Alex Mitchell and Tyler Leicht
5 February - Vladivostok and Sapporo

Big Picture

The major feature within this region is the jet stream, a climatological feature of east Asia due to sharp temperature gradients in the region as well as conservation of angular momentum from flow around the Himalayas. Nevertheless, according to Andrew Winters' phase diagram, the jet is forecasted to remain retracted (shifted further west) across northern China, with 2-3 sigma positive anomalies in the 250mb wind speed. With the exception of the effects of a few shortwave disturbances, the jet will predominantly be oriented southwest to northeast with a few instances of 2-3 sigma positive anomalies in the v-component of the 250mb wind as disturbances move through. Along with the enhanced jet wind speeds, a +2 sigma Siberian surface high is situated to the northwest of our forecast area, keeping 850mb temperatures much below average across far northern China, Mongolia, and eastern Siberia. This pattern will remain dominant across mainland Asia throughout the first 5 days of the forecast period. However, Japan and southeastern Russia are just to the southwest of the area of favored cyclogenesis with the favorable location in the northern jet exit region and a strong area of baroclinicity between the cold continental air and the relatively warm ocean. With persistent northwesterly flow, small amounts of directional wind shear, and favorable upslope topography, western Hokkaido is expected to get significant sea-effect snowfall throughout the period. By day 6, more significant ridge building will occur across most of China extending into Mongolia and last through the end of the period. Much of this is due to downstream effects of a highly anomalous shortwave feature across Pakistan and northwest India, with precipitable water anomalies of +3 sigma and 500 mb height anomalies of -3 sigma. With this, the jet stream pushes further over Japan and Korea in a more climatological region.

Day 7-10

The last portion of our forecast period will be dominated by the large-scale but relatively weak ridge across much of eastern Asia. This ridge replaces the predominant trough over the area from the rest of the forecast period after an anomalous low pressure across the Indian subcontinent brings high levels of precipitable water into the Tibetan plateau, a precursor for downstream ridge building. In addition, negative potential vorticity advection by the ageostrophic wind occurs across central China, further helping to build the upper level ridge. This in turn helps to shift the main core of the jet further east over the Korean peninsula and Japan which further shifts the region of cyclogenesis south toward the coastline of Japan. With the ridge in place, temperatures are expected to be predominantly above average for most of the domain with the only areas of negative anomalies poleward of 50°N.

Day 4-6

An amplified pattern in western Asia will create a zonally propagating Rossby wave packet that allows multiple shortwaves to propagate eastward at a faster phase speed throughout the period. The conjunction of these shortwaves with the superposition of the polar and subtropical jet will favor a large area of ascent off the east coast of Japan for cyclogenesis to occur by the beginning of the period. Similar to day 0-3, a surface cyclone develops and tracks northeast off the coast of Japan and initiates a low-level northwesterly flow pattern for Japan, bringing about frozen precipitation for areas along the windward side of the island country. With the base of the neutral trough centered on 35°N, anticyclonic vorticity advection behind the trough will aid in developing a surface high into North Korea, and provide further subsidence for Vladivostok, Russia, in combination with polar air subjected to downsloping locally.

Day 0-3

The period is introduced by a short wave that displaced its energy east through a broad upper level trough centered over eastern Siberia. This distorts its shape from a positive to a negative orientation, indicative of mature surface low and strong differential advection, increasing thermodynamic instability. An upper level jet concurrently provides favorability for ascent in its left exit region, furthering cyclogenesis for the surface low shortly before the beginning period that moves northeastward with high pressure building into Japan by the beginning of the period. By day 2, a subsequent surface low is similarly generated from vertical cyclonic vorticity advection ahead of the eastern Asian trough and ascent favored in the left exit region of an upper level polar jet at 40°N, dividing the almost barotropic air from the baroclinic air farther north as shown from the dynamic tropopause. Consecutive cyclones forming northeast of Sapporo, Japan, will provide persistent northwesterly onshore flow, coupled with sufficient instability due to relatively warmer sea surface temperatures of approximately 5°C to form persistent snow in the region, particularly in areas of enhanced topography. Vladivostok, Russia, is forecasted to exhibit very brief periods of snow when northerly flow is favored from upstream cyclogenesis, though will be dominated mostly by downsloping.

Probabilistic Forecasts for the period

Vladivostok, Russia

Day 0-3
- High Temperature 10th: 13°F 50th: 18°F 90th: 26°F
- Low Temperature 10th: 7°F 50th: 12°F 90th: 19°F
- Precipitation 10th: 0.00” 50th: 0.02” 90th: 0.04”

Day 4-6
- High Temperature 10th: 18°F 50th: 20°F 90th: 22°F
- Low Temperature 10th: 10°F 50th: 12°F 90th: 14°F
- Precipitation 10th: 0.00” 50th: 0.00” 90th: 0.00”

Day 7-10

High Temperature 10th: 25°F 50th: 30°F 90th: 33°F
Low Temperature 10th: 6°F 50th: 9°F 90th: 12°F
Precipitation 10th: 0.40” 50th: 0.50” 90th: 0.70”

Sapporo, Japan

Day 0-3
High Temperature 10th: 22°F 50th: 24°F 90th: 26°F
Low Temperature 10th: 17°F 50th: 19°F 90th: 21°F
Precipitation 10th: 0.20” 50th: 0.80” 90th: 1.30”
Day 4-6
High Temperature 10th: 18°F 50th: 20°F 90th: 21°F
Low Temperature 10th: 6°F 50th: 10°F 90th: 12°F
Precipitation 10th: 0.30” 50th: 0.70” 90th: 1.00”
Day 7-10
High Temperature 10th: 24°F 50th: 27°F 90th: 30°F
Low Temperature 10th: 14°F 50th: 16°F 90th: 18°F
Precipitation 10th: 0.20” 50th: 0.40” 90th: 0.60”