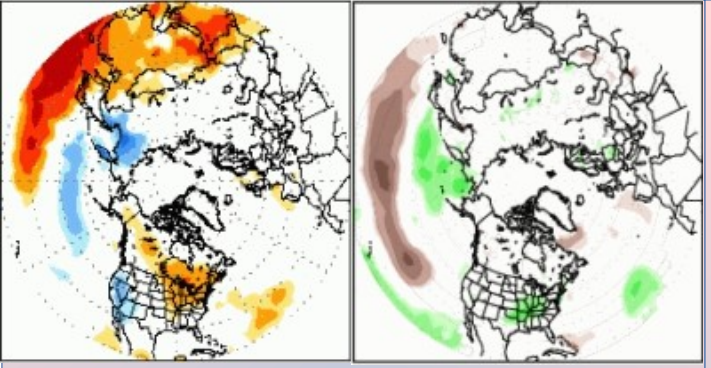


Fig. 3: WP correlation with surface temperature and precipitation in the Northern Hemisphere

What are the impacts of the WP?

The positive phase is associated with above-average temperature in West Pacific regions and the East coast of the U.S. during winter/spring, and below-average temperatures in eastern Siberia during all seasons (Fig.3, left). Precipitation is above average in the high latitudes of the North Pacific and below average over central North Pacific (Fig.3, right). The WP can also influence the location of the Pacific Jet stream and therefore wind directions and intensities.

Can climate change mask the WP?

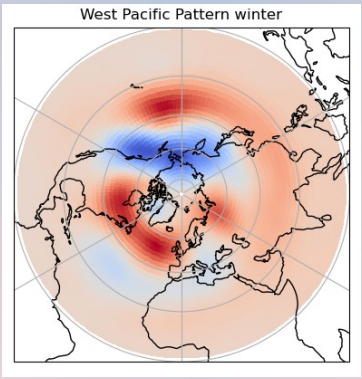
Climate change (warmer surface temperature) can mask a negative phase of the WP Index. A positive phase of the WP Index on the other hand can mask global warming. We would measure e.g. lower temperature in Siberia, but not due to a reduction of global warming, but because we are in a positive phase of the WP Index.

References: Aru et al., 2020: Comparisons of the different definitions of the western Pacific pattern and associated winter climate anomalies in Eurasia and North America.

https://www.worldclimateservice.com/2021/10/04/western-pacific-oscillation/
Python code from Marco Schulz:
https://github.com/mschulzie/climAPCREGION;
Fig.3:
https://www.cpc.ncep.noaa.gov/data/teledoc/wp_tmap.shtml

Impressum:
Conny Posern
Climate Physics Master course at GEOMAR
Düsternbrooker Weg 20
24105 Kiel

The West Pacific Pattern

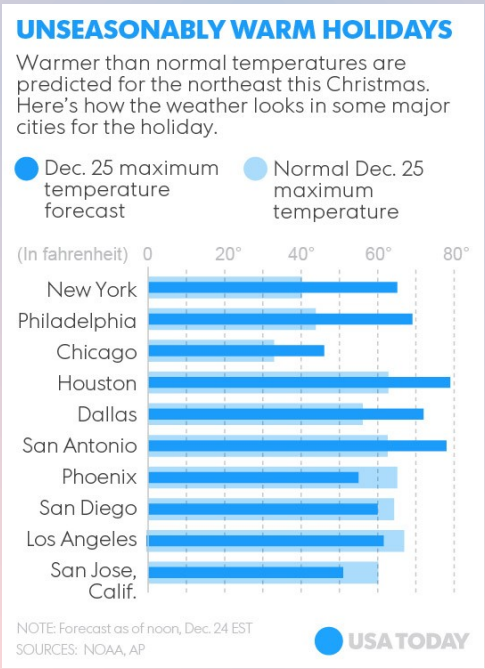


by Conny Posern
Regional Climate Variability Master Course

What has the weather in New York to do with pressure differences over the North Pacific region?

On the 25th Dec, 2015 New York experienced anomalously warm temperatures up to 18°C, when normally it is around 4°C during Christmas. So what happened?

Warm and cold air masses in the atmosphere result in surface pressure differences which are changing on different time scales. These pressure differences can lead to so-called teleconnections in far-away regions causing abnormal weather, e.g. temperature, rainfall, or storms.



Source: https://eu.usatoday.com

The West Pacific Pattern (WP) is such a pressure difference with more cold air/high pressure over Kamtschatka and more warm air/low pressure over Southeast Asia and the western subtropical Pacific. Air pressure differences can be expressed as geopotential height anomalies at a certain pressure level, e.g. 500 hPa (Fig. 1, left).

This pressure level is at around 5 km height for colder air masses and around 6 km height for warmer air masses. We have longterm measurements of these height anomalies over the Northern Hemisphere and can calculate Empirical Orthogonal Functions (EOF) modes. These modes show where the dominant recurrent pressure anomalies exist. This can be different for each season, e.g. winter shows the strongest pressure differences between Kamtschatka and the West North Pacific (Fig. 1, right).

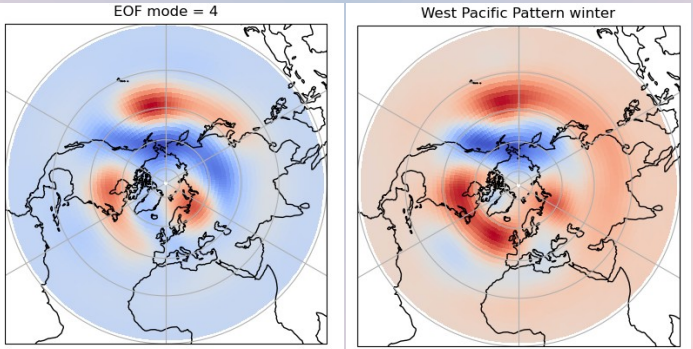


Fig. 1: EOF4 of geopotential height anomalies at 500 hPa in the Northern hemisphere, for all months (left) and winter (right).

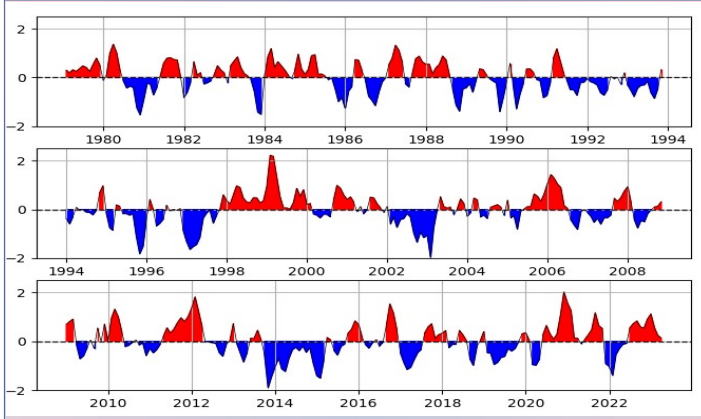


Fig. 2: West Pacific Pattern Index from the PC time series, 3-month running mean

West Pacific Pattern (WP) Index

The intensity of the pressure differences can be shown in a time series: the West Pacific Pattern Index (Fig. 2). Positive values stand for a strong pressure difference and negative values for a lower pressure difference.

What WP Index phase do you see over the winter 2015/2016? And what would the influence on New York's air temperature on the east coast of the U.S. would look like? Can you see other winter periods where the WP Index is positive? And what happens in negative phase WP Index winters?