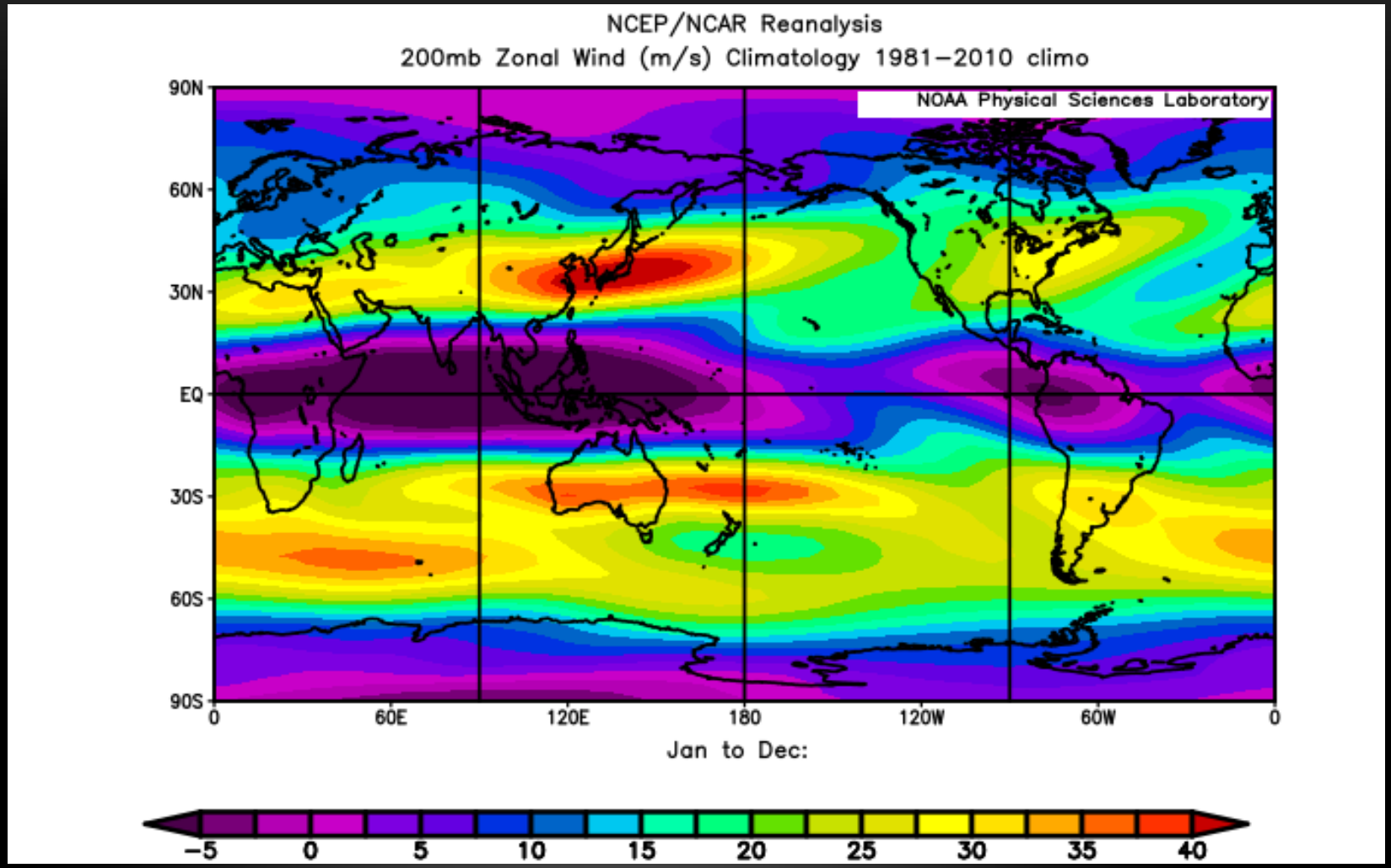
Atmospheric General Circulation: Jet Streams and Storm Tracks

Jet Streams: Long-term annual mean 200-hPa Zonal wind



- prevailing westerly flow in the midlatitudes (the East Asian jet and the North Atlantic jet)
- The westerly flow is more uniform in the southern hemisphere.

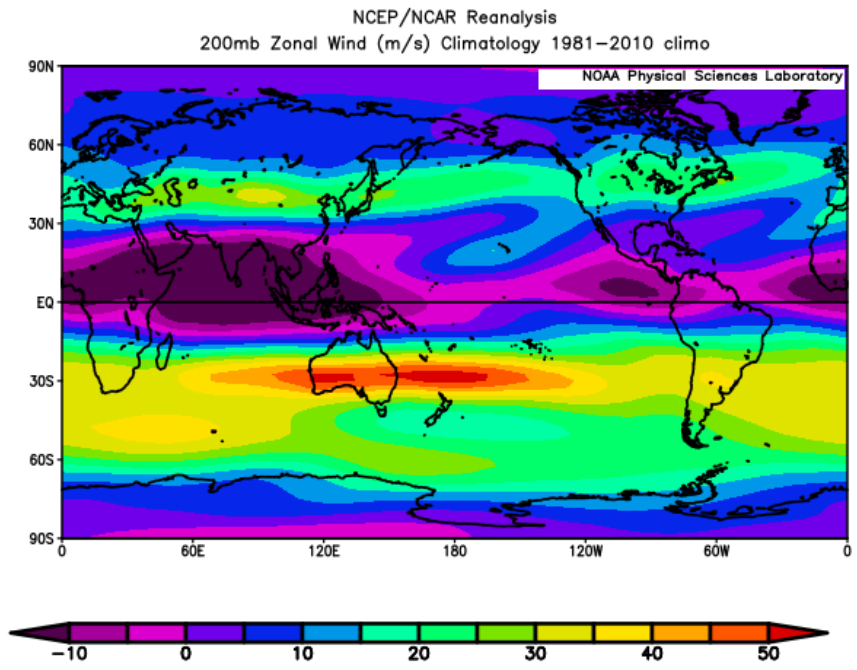
Plots created from https://psl.noaa.gov/cgi-bin/data/composites/printpage.pl

Seasonal Changes of the Jet Stream (long-term seasonal mean U200)

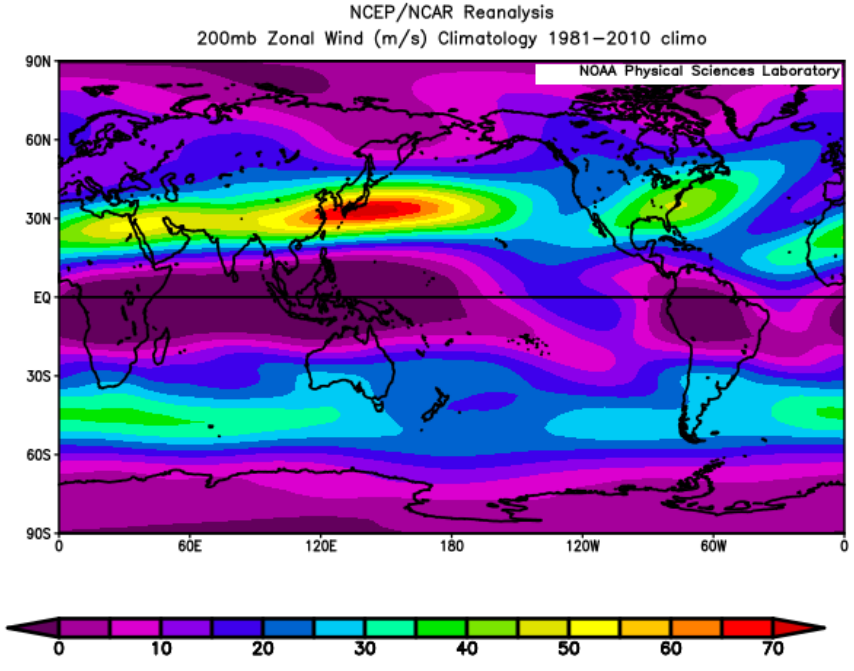
Which figure represents the boreal summer and which one the boreal winter?

Pause and Think

June-August



Dec-Feb

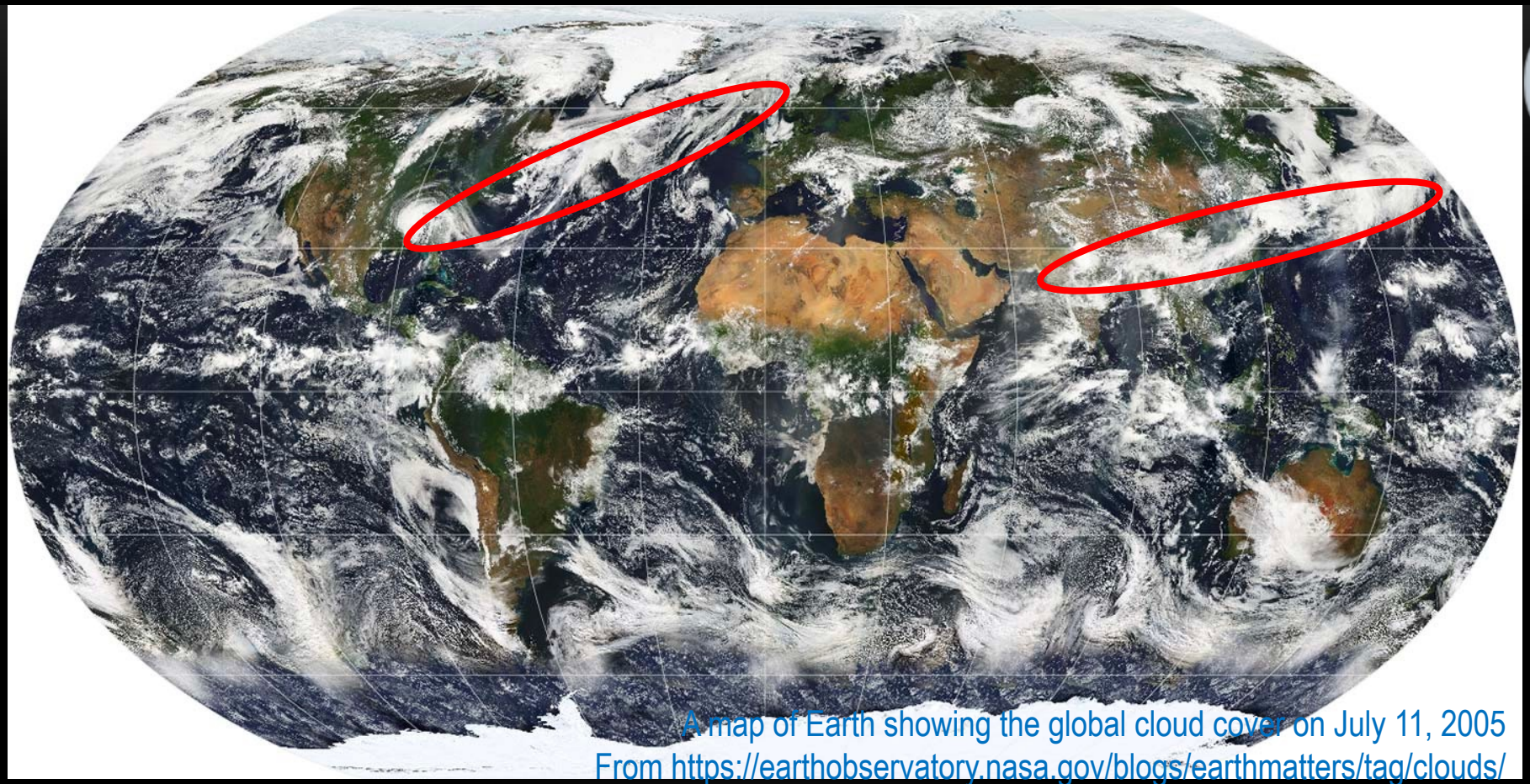


- The stronger midlatitude jet stream in the winter hemisphere is consistent with the stronger meridional temperature gradient

Plots created from https://psl.noaa.gov/cgi-bin/data/composites/printpage.pl

Could you identify storm tracks on this map?

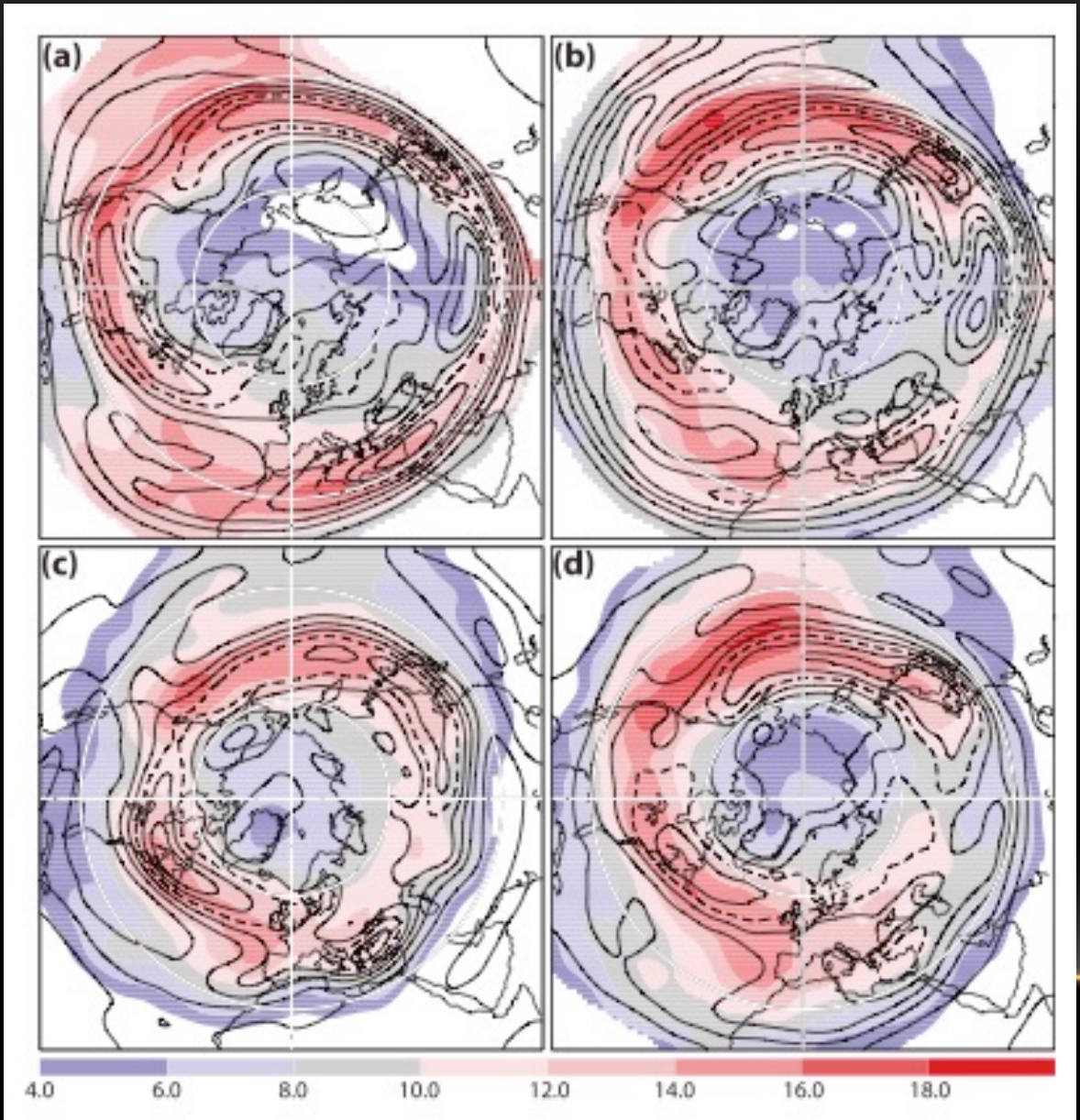
Pause and Think



A map of Earth showing the global cloud cover on July 11, 2005
From https://earthobservatory.nasa.gov/blogs/earthmatters/tag/clouds/

- Storm tracks: a region in which storms are statistically and locally most prevalent and intense
- See an animation of weather 2015 on YouTube (https://www.youtube.com/watch?v=i4mBYwBNULk)
- Storm motion is strongly modulated by the background wind, and the midlatitude storm tracks are thus closely tied to the jet streams.

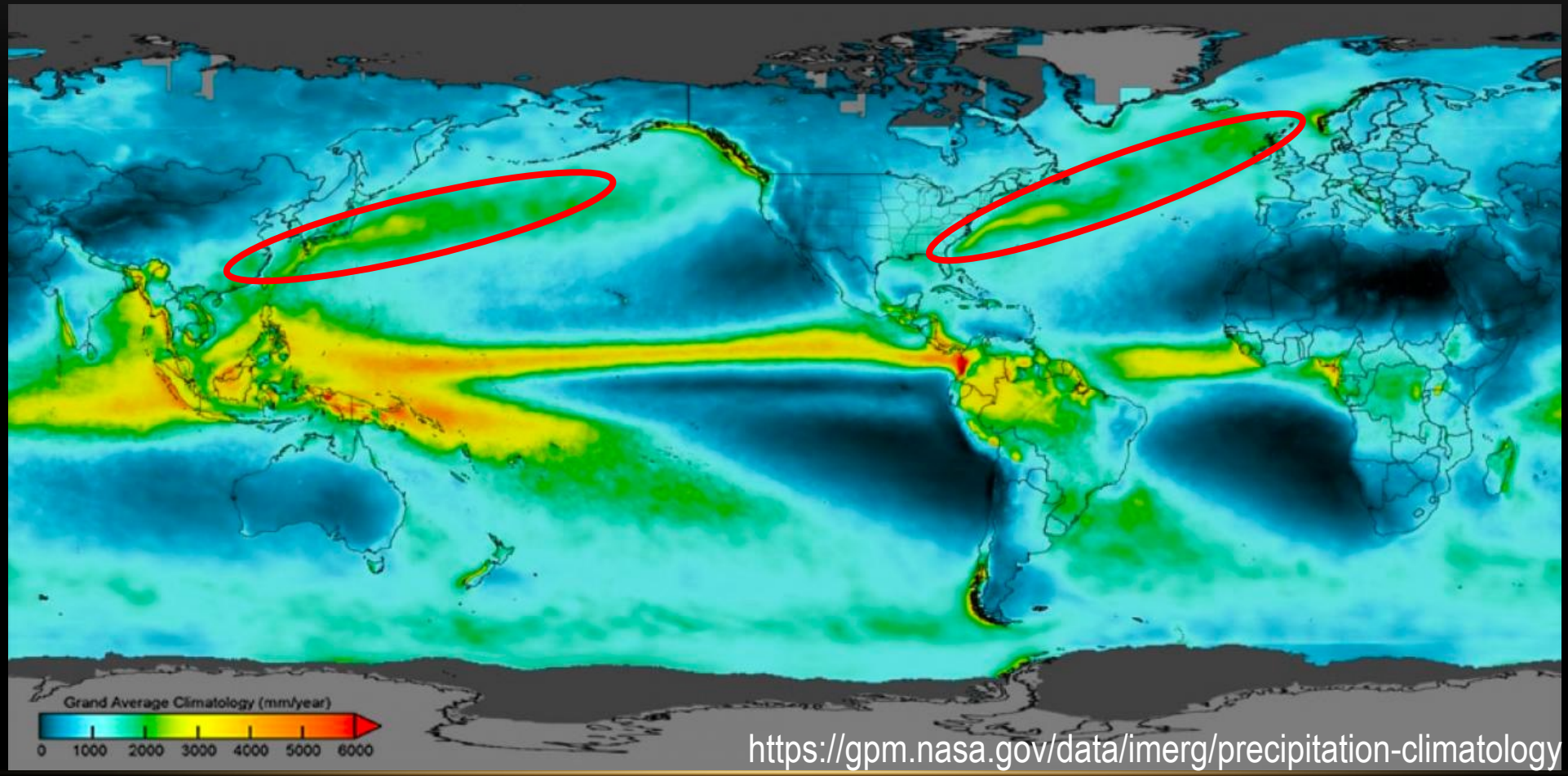
Storm Tracks in the Northern Hemisphere



- Winter storm tracks: starting from the west coast of North Africa → the Middle East → the western North Pacific and North America → continuing over the North Atlantic and Europe → northern Asia
- In summer the track becomes almost a circle at higher latitudes. The intensity maxima are somewhat smaller than in winter.
- The spring and autumn pictures are transitional between the two solstitial seasons

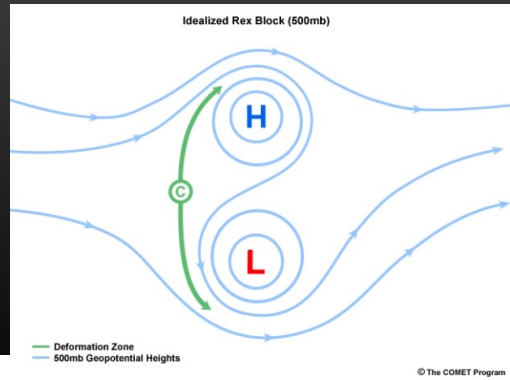
Track density (contours) and mean intensity (color) of 250-hPa vorticity maxima for each season: (a) DJF, (b) MAM, (c) JJA, and (d) SON. From Hoskins and Hodges (2019, Part I) © American Meteorological Society. Used with permission

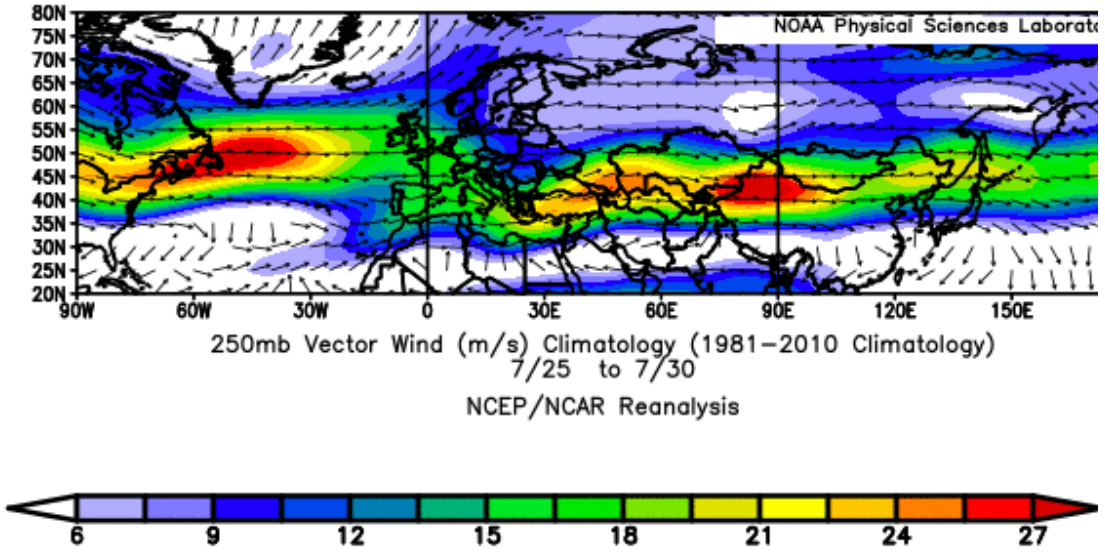
Can you identify storm tracks in the precipitation field?

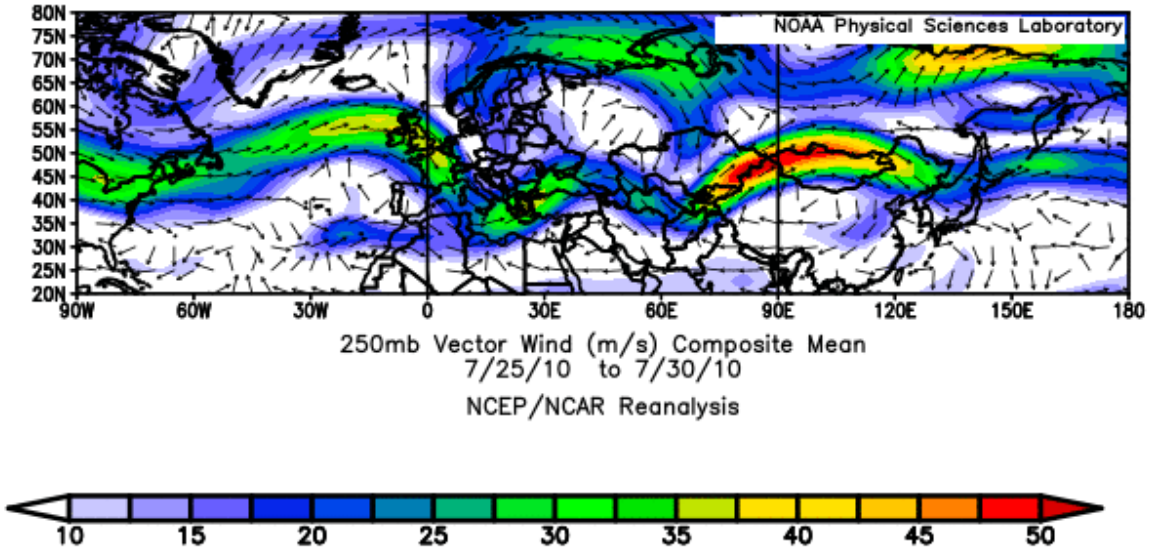


- Storm Tracks are characterized by enhanced precipitation
- The tilting of the storm tracks over the North Pacific and North Atlantic is consistent with the tilting of the jets.

Disruption of the Jet/Storm Track by Blocking







Left: the long-term mean 250-hPa wind between July 25-July 30
Right: 250-hPa wind between July 25-July 30, 2010, associated with a blocking high over Russia, which induces the split of the jet (see more discussion in Hoskins et al. 2012)

Plots created from https://psl.noaa.gov/cgi-bin/data/composites/printpage.pl

References

- Cook, K. H., 2013: Section 2.1
- COMET: Introduction to Tropical Meteorology, Section 3.1 and 3.2 https://www.meted.ucar.edu/tropical/textbook_2nd_edition/navmenu.php?tab=4
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