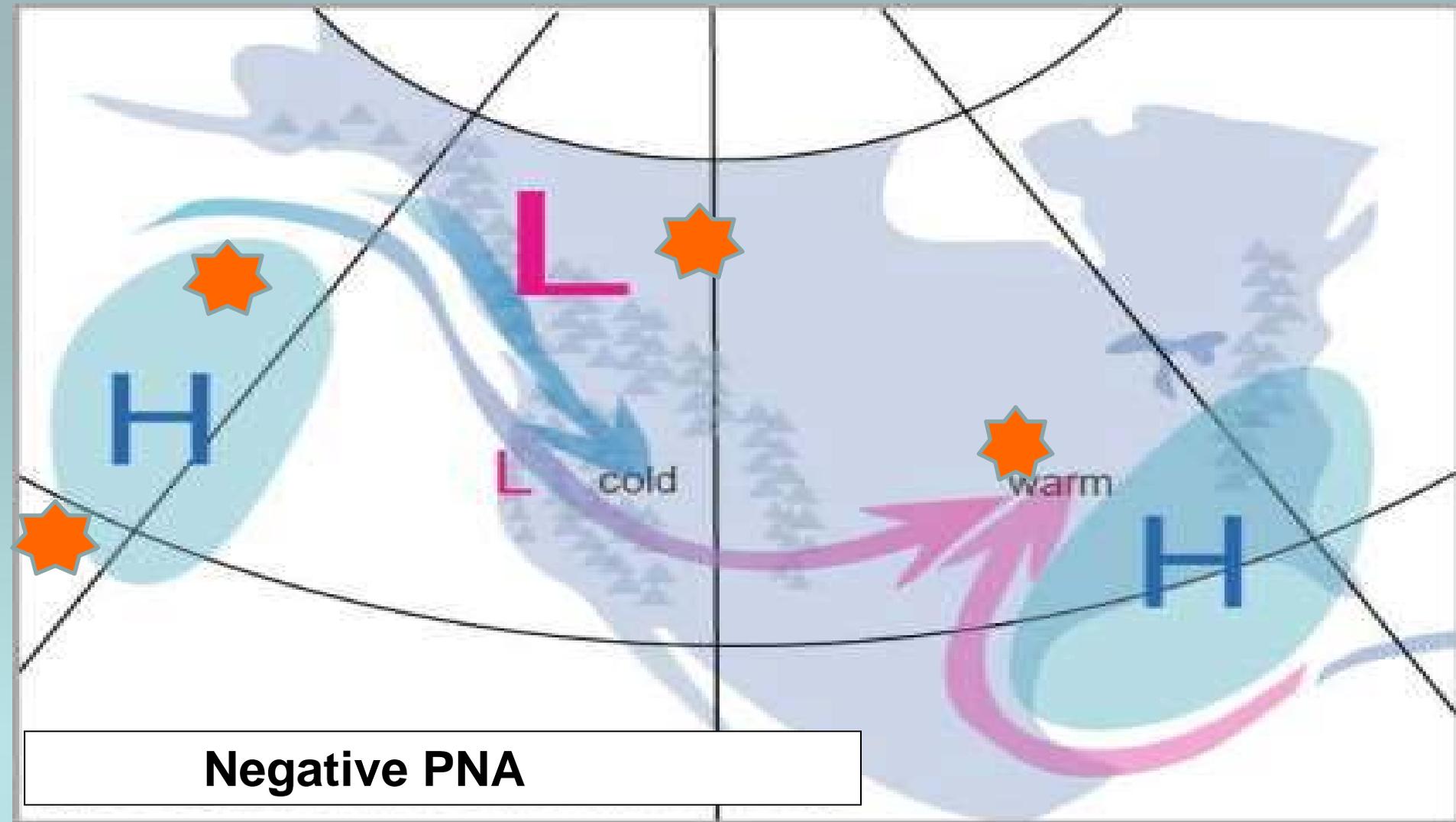
Each line represents an elevation where the pressure is 500 mb.

The Pacific/North American Index

Uses the pressure at 4 points to measure the strength of low pressure south of the Aleutians, high pressure over the eastern Pac. ocean and low pressure over the central US



During a negative PNA, the high pressure over California moves west and troughing develops over the western US



Madden Julian Oscillation (MJO)

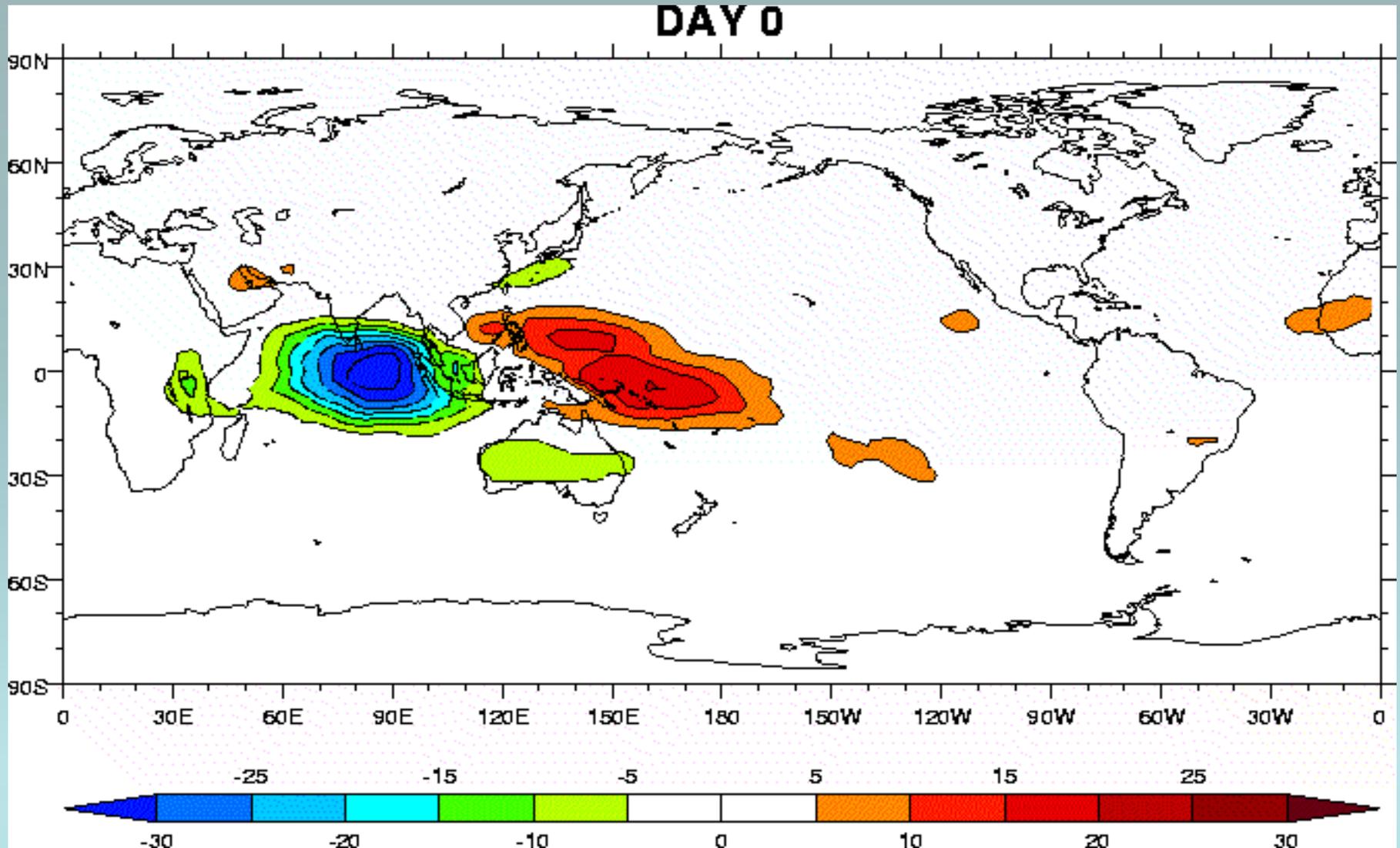
MJO = Large area of
convection moving eastward
from the Indian Ocean.

- **SOURCE OF MOISTURE**

How is convection measured?

- **High, cool cloud tops emit little amounts of Outgoing Longwave Radiation (OLR).**
- **Small amounts of OLR indicate convection**
- **Satellites measure OLR**
- **Measurements are compared to norms**

Enhanced and Suppressed Convection



Southern Oscillation Index (SOI)=

$$P_{\text{Tahiti}} - P_{\text{Darwin}}$$

$\Delta\text{SST}'\text{s}$ \longrightarrow $\Delta\text{Pressure}$

Lower pressure at Tahiti than Darwin (a negative index) indicates more convection than normal in the central and eastern Pacific and more precipitable water...Atmospheric River potential



Pacific Decadal Oscillation

- **What is it?** A long-term fluctuation of SST's in the North Pacific

Long term = 20 to 30 YRS

- **Where?** North of 20N in the central and eastern north Pacific

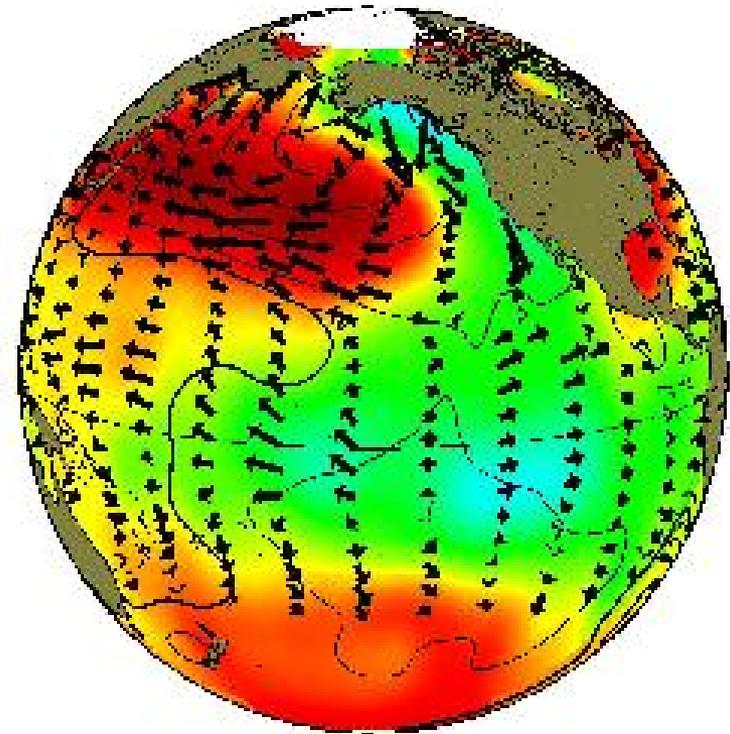
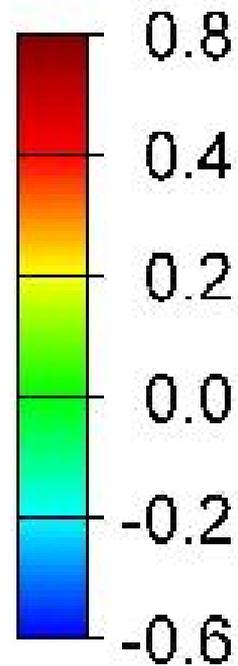
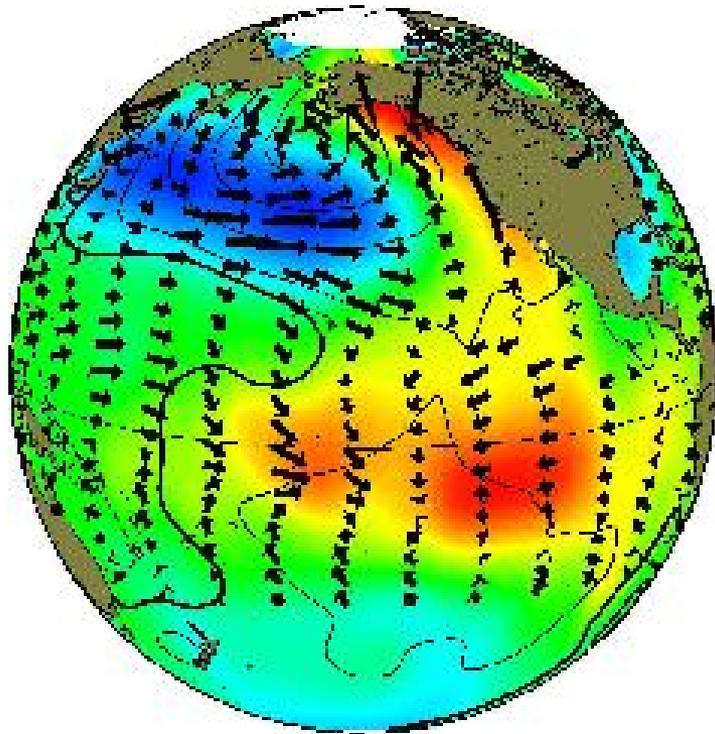
PDO notes:

- **Measured by satellite that detects sea level elevation (therefore temps and pressure are inferred)**
- **“observations are from systems encompassing the evolution of measurement technology”**

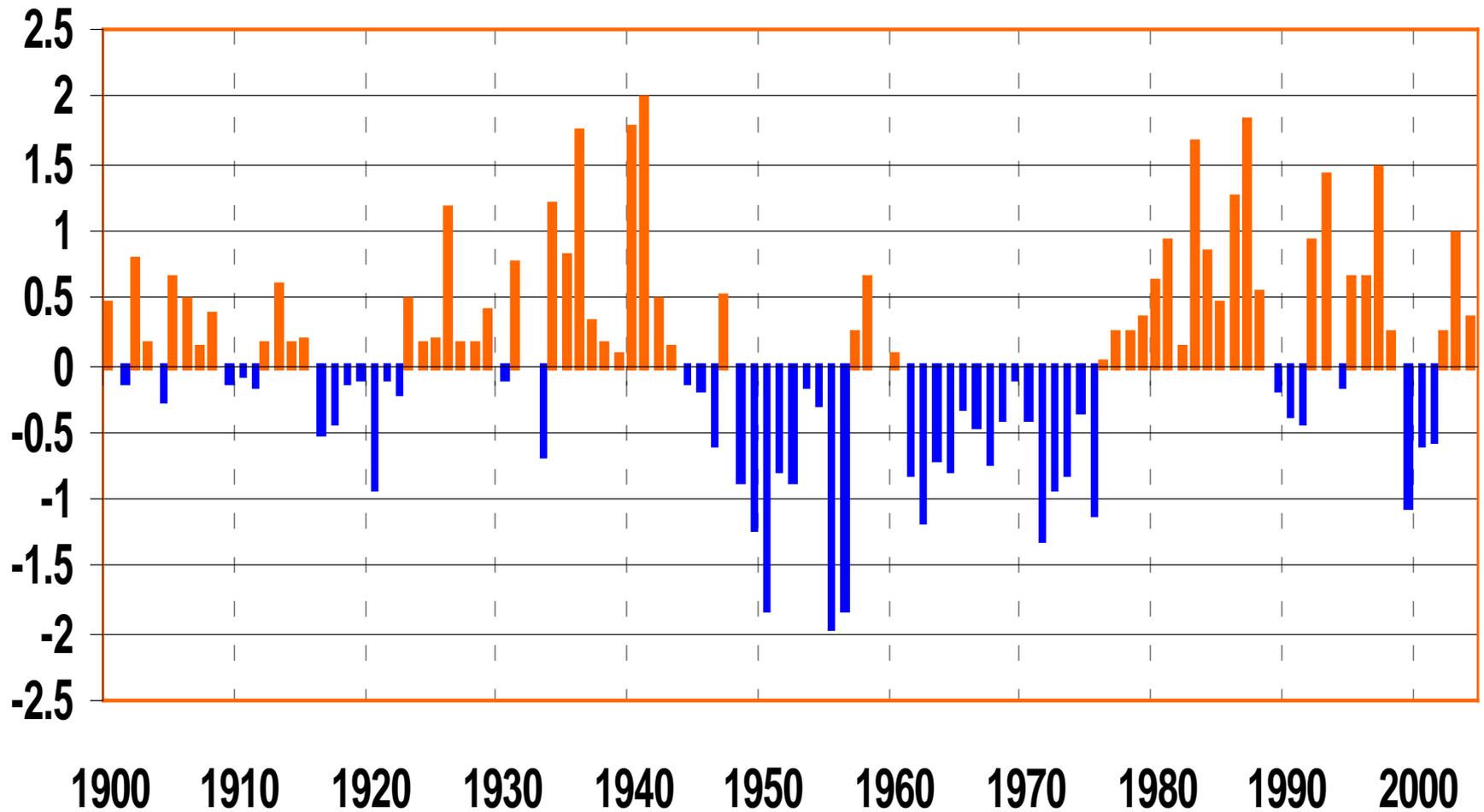
PDO

Warm phase

Cool Phase



PDO Index - N Pac poleward of 20N



Don't forget about the Arctic Ocean...

and the Arctic Oscillation (AO)

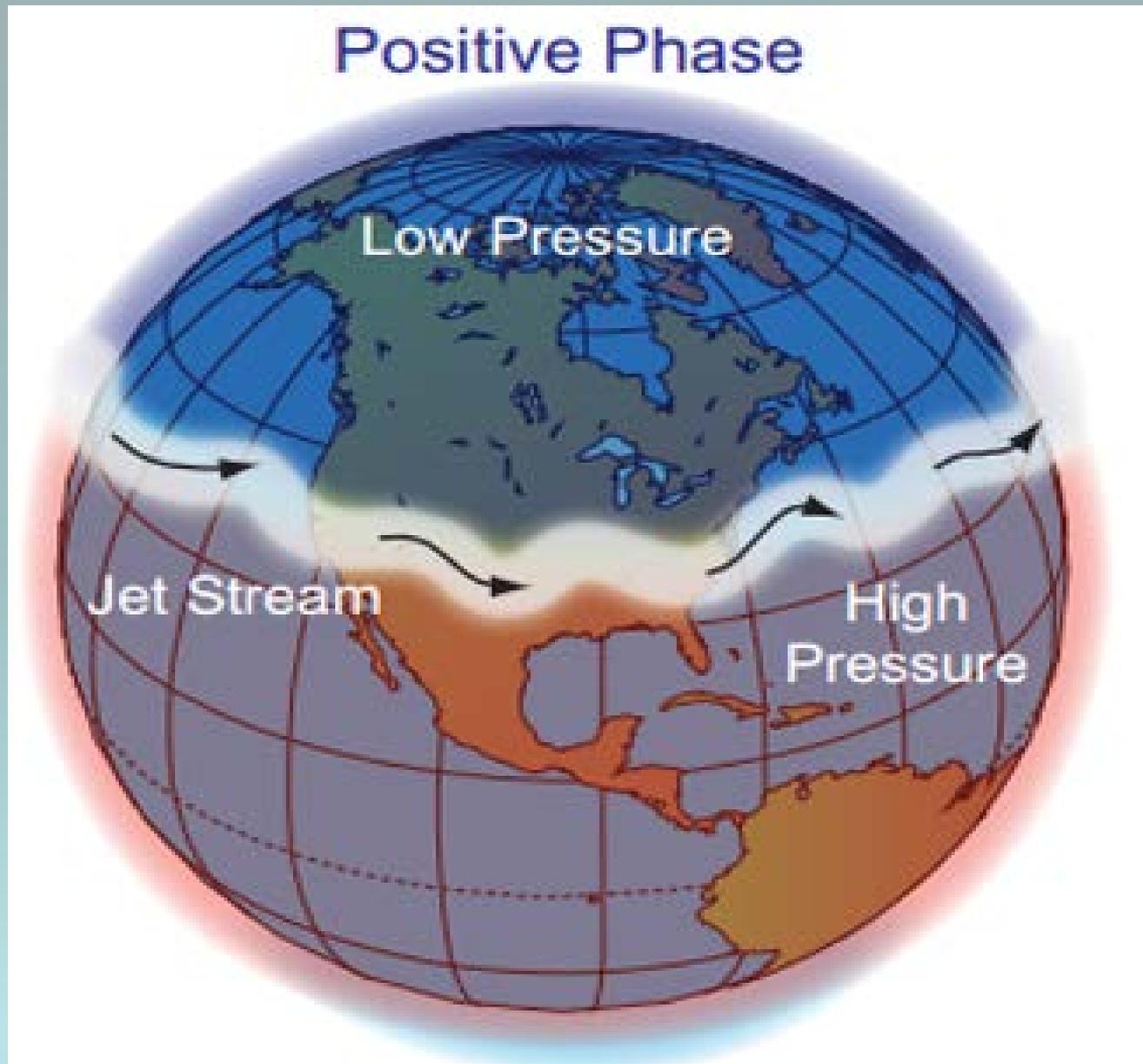
**which measures the pressure
anomaly over the Arctic**

Positive phase of the AO...

Stronger Low over the Arctic

Stronger westerlies over Canada

US gets a warm winter

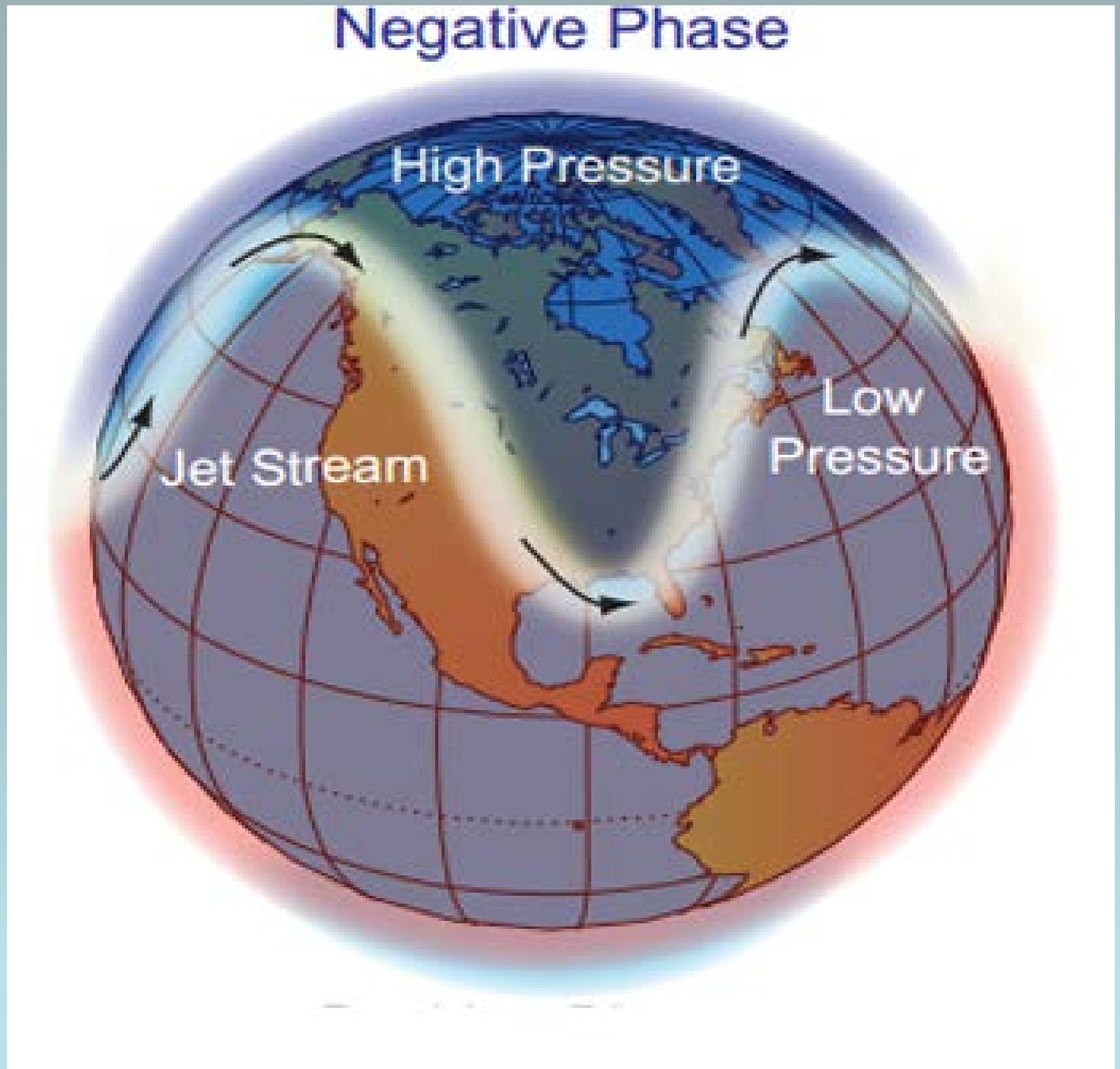


Negative phase of the AO...

Weaker Low over Arctic

Weaker westerlies over Canada

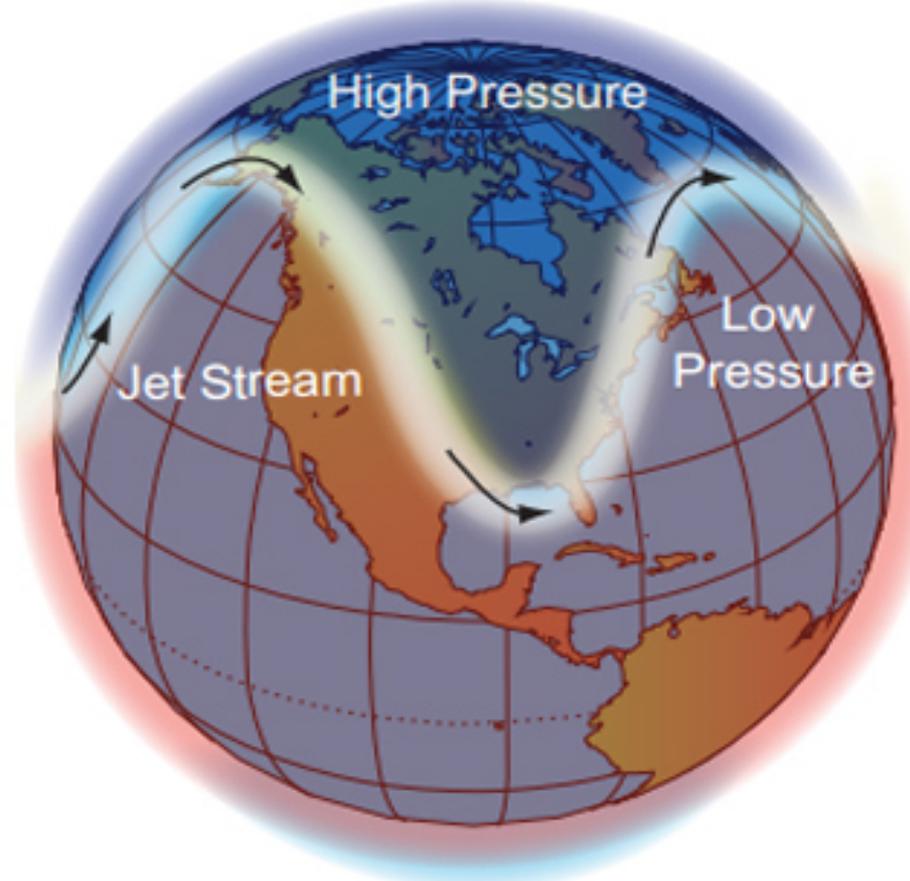
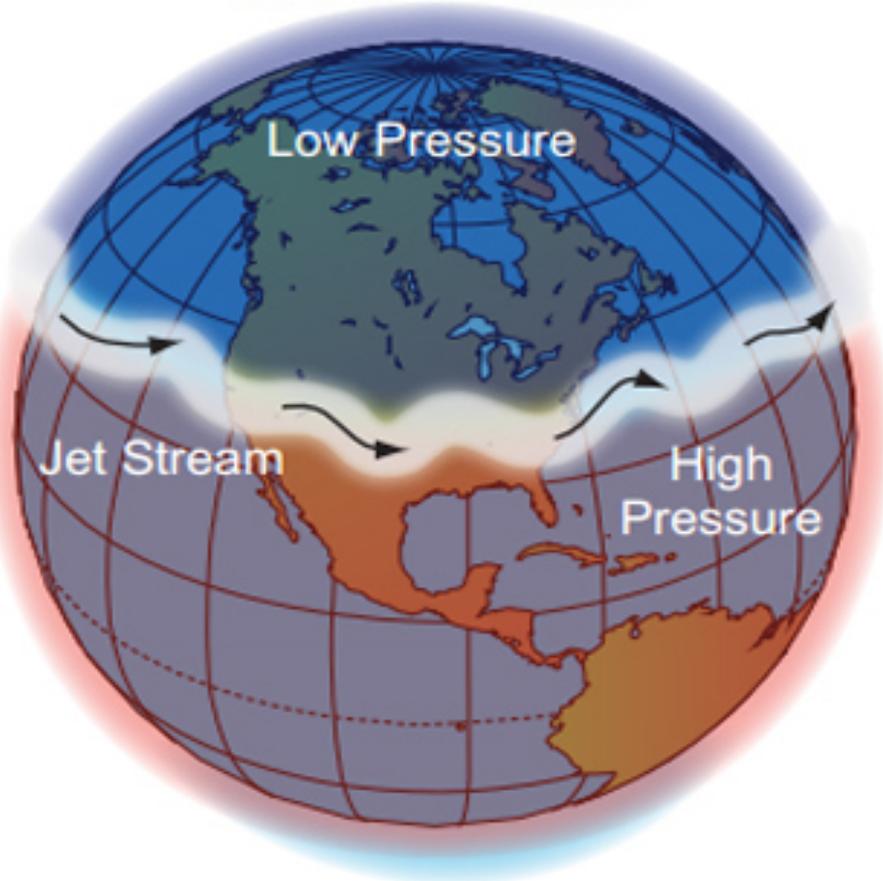
US gets a cold winter



Arctic Oscillation

Positive Phase

Negative Phase



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- **COMMENTS OR
QUESTIONS?**