2016

Extreme Cold Weather in January South China

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Abstract

From January 20-25, 2016, there was a significant cold wave in Southern China as reported and an orange alert of cold wave was issued by the National Meteorological on January 24th. Weather China showed that the strong cold wave pushed the Chinese snowline southwards, reaching its southernmost position since 1951. The average temperature anomaly was 6 to 8° C below the climatological average.

Similar patterns have been identified during previous cold waves, and has been attributed to variability in the Arctic Oscillation (AO) and moving of the Polar Vortex (PV) (Wang and Chen, 2010; He and Wang, 2016). Based on the AO index from the Climate Prediction Center (CPC), the AO was in the negative phase since the beginning of January, and peaked from 15 – 18 January. Additionally, there was an observed extreme high pressure center over eastern Siberia, causing the extreme cold weather in China.

This work seeks to identify the factors of this extreme weather event and its correlation to the AO, East Asian winter monsoon (EAWM), and the movement of the PV. Investigation of this connection explains the generation process of extreme cold waves in the region, and this allows for the development of- better forecasts of extreme cold wave events, and enhances our prediction of the probabilities cold winters.

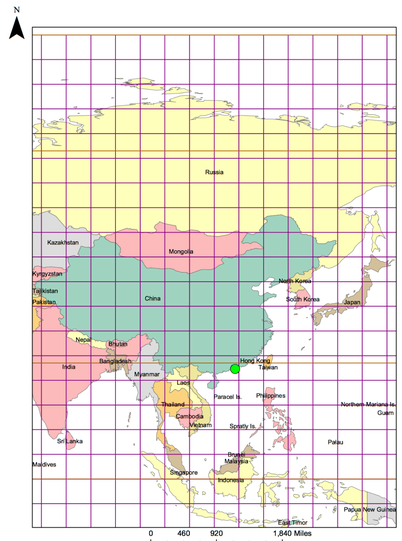

Figure 1. first snowfall since 1996 came to Chongqing and sixty- year low temperature was observed in Hong Kong (green dot).

Introduction

Inclement weather hit Southern China from Jan. 20th to 25th. The week- long cold wave broke records in southern China area, pushing the Chinese snowline southward. Residents of Chongqing, experienced their first snowfall since 1996, and places like Hong Kong, had temperatures reach a 60-year minimum of ~ 4°C (39°F). This strong wave caused school to be suspended, flight cancellations, and closure of area airports and roads.

This work seeks to figure out the influential factors of this extreme event and its correlation to the negative phase of Arctic Oscillation(AO), anomalous East Asian winter monsoon (EAWM), and southward migration of the polar vortex. Investigation of these relationships will help explain the synoptic relationship to such events, and can provide better prediction and forecasting of extreme cold weather.

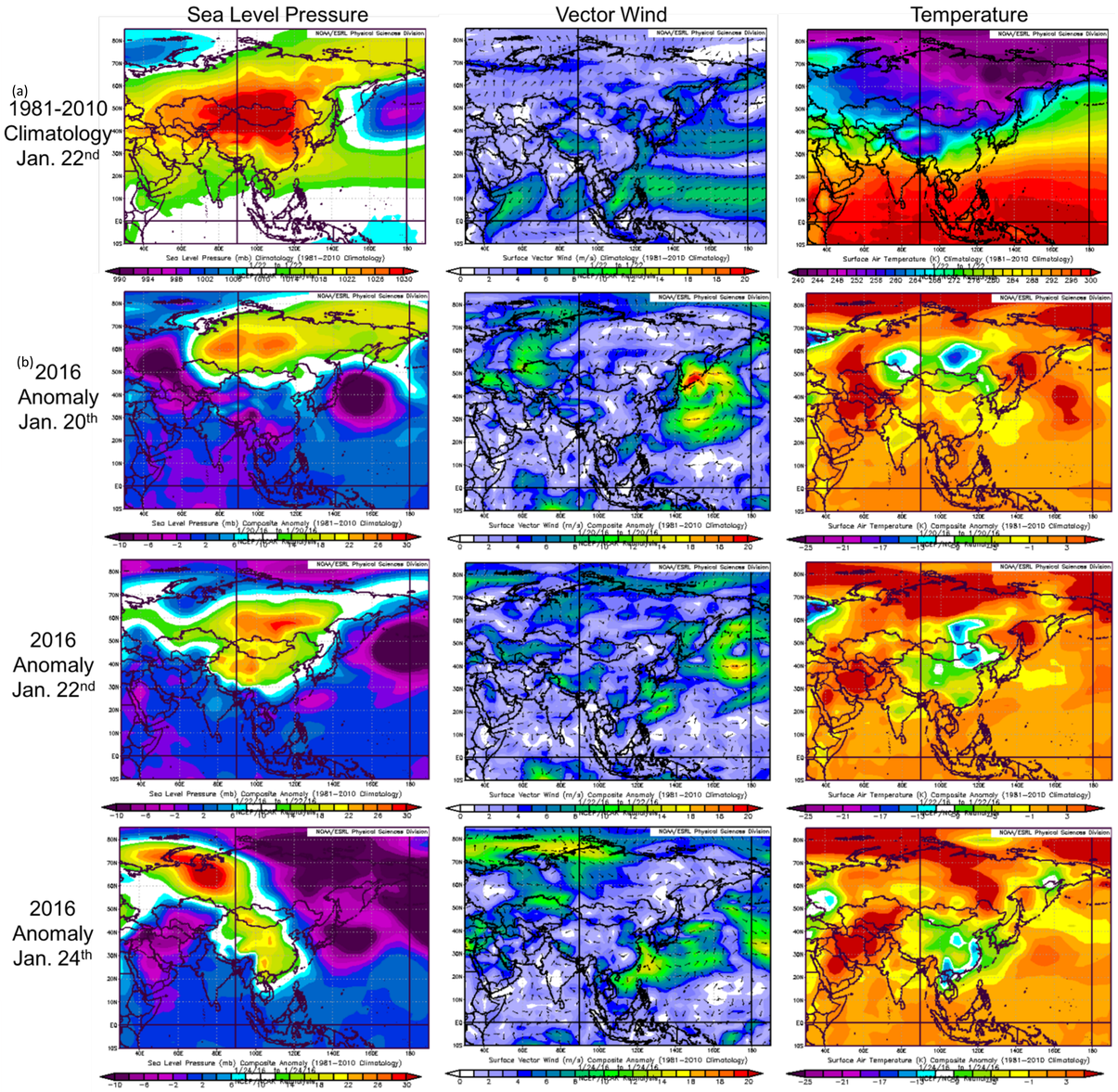

Figure 2. (a) The daily mean sea level pressure, surface vector wind and surface temperature from 1981 to 2010 on January 22nd. (b) The daily mean sea level pressure, surface vector wind, and surface temperature anomalies on January 20th, 22nd and 24th.

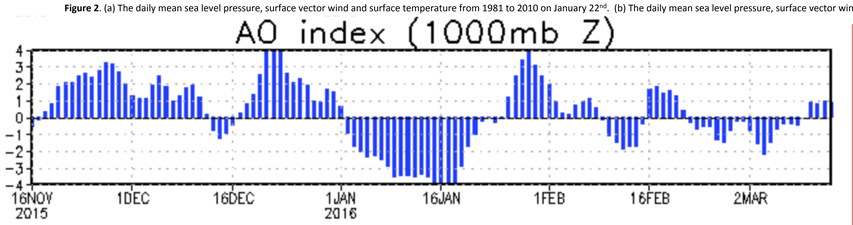

Figure 3. The daily AO index at 1000mb level from November 16th, 2015 to March 13th, 2016.

Methodology

- Acquire official reports and news to determine the specific temporal parameters of the cold wave.
- Develop a literature review for climatological influential factors.
- Acquire NCEP/NCAR Reanalysis data on: sea level pressure, vector wind and temperature at surface, 500mb and 1000mb (elevations), and perform qualitative analysis on these variables.
- Compare synoptic data to the AO index.

Results

- AO Index (Figure 3) is in negative phase, peaking 15-18 Jan..
- Siberian High (Figure 2b) is 22 to 30 mb above the climatological mean, and the Aleutian Low is ~ 10 mb below normal. The stronger pressure gradient generated stronger winds over this area.
- Comparison between the daily anomaly and climatological weather maps shows a higher pressure center located further north, and low pressure center located further south. This enabled the observed cold air advection to southeast China.

Conclusions

Since the beginning of January, negative phase of AO index was observed and peaked in mid-January. Large negative AO phase, which is connected with a stronger polar jet stream (Shengping He and Huijun Wang, 2015), strengthened the polar vortex. From the weather maps, strong southward-moving polar vortex strengthened the Siberian High at the same time pushed the Aleutian Low southward. Two streams of north wind meet on the northwestern Pacific, bringing and pushing a great amount of cold air mass pass south China, causing the extreme cold weather in January. Similar strong temperature process was also found in December, 2009 (Lin Wang and Wen Chen, 2010). We could conclude that observation of negative AO phase can be used to predict the stronger polar vortex. When this stronger polar vortex moves southward and enhance the Siberian High, there might come a strong cold wave thorough east Asian area.

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