Climate Discussion for February 2020

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Valid: January 24, 2020

Currently, the MJO is Phase 7, meaning that MJO convection is located around the western Pacific (Figure 1). In general, an MJO Phase 7 would favor colder-than-normal conditions and a negative North Atlantic Oscillation (NAO) phase, but I don't think this is the case for the recent cold event around January 21st because the NAO index was positive. The ensemble forecasts for the MJO suggests that the MJO will tend toward Phases 2, 6, and 7, which does not bode well for snow enthusiasts because the probability of a positive NAO is increased significantly about 10 days after MJO convection is over the Indian Ocean (Phase 2/3). Also, some studies show that phases 1 and 8 are more conducive to cold and snowy weather across the Northeast United States. The possibility of the MJO transitioning to phase 2 in early February means that I am more inclined to say that warmer-than-normal conditions will be favored across Northeastern United States later in February. However, the intensity of the MJO is forecast to be rather weak so that MJO impacts on Northeast US weather will likely be minimal. Moreover, the Quasi-biennial oscillation is in a westerly phase (QBO index is positive; Figure 2) and could remain slightly positive in February, weakening the influence of the MJO on North American weather. Therefore, I am not giving the MJO much weight in my February forecast. So far this winter, the MJO has infrequently been in phases 1 and 8, which could explain the relatively low frequency of cold outbreaks across the eastern United States and the propensity for a positive NAO.

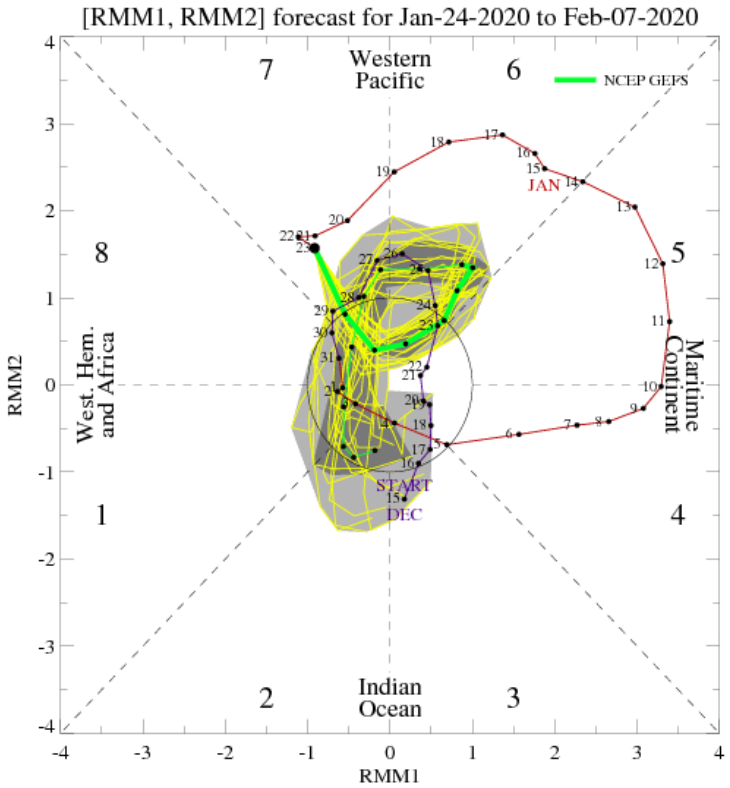

Figure 1. MJO forecasts provided the climate prediction center. (https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/clivar_wh.shtml**)**

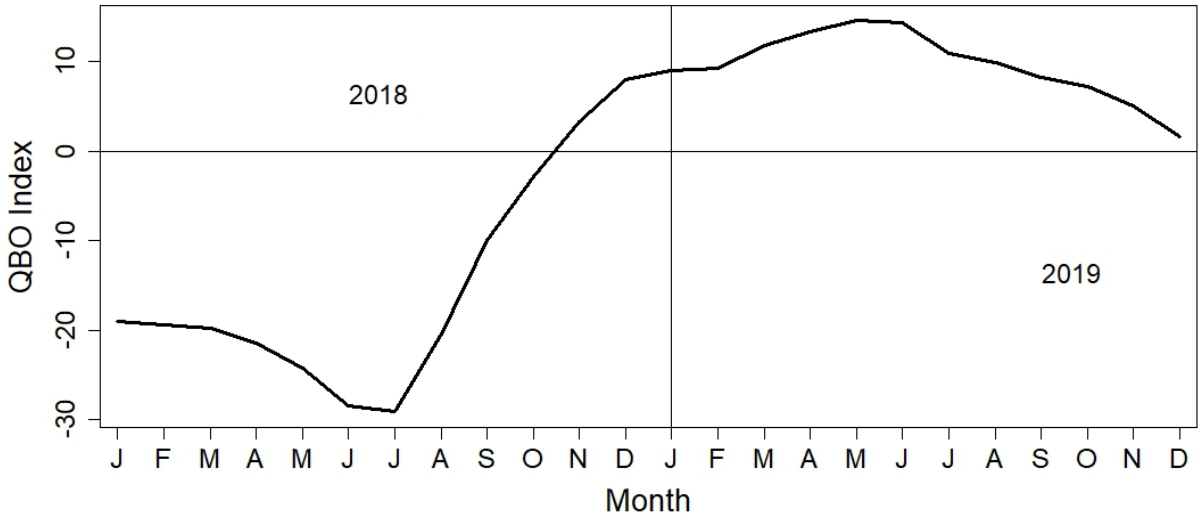

Figure 2. QBO for the past 24 months. Data can be found at: https://www.esrl.noaa.gov/psd/data/correlation/qbo.data.

Current forecasts suggest that the NAO (Figure 3) will be in a neutral or positive phase in the beginning of February, favoring warmer-than-normal conditions across the Southeast US and Mid-Atlantic states. The positive NAO will also tend to favor storm tracks whose origins are located around the Gulf of Mexico, contrasting with negative NAO phases that are associated with rapid cyclogenesis off the East Coast United States. Like the MJO forecast, this NAO forecast for early February does not favor major East Coast snowstorms. The warmer-than-normal conditions across the Southeast United States associated with the positive NAO will likely be offset by a positive PNA phase (Figure 4) that is likely to persist through at least early February. The positive PNA will favor warmer-than-normal conditions across the Pacific Northwest and places like Montana and Wyoming. However, the PNA is forecast to be weak so that its imprint on the weather for the next few weeks may be elusive.

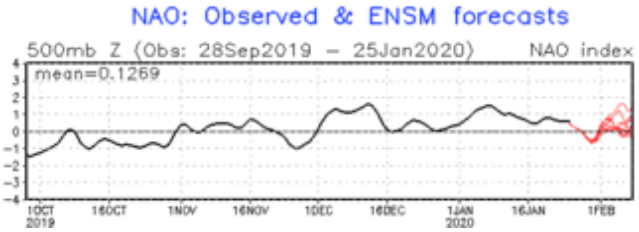

Figure 3. NAO forecast from the Climate Prediction Center.

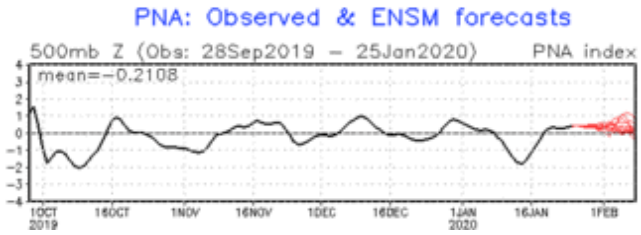

Figure 4. PNA forecast from the Climate Prediction Center.

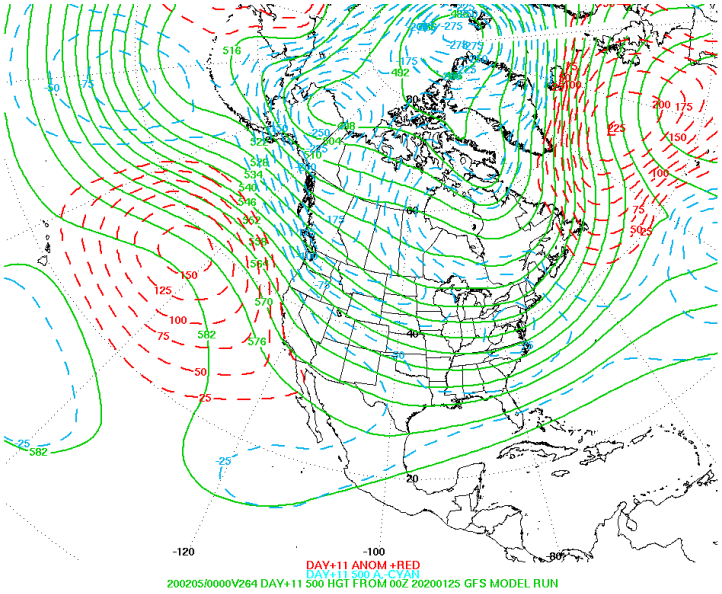

Figure 5. 11-day 500 mb height forecasts obtained by applying a 7-day mean centered on the 11-th day.

Given that the NAO and PNA indices are not strongly correlated with temperature across the Northeast United States, it is important to look at the forecast 500-mb geopotential height anomalies to infer the intensity of the North American ridge-trough dipole pattern. The current 11-day forecast for 500-mb geopotential height anomalies (Figure 5) suggests that anomalous troughing will be present over the eastern United States. This predicted configuration suggests that the colder-than-normal conditions should prevail in early February. However, the forecast negative 500 mb geopotential height anomalies across Alaska are more intense than those across the eastern United States. Thus, the ridge-trough dipole index is positive, which is more favorable for warmer-than-normal conditions across the eastern United States. Without strong ridging over Alaska, it will be impossible for a strong surface anti-cyclone to develop across western Canada, which is necessary for the intrusion of Artic air into the eastern United States. Moreover, 500-mb geopotential height anomalies are forecast to be negative over the Hudson Bay and Greenland, which is also not favorable for extreme cold. Based on this forecast 500 mb geopotential height anomaly pattern, I think a lot of the eastern United States will experience near-normal to above-average temperature conditions for the first half of February.

For the past month, equatorial Pacific SST anomalies have been positive around the date line and near climatological elsewhere across the equatorial Pacific (Figure 6). This pattern corresponds with a negative trans Nino index and a central Pacific El Nino. This SST configuration generally supports colder-than-normal conditions across the Northeastern United States, especially in February when the ridge-

trough dipole is more closely related to tropical convection. Thus, I am not surprised that January has been warmer-than-normal for many locations despite the central Pacific El Nino. Recent SST forecasts suggest that this pattern will persist through February, which is good for winter lovers because it will enhance the probability of an upper-level ridge forming over Northern Alaska, a requisite for severe cold across the Northeastern United States.

In terms of precipitation, this negative trans Nino 3 pattern does not favor above or below normal precipitation so that long-range forecasts for precipitation are too uncertain to draw any conclusions. However, some SST anomaly forecasts suggest that negative SST anomalies may form across the eastern equatorial Pacific, which would favor drier-than-normal conditions across the East Coast United States. Also, those negative SST anomalies would reduce the probability of cyclogenesis around the Gulf of Mexico, which could mean fewer severe weather events around the Southeast. Of course, this situation is contingent upon how quickly and strongly the negative SST anomalies intensify across the eastern equatorial Pacific.

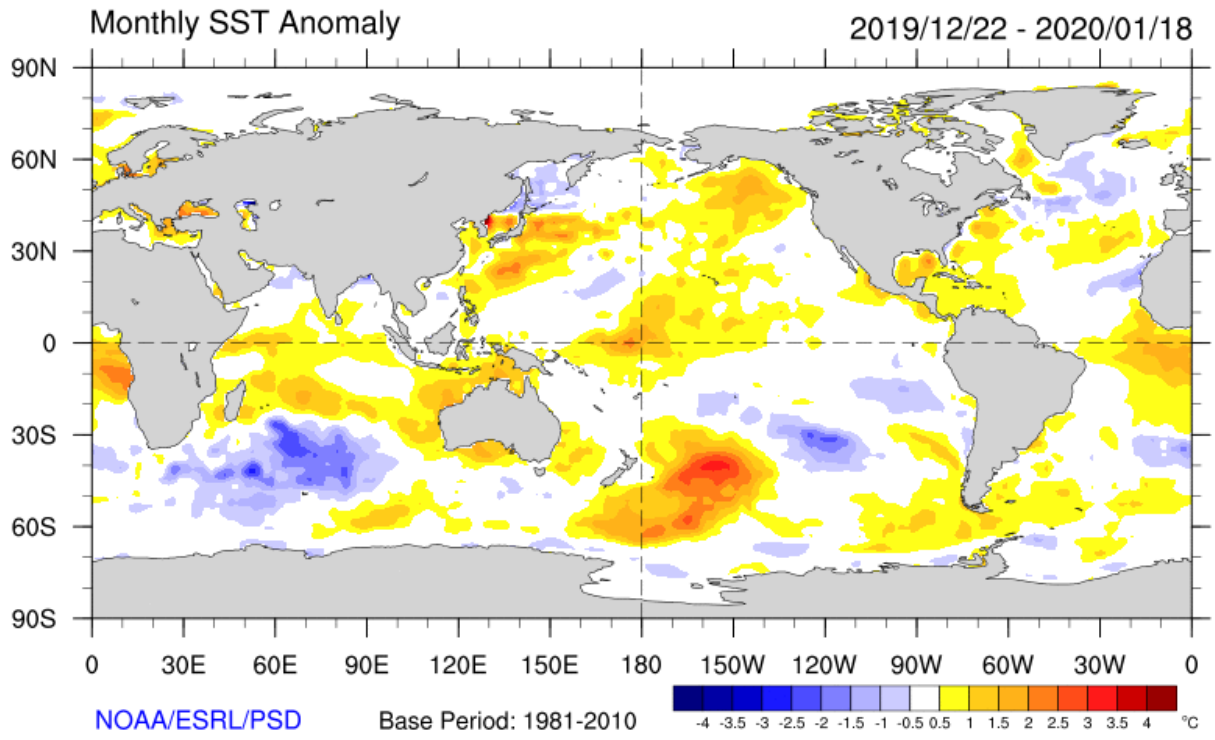

Figure 6. SST anomalies over the course of the last month.