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Climate change detection with the FORMOSAT-3/COSMIC GPS RO satellite

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Statement of the Problem: The Intergovernmental Panel on Climate Change (IPCC) reports has made predictions of a persistent and wide-spread warming of temperatures close to the surface over the entire globe in the 21st century (IPCC, 2013). How realistic are the predictions made by the IPCC models, especially over the polar region where the highest increases in temperatures were predicted? Due to the lack of accurate temperature measurements over polar region, the estimate of temperature trends over the polar region remains to be determined.

Methodology & Theoretical Orientation: In this work, we use profiles of temperature measurements from the FORMOSAT-3/ COSMIC (F3C) to determine global temperature trends during the period 2006-2016. Based on known sources from the radio waves provided by the Global Positioning System (GPS), the F3C uses radio occultation (RO) technique to obtain profiles of atmospheric temperatures from surface to 40-km altitudes. With a good global coverage by the F3C, we can work out temperature trends on a global scale.

Findings: There was distinctive warming over the northern hemisphere polar regions. This warming in the polar region, identified by the F3C observations, confirms the predictions made by the IPCC models. The continuously warming trends in the polar region can lead to progressive reduction in sea ice extent, melting glaciers, etc. Our work with the F3C data proves that this terrifying picture actually occurs now.

Conclusion & Significance: The F3C data demonstrates that significant warming has occurred during the period 2007-2016, and most pronounced warming areas have occurred over the polar region. The pronounced warming over the polar region are exacerbating sea ice lost, and melting glaciers. Satellite measurements are keys for mankind to continuously observe what have occurred over the polar region.

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