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Reconstruction of Arctic surface temperature in past 100 years using DINEOF

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Global annual mean surface temperature has not risen apparently since 1998, which is described as global warming hiatus in recent years. However, measuring of temperature variability in Arctic is difficult because of large gaps in coverage of Arctic region in most observed gridded datasets. Since Arctic has experienced a rapid temperature change in recent years that called polar amplification, and temperature risen in Arctic is faster than global mean, the unobserved temperature in central Arctic will result in cold bias in both global and Arctic temperature measurement compared with model simulations and reanalysis datasets. Moreover, some datasets that have complete coverage in Arctic but short temporal scale cannot show Arctic temperature variability for long time.

Data Interpolating Empirical Orthogonal Function (DINEOF) were applied to fill the coverage gap of NASA's Goddard Institute for Space Studies Surface Temperature Analysis (GISTEMP 250km smooth) product in Arctic with IABP dataset which covers entire Arctic region between 1979 and 1998, and to reconstruct Arctic temperature in 1900-2012. This method provided temperature reconstruction in central Arctic and precise estimation of both global and Arctic temperature variability with a long temporal scale. Results have been verified by extra independent station records in Arctic by statistical analysis, such as variance and standard deviation.

The result of reconstruction shows significant warming trend in Arctic in recent 30 years, as the temperature trend in Arctic since 1997 is 0.76°C per decade, compared with 0.48°C and 0.67°C per decade from 250km smooth and 1200km smooth of GISTEMP. And global temperature trend is two times greater after using DINEOF. The discrepancies above stress the importance of fully consideration of temperature variance in Arctic because gaps of coverage in Arctic cause apparent cold bias in temperature estimation. The result of global surface temperature also proves that global warming in recent years is not as slow as thought.