Trends in Sea Ice Extent as observed from Microwave Remote Sensing

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Changes in sea ice extent are strong modulators of climate change as well as indicator of the effect of global warming. The ocean-atmospheric heat budget is also affected by the sea ice dynamics owing to reflection of solar radiation back to the space by sea ice cover. In the present work, we have analysed about 30 years of sea ice data (1981–2013) over the Antarctic and Arctic regions using 25 km spatial resolution re-gridded data products obtained from National Snow and Ice Data Centre (NSIDC), USA. These sea ice data products result from combined observations by the Scanning Multi-channel Microwave Radiometer (SMMR) on Nimbus-7 platform and a series of Special Sensor Microwave Imager (SSM/I) and Special Sensor Microwave Imager/Sounder (SSMIS) instruments on board the Defense Meteorological Satellite Program (DMSP) satellites.

Analysis of the trends in sea ice extent spanning a period of 30 years over the Arctic and Antarctic regions for two months representative of the Antarctic Summer/Arctic Winter (February) and Antarctic Winter/Arctic Summer (September) seasons are presented in Figure 1.

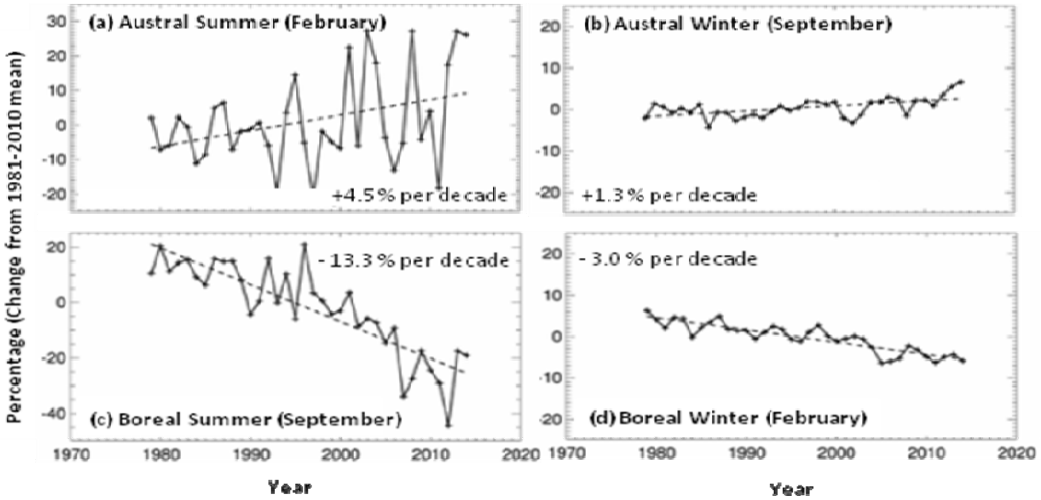

Figure 1: Trends in sea ice extent over the Antarctic during (a) Austral Summer (b) Austral Winter; and over the Arctic during (c) Boreal Summer (d) Boreal Winter

It is interesting to note from the analysis that the Arctic shows a continuous downward trend in sea ice cover both during the summer (-13.3 % per decade) and winter (-3.0 % per decade) periods as has also been observed in earlier works. In contrast, the sea ice extent is actually increasing in the Antarctic region with a trend of 4.5 % (1.3 %) per decade for summer (winter) periods. Additionally, we have analysed the extent of sea ice cover for all the 12 months (during 1981-2013) and investigated the role of physical forcing parameters in modulating the contrasting sea ice trends. The impact of dominant climate oscillators such as the Arctic Oscillation (AO) and Antarctic Oscillation (AAO) have also been analysed to explain the observed variability.