

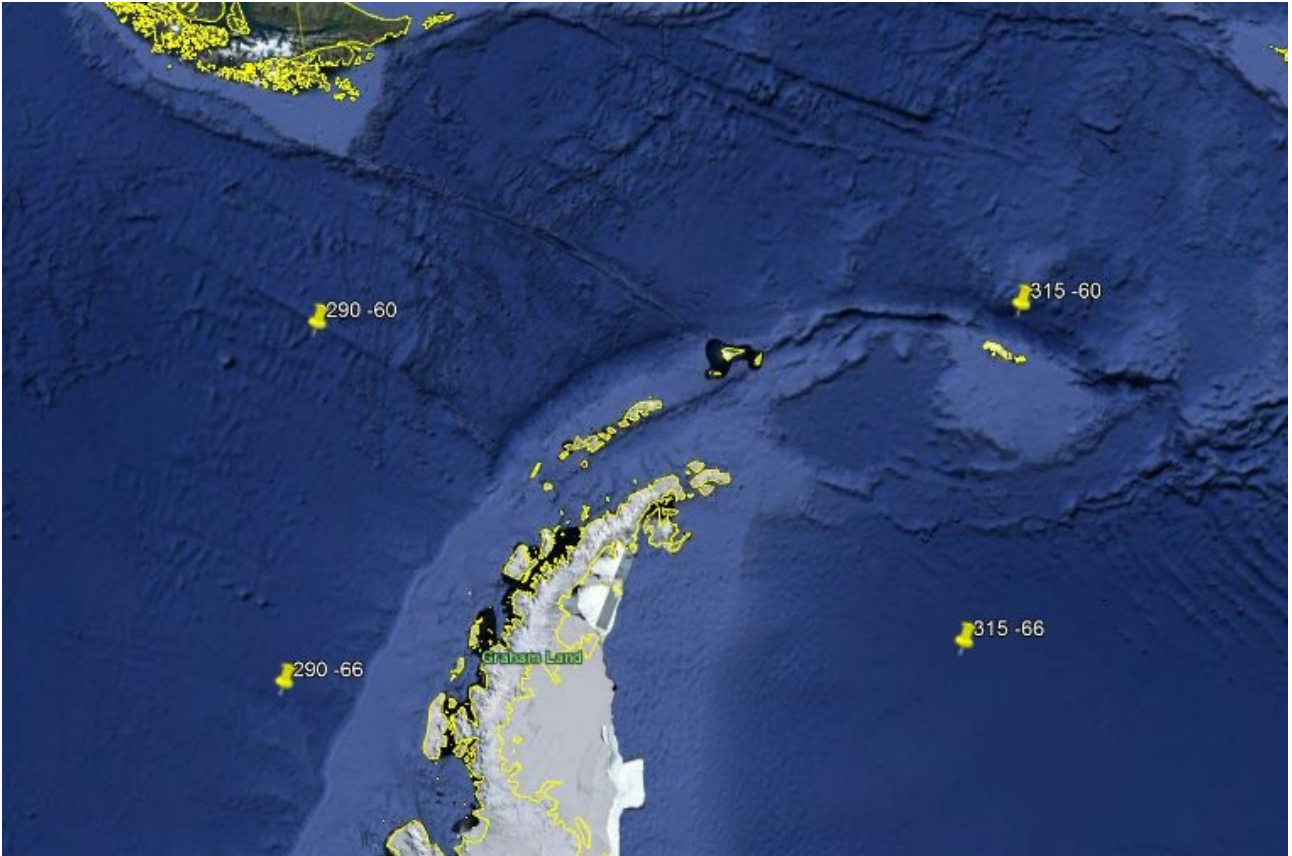
## Supplementary Information

Maps are from Google Earth Pro (2018).

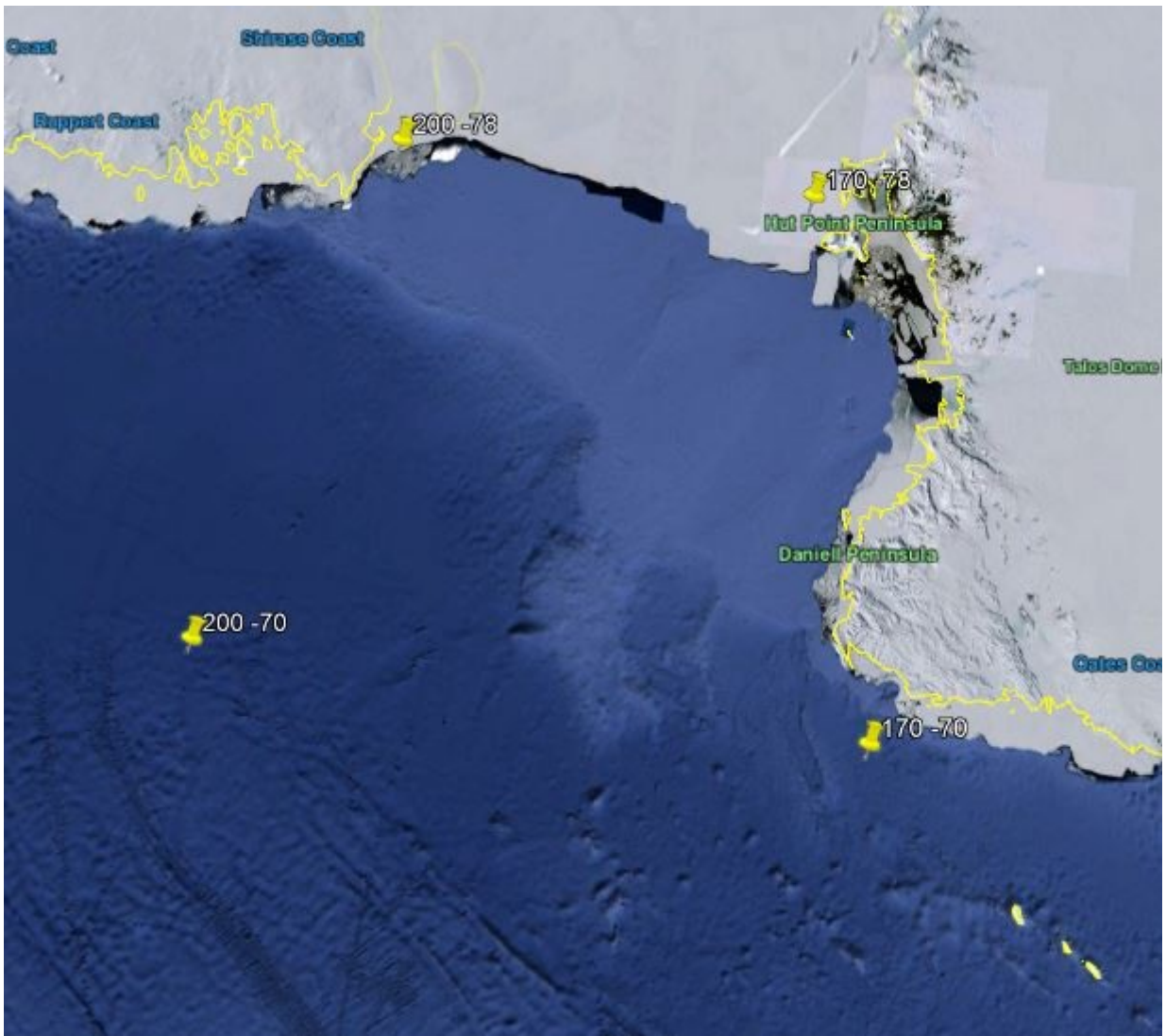
Graphs are from data as referenced below or in the main paper.

### 1. Maps

Corners of the areas used in **4.1 Other Areas** are shown with Placemark pins.



*Map - Tip of West Antarctic Peninsula*



Map - Ross Sea



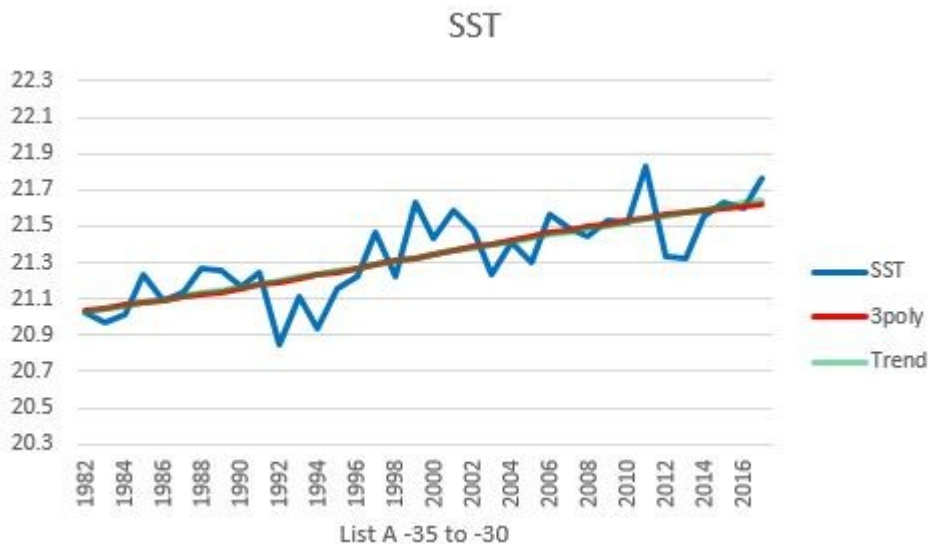
Map - Weddell Sea

## 2. Sea Surface Temperature graphs

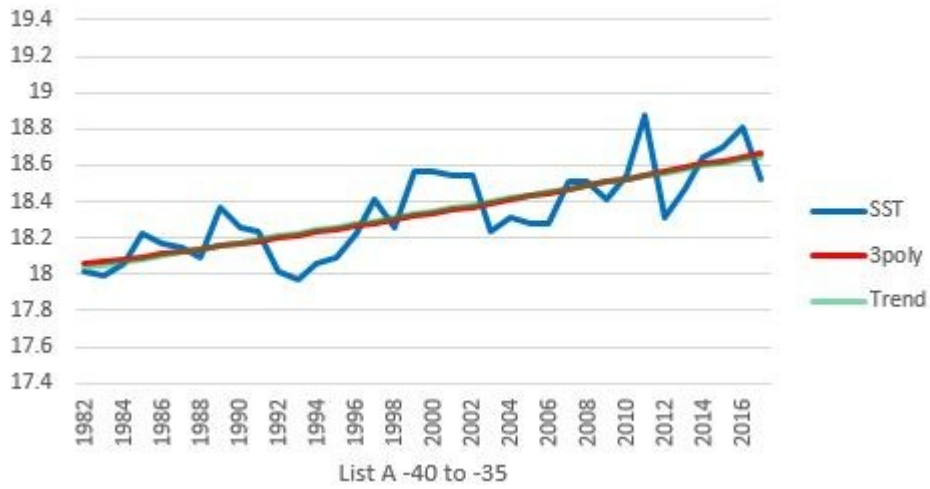
These graphs all show annual summer average temperature, with 3<sup>rd</sup> order polynomial fit and linear trend.

### 2.1 Antarctic-wide Temperature Graphs

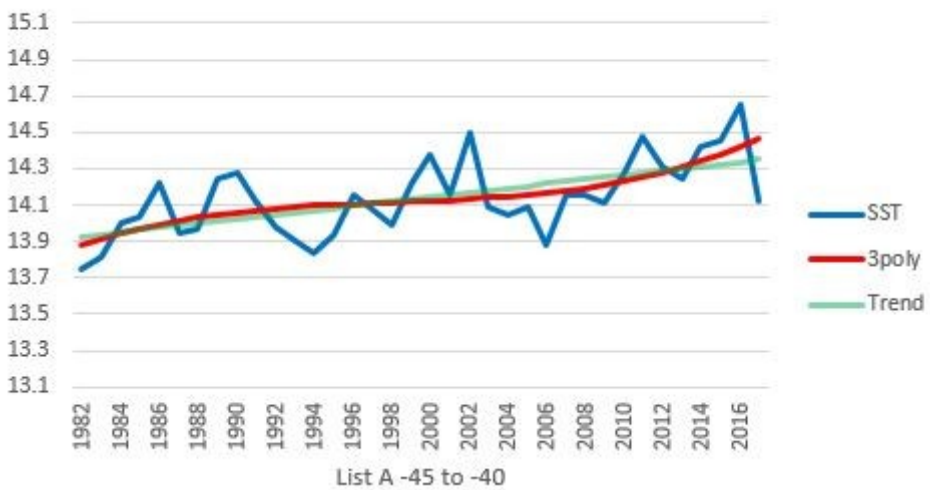
The full set of temperature graphs, by Longitude List and Latitude, are presented here. Each graph, unless stated otherwise, is for all longitudes in a given list and is from complete data. For more explanation, see the main paper.



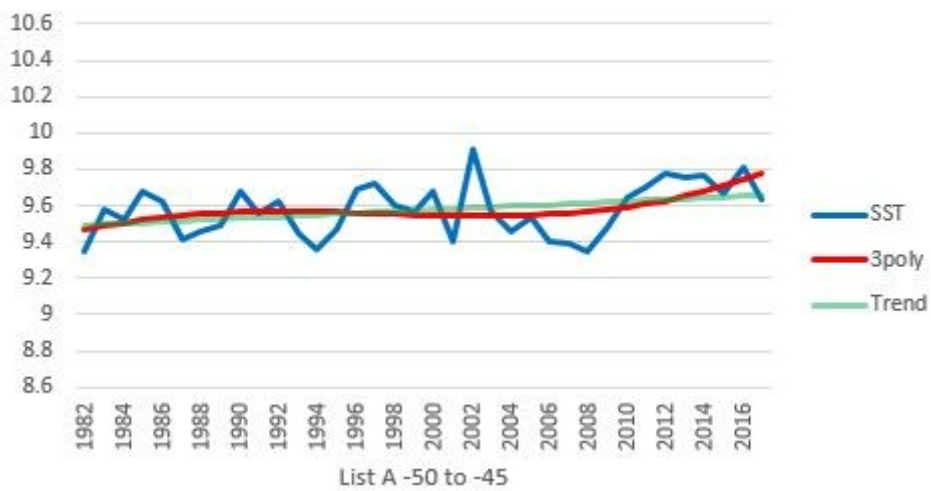
### SST

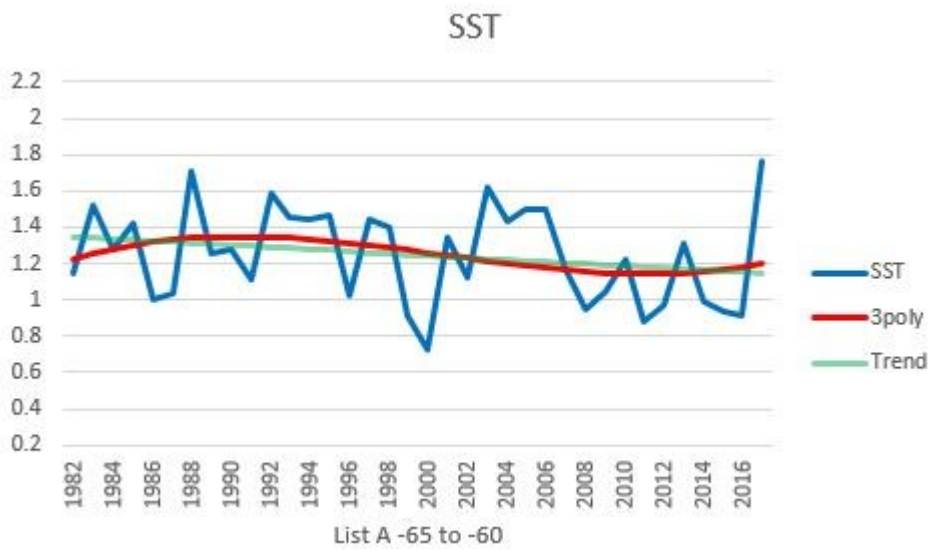
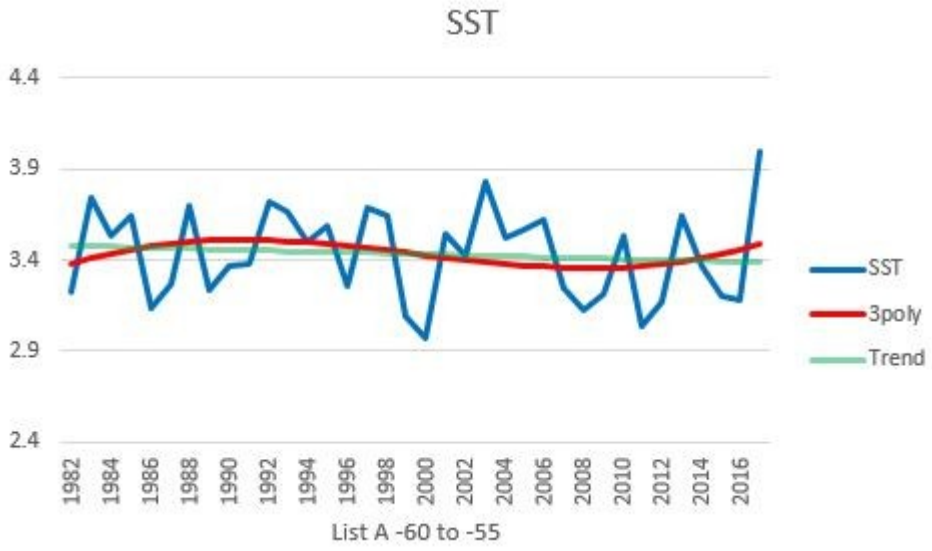
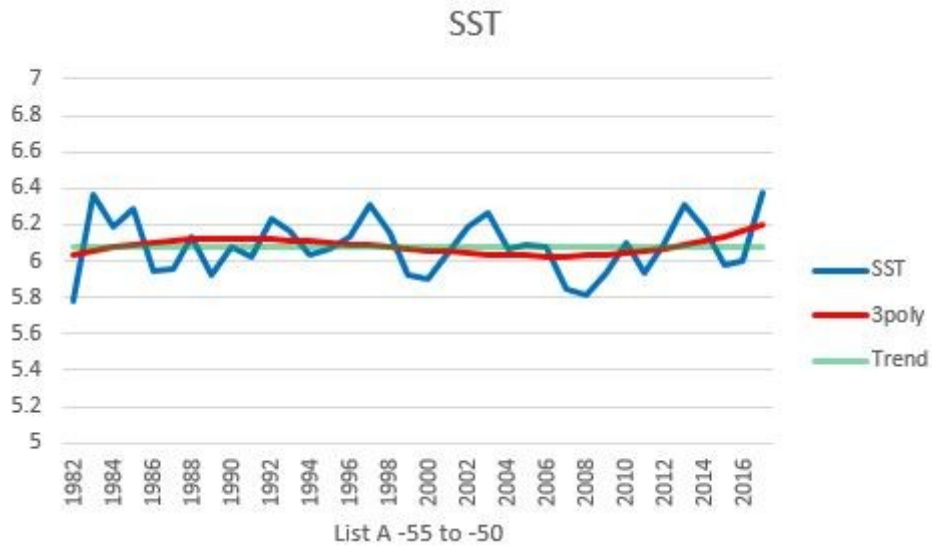


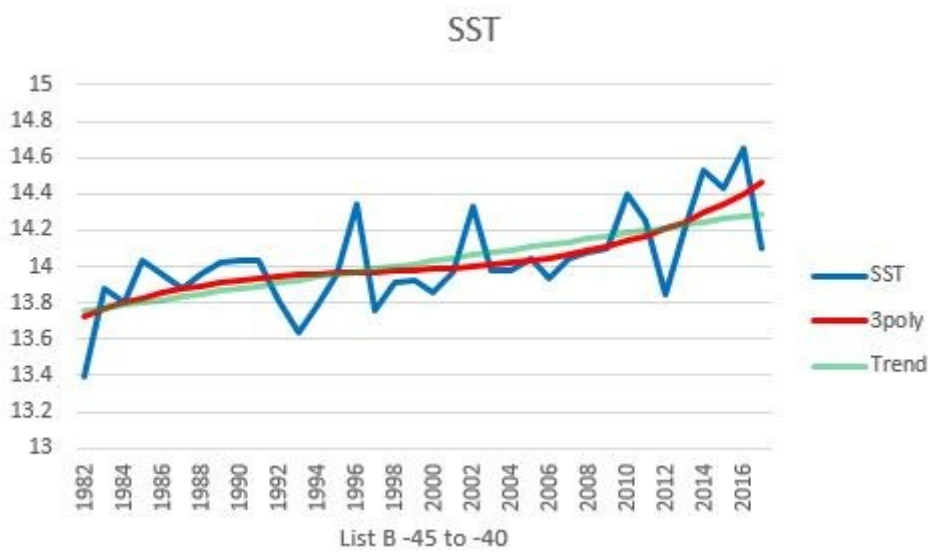
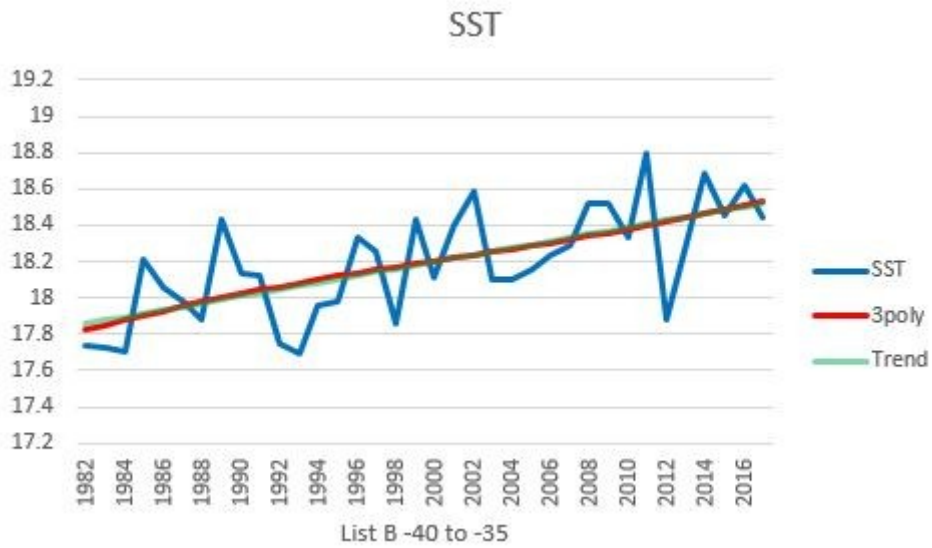
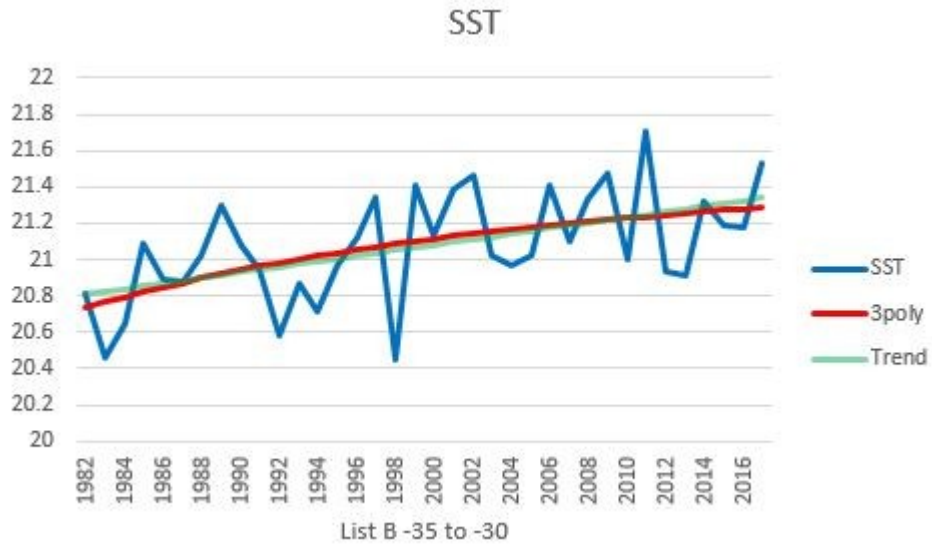
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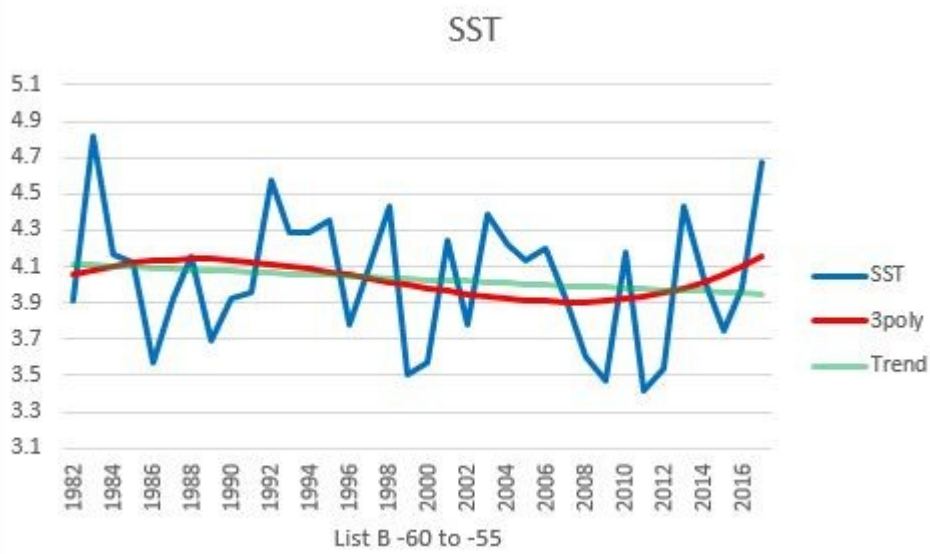
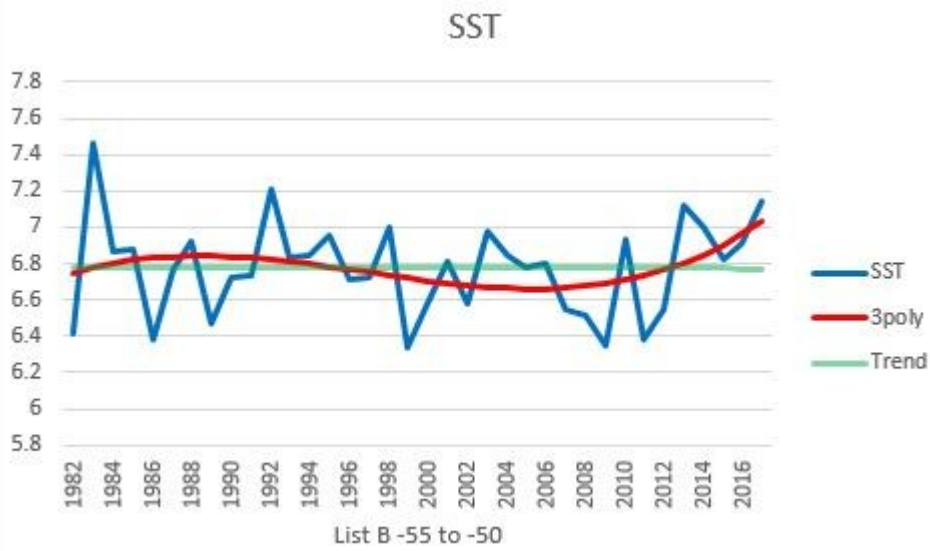
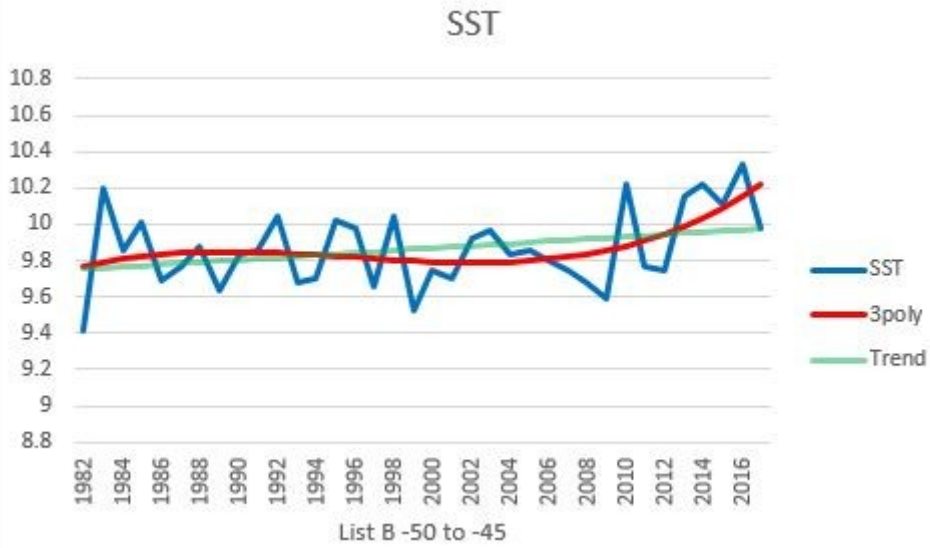


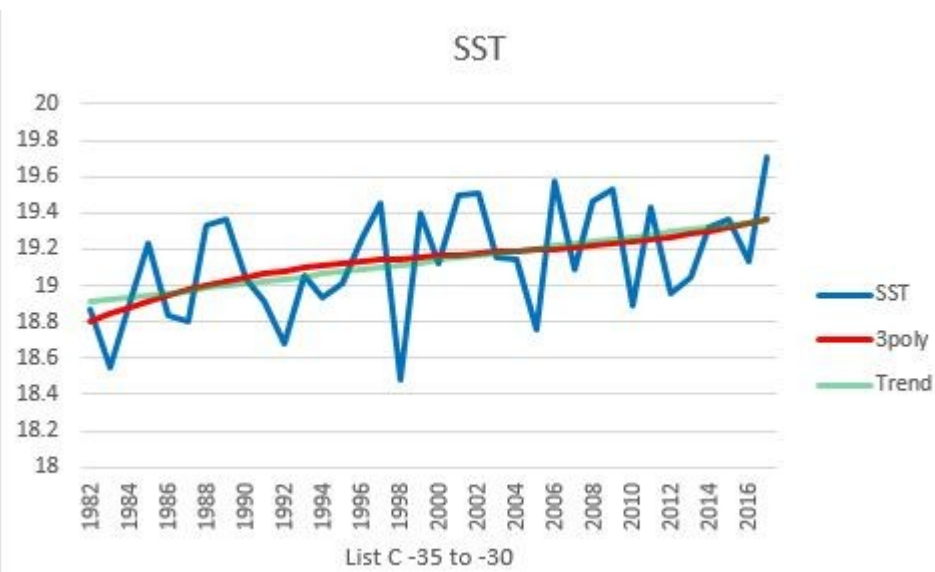
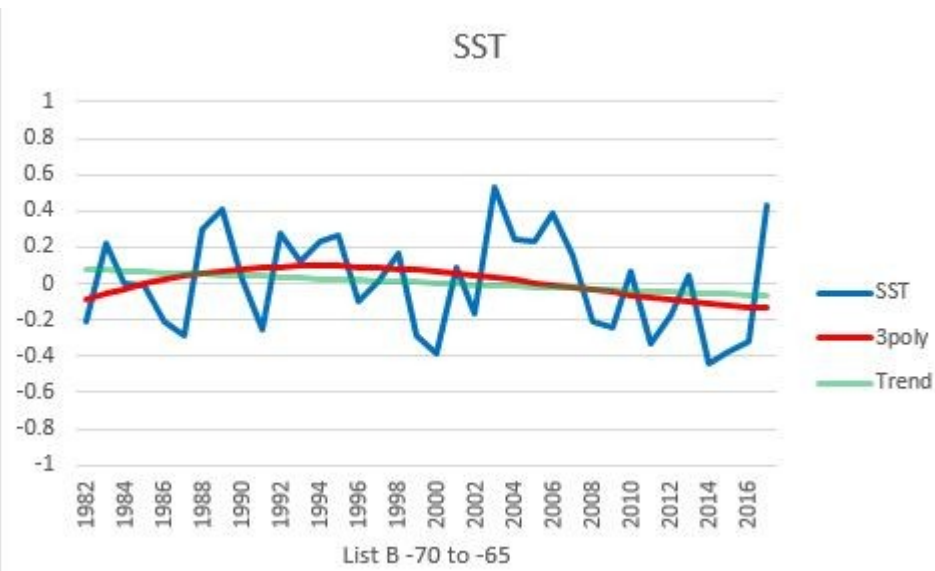
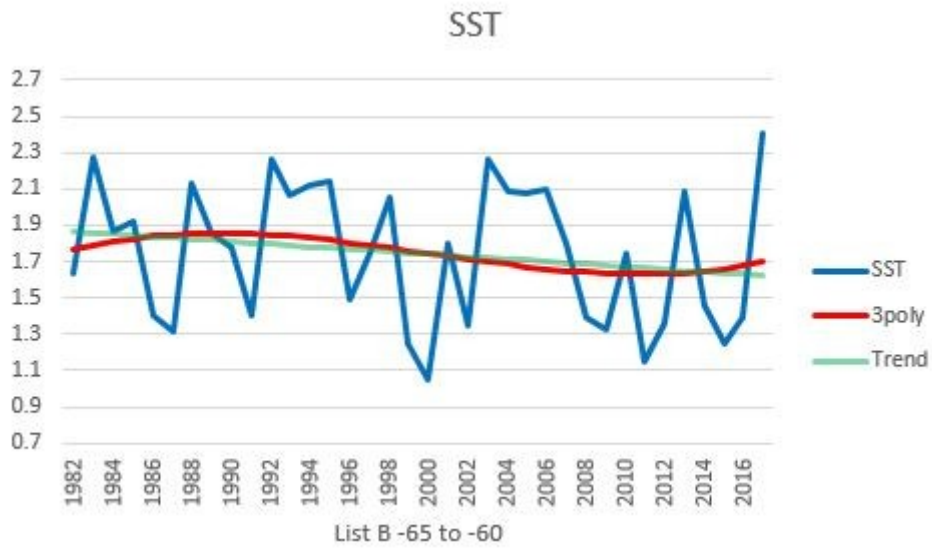
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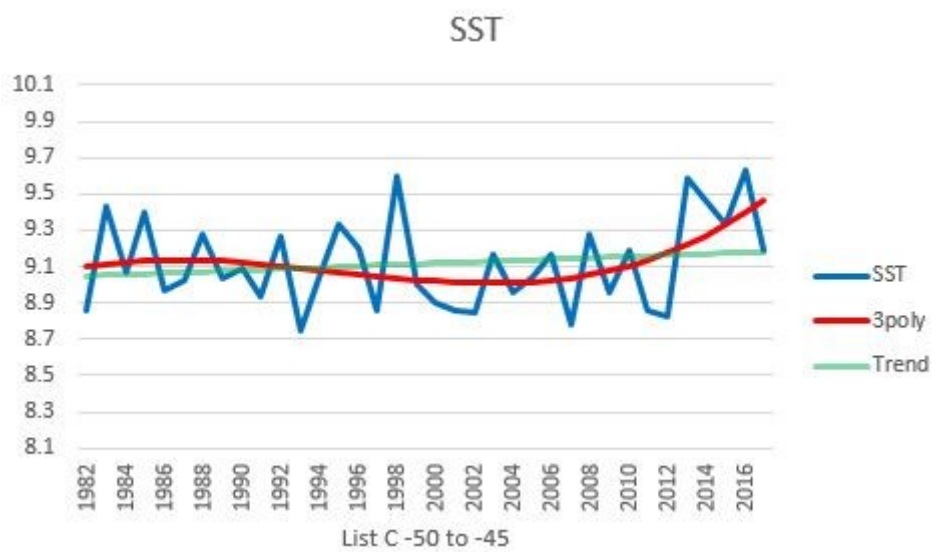
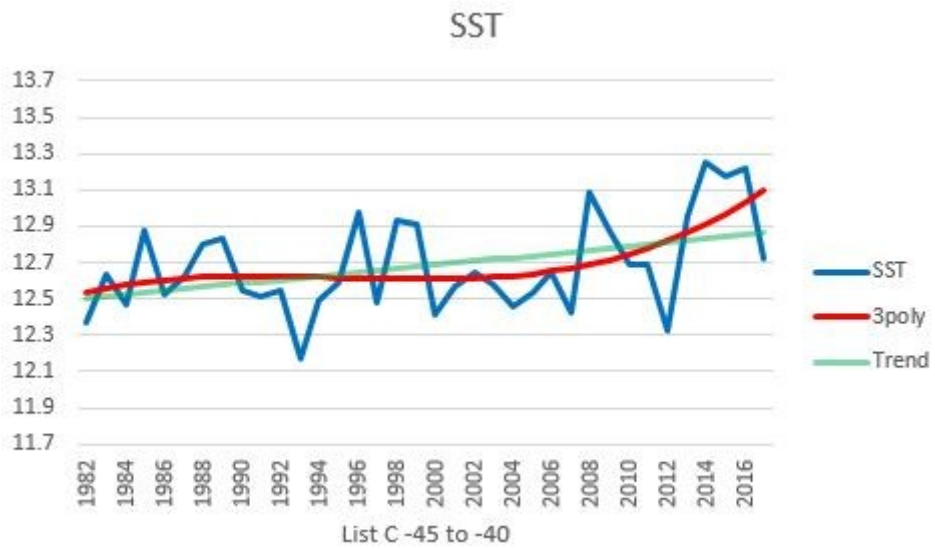
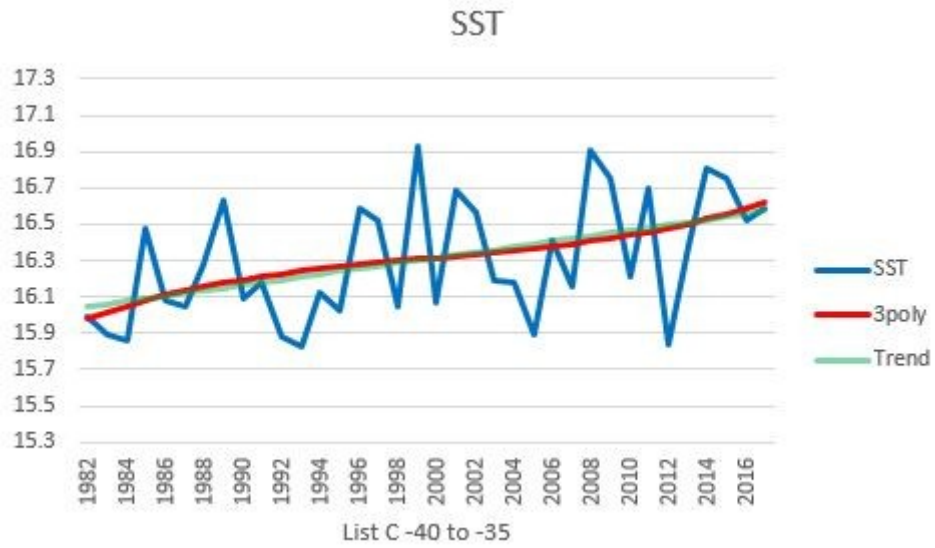




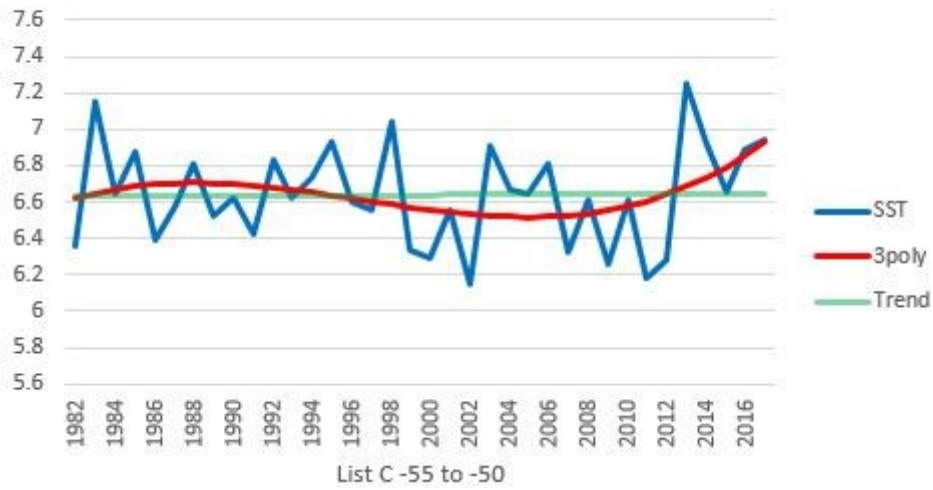




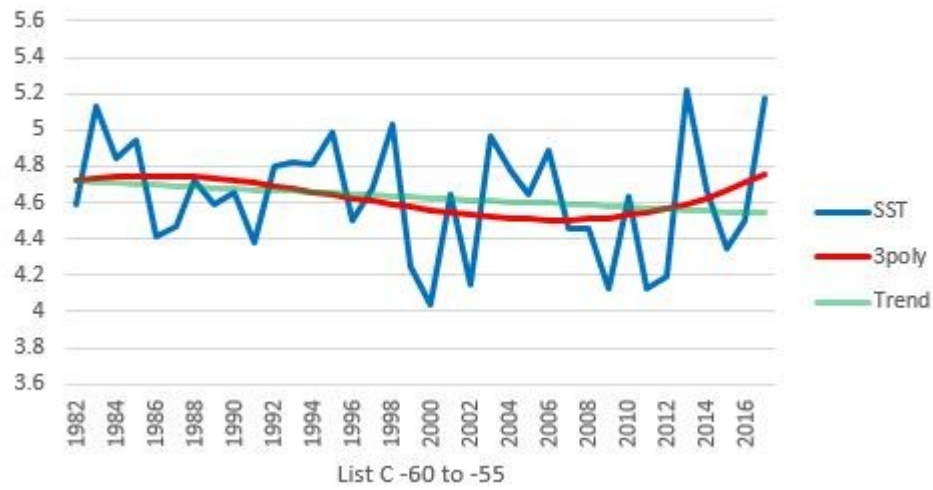




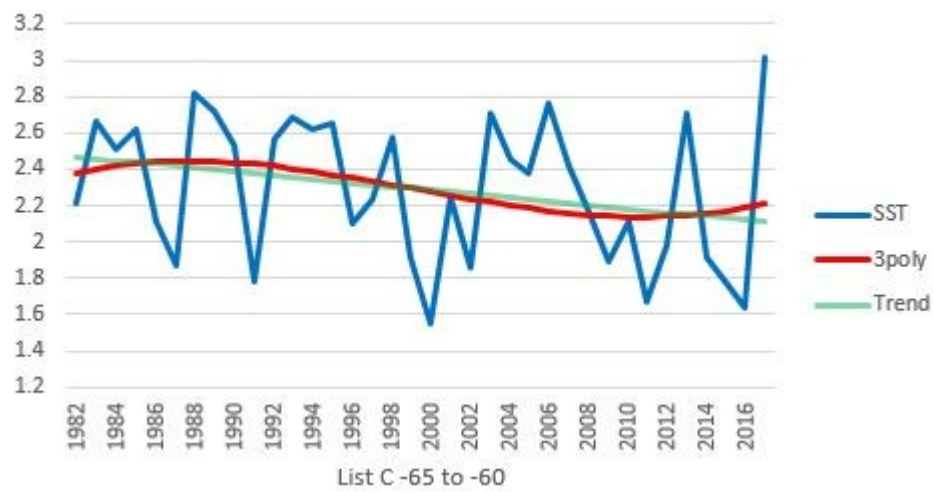
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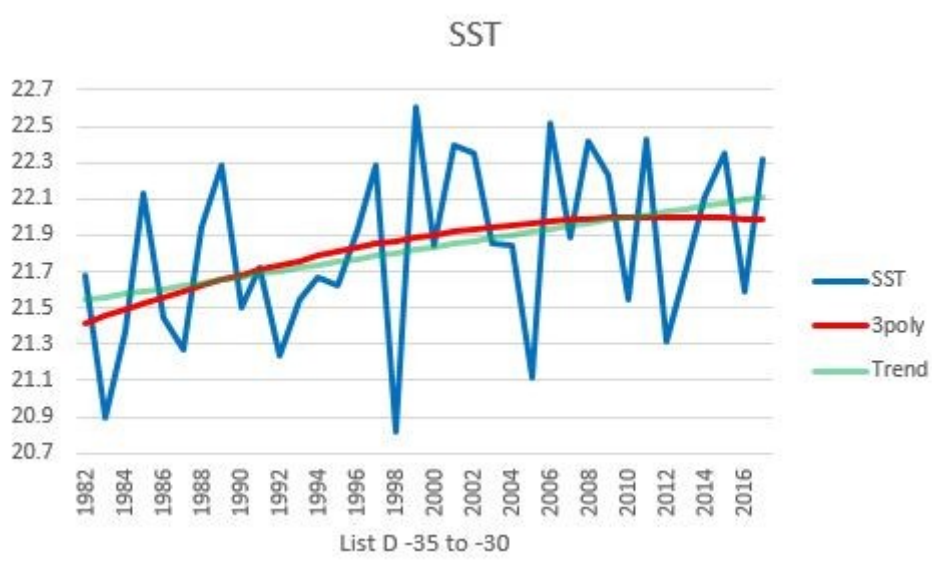
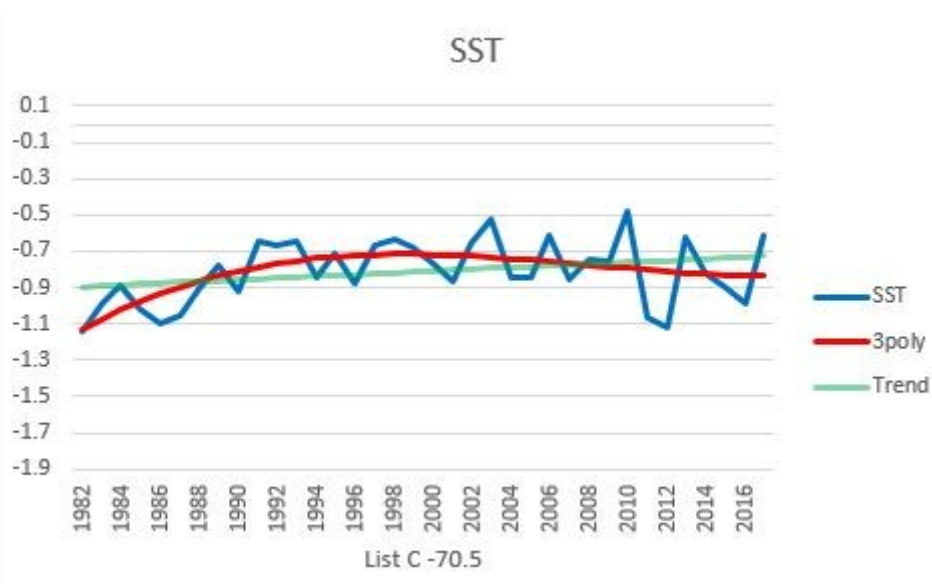
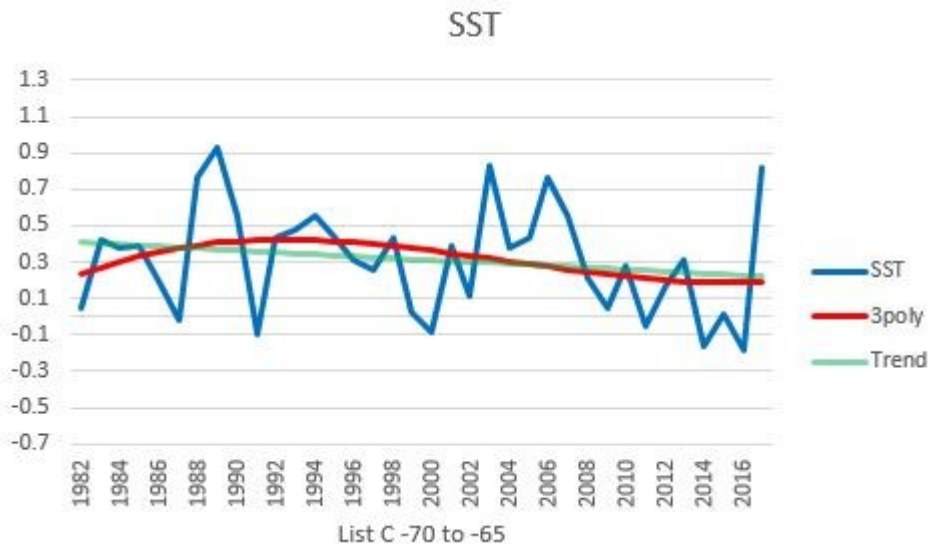


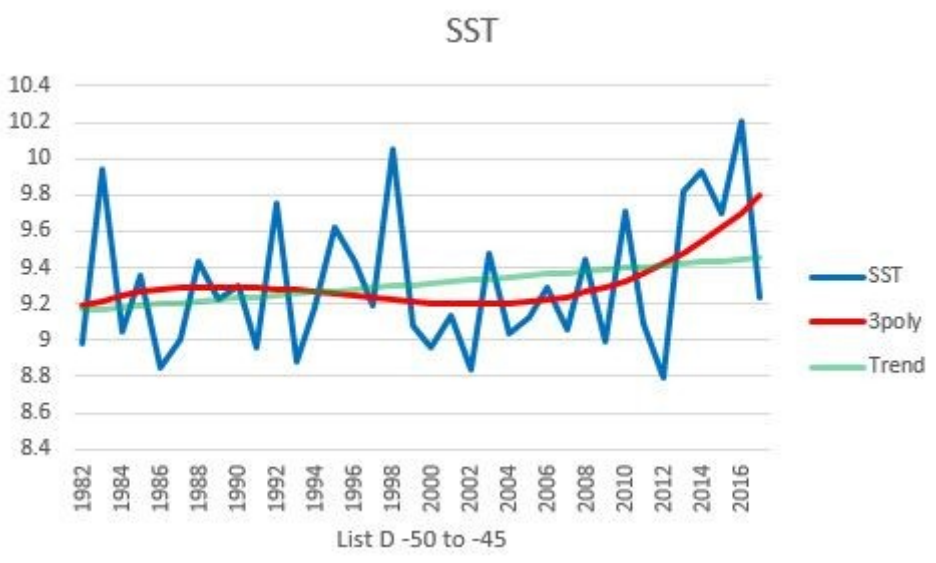
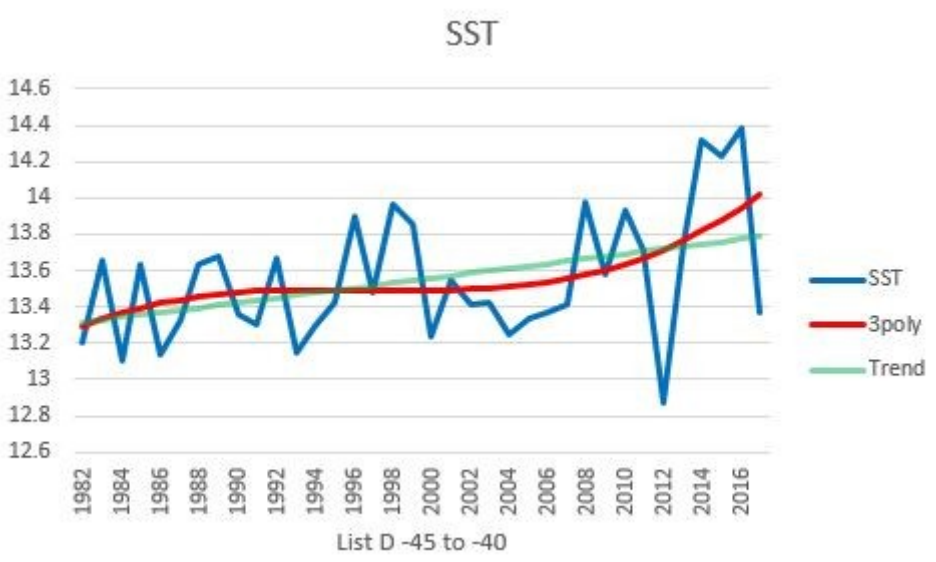
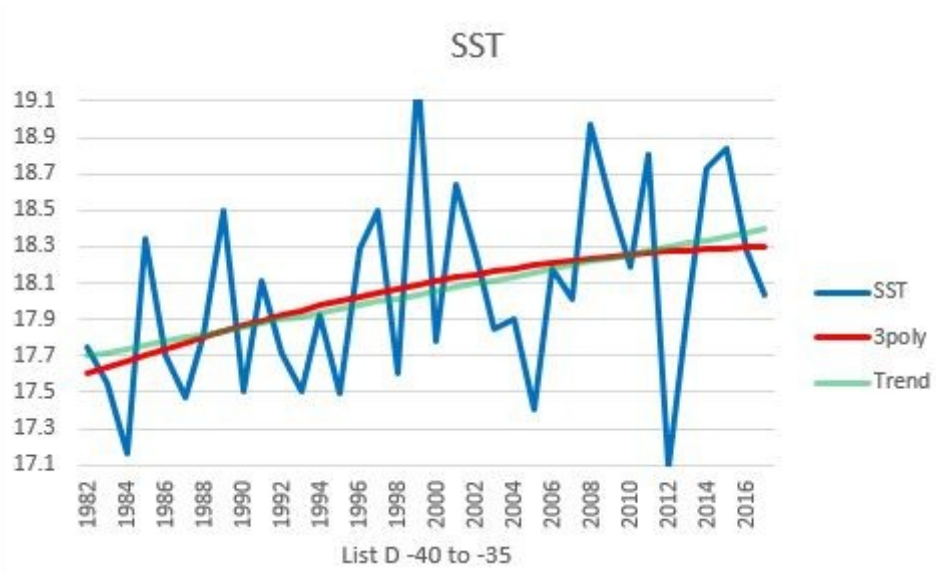
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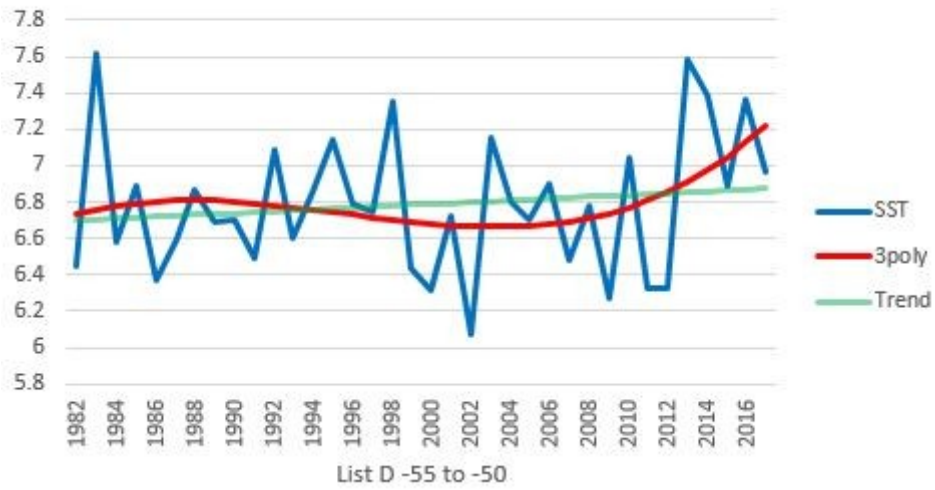
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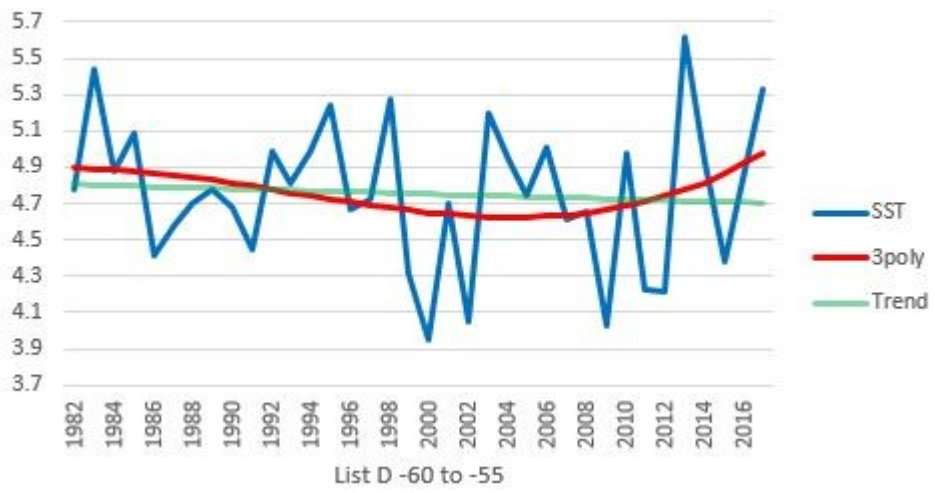




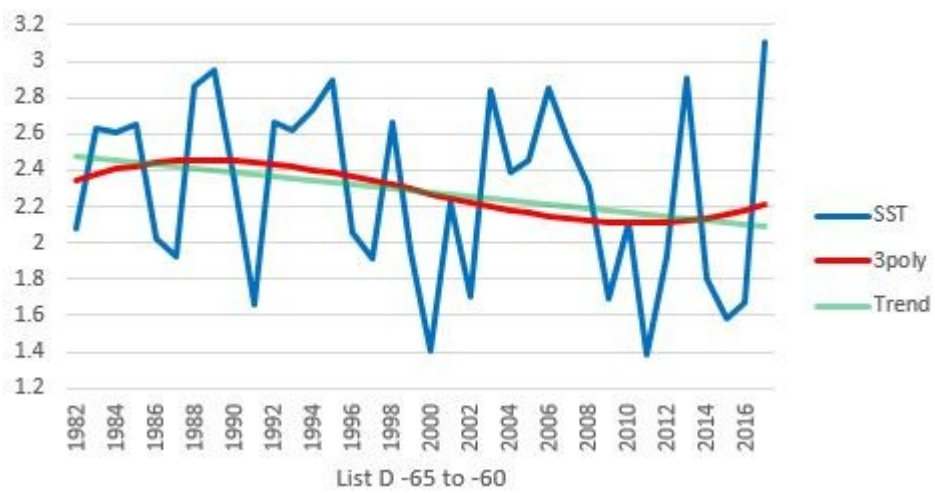
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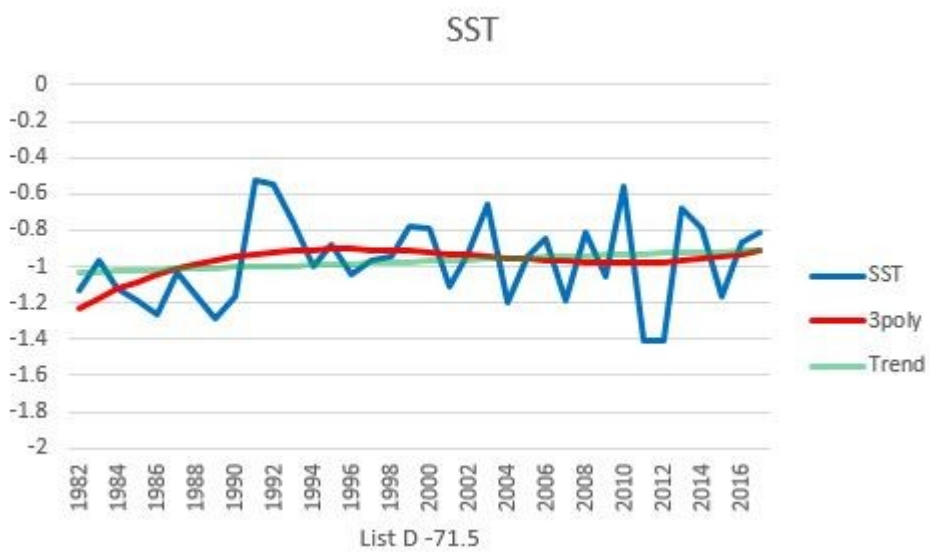
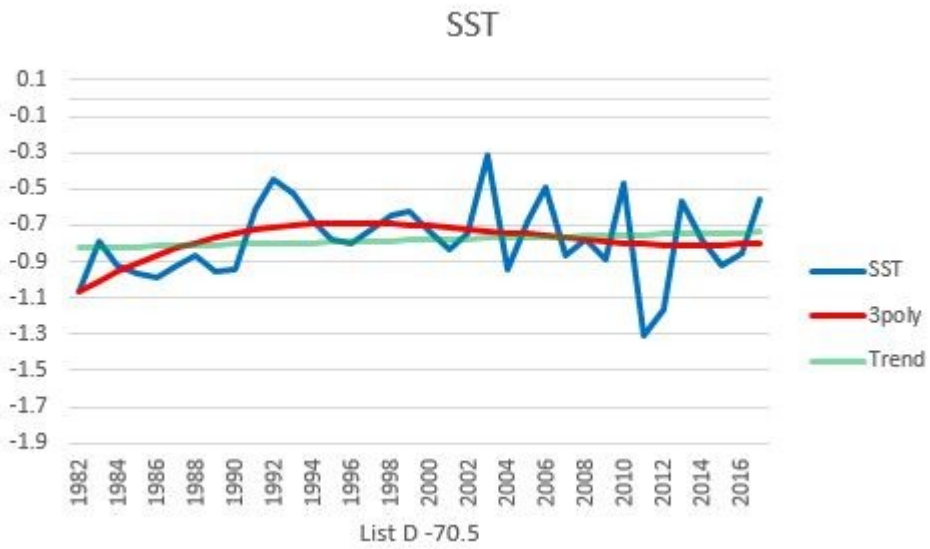
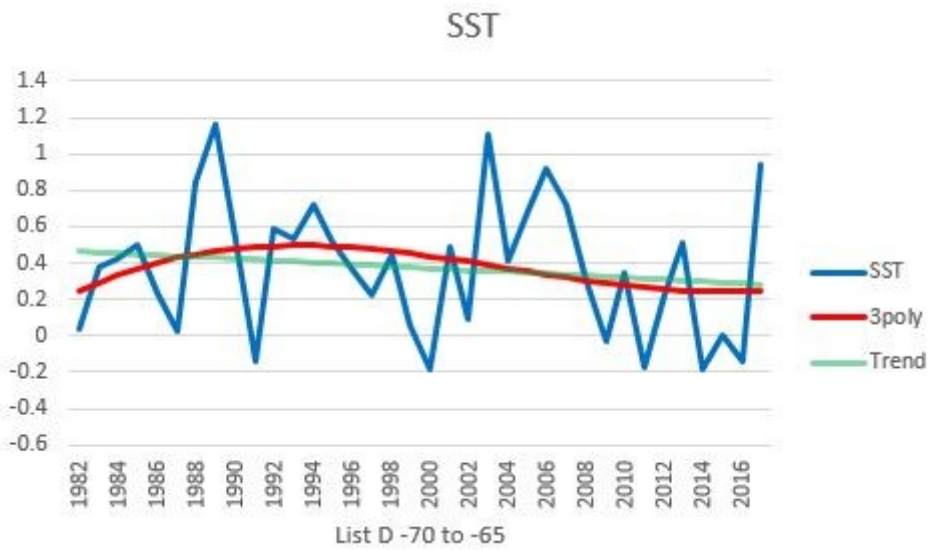


SST



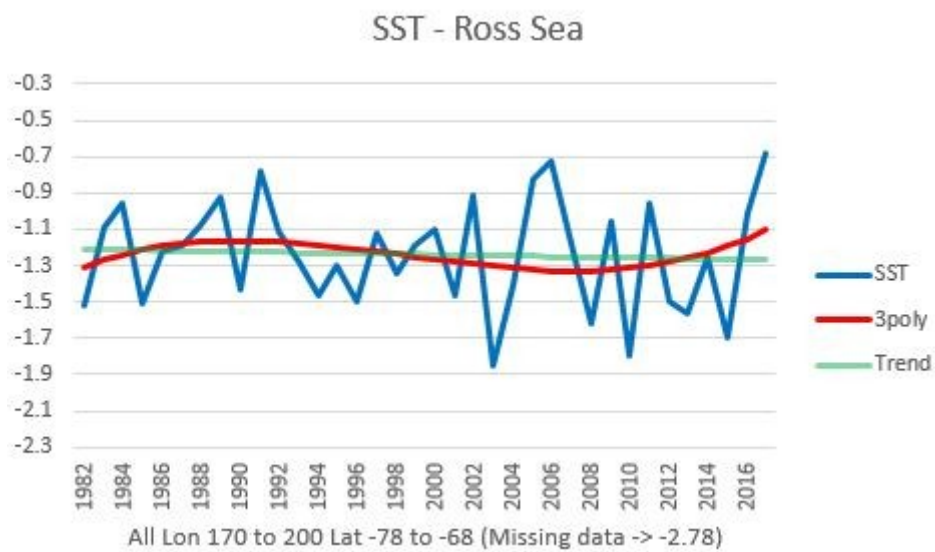
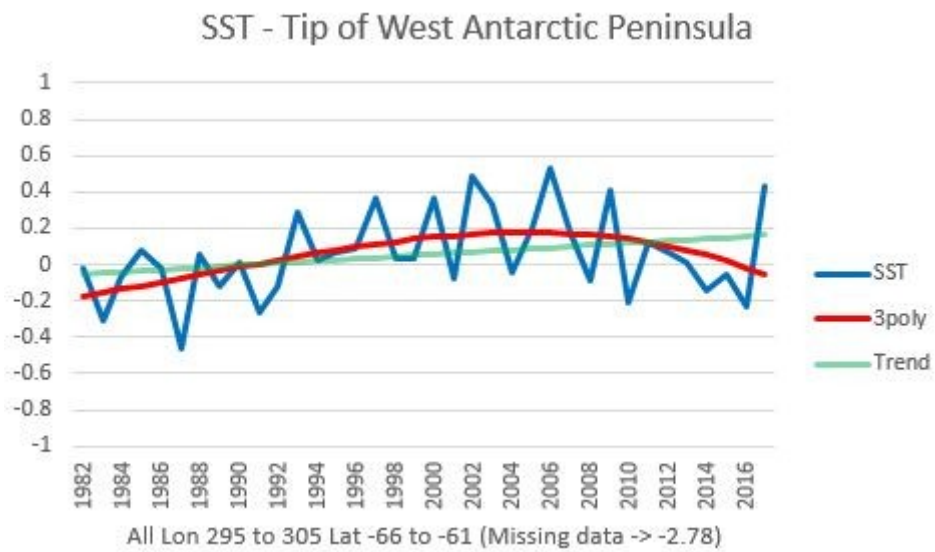
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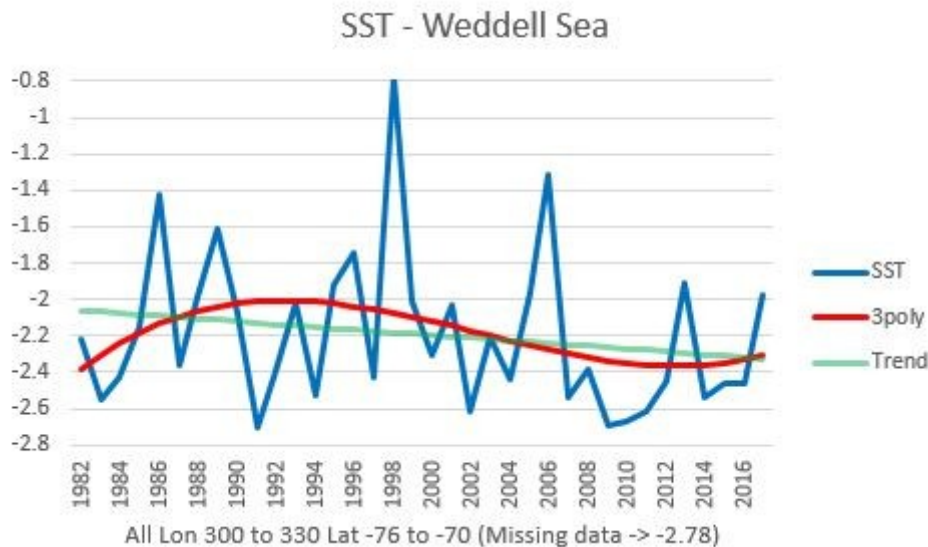




## 2.2 Specific Area Temperature Graphs

The graphs in this section are for specific areas, and are presented in the main paper. They are also presented here for completeness. Some have an arbitrary value replacing missing data, as explained in the main paper.





### 3. Land Temperatures

The main paper is concerned only with sea-ice feedback and sea surface temperatures. However, there was a reference to *short and sparse* land station records. Land station data was examined to see if it could in fact be useful. It was found to be sparse and incomplete, and unlikely to be able to add anything useful to the analysis. But, since the data was accessed, it is presented here for additional information.

Antarctic snow rarely melts, except at the warmer coastal regions (Das and Alley, 2005). Any snow feedback will therefore originate at or near the coast at similar latitudes to the sea-ice feedback, but possibly more so at the lower latitudes (the warmer coastal regions) and less so at the higher latitudes.

The graphs in this section are for individual Antarctic coastal stations, including islands up to latitude -50 (50S), with GISTEMP (2017) data from Dec 1981 to Oct 2017. The 3<sup>rd</sup>-order polynomial fit is omitted for stations with any missing data. The downloaded data is presented in file *GISTEMPCoastalStationsData*.

GISTEMP (2017) sources station data from other organisations, such as SCAR (Scientific Committee on Antarctic Research). This study uses temperatures averaged over the 5 summer months (Dec-Apr) for compatibility with the SST analyses. Only years with all 5 months' data are used. In this section, names of stations with 3 or more missing years are prefixed with an asterisk (\*).

Many stations have missing data. Presumably this is at least partly because taking readings in Antarctic conditions is difficult. So it could be questioned whether even the given data is reliable. Two curious features were noticed, which also may indicate that the data is unreliable:

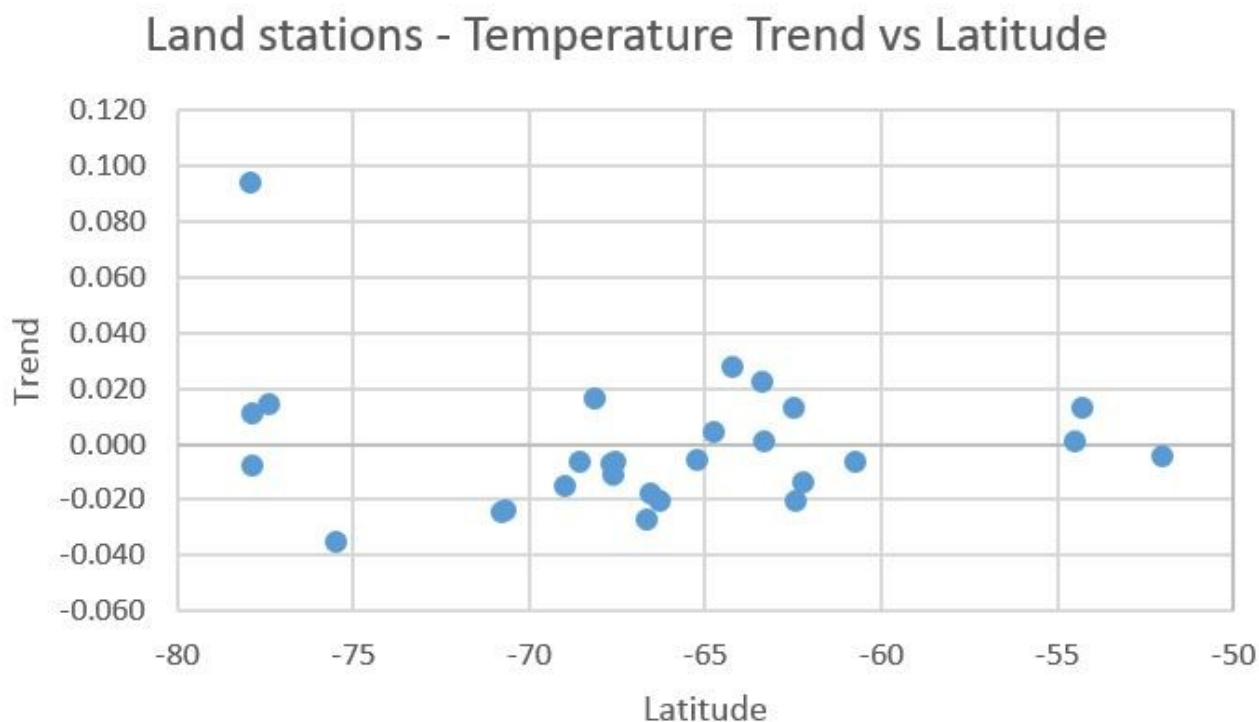
- \*Ferrell station has a temperature trend of 0.094 deg C/yr. This is significantly higher than all the other stations, whose trends are between -0.035 and 0.028 deg C/yr. \*Ferrell data is missing 12 of the 36 years, but its trend is clearly visible in its chart, below. There are two stations in the same area as \*Ferrell, and their trends are quite different: \*Mcmurdo (-0.008 deg C/yr) and \*Marble Point (0.015 deg C/yr), although \*Mcmurdo is missing too much data (25 of 36 years) to be meaningful.
- Casey station has “unadjusted” data from Mar 1957. Casey is an Australian station (SCAR, 2002) that opened in Jan 1989 (BOM, 2017). A different but nearby station, Casey (The



Tunnel), was open from Feb 1969 to Jan 1990. BOM (2017) lists no “Casey” station between Mar 1957 and Feb 1969. It is difficult to see how unadjusted data can exist for Casey from Mar 1957 onwards, or how it can be usable for determining a temperature trend.

Note: The station given as “Syowa” in GISTEMP (2017) is given as “Showa” in SCAR (2002).

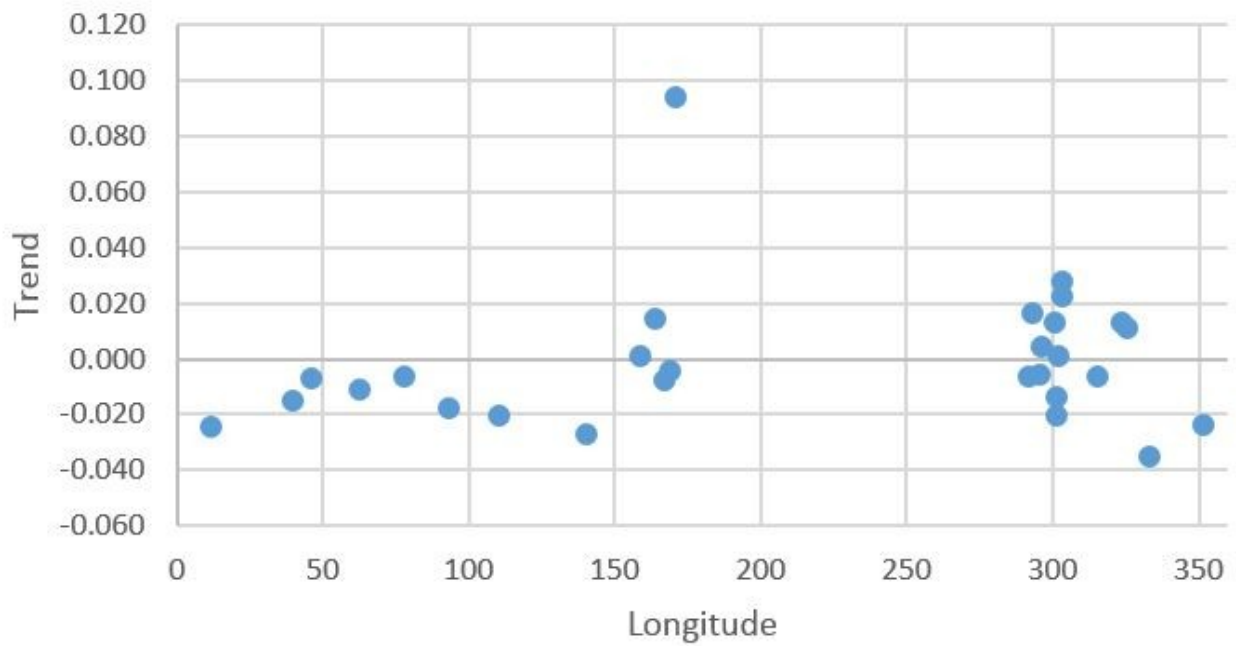
The stations, in longitude sequence, are as follows (see below for map):



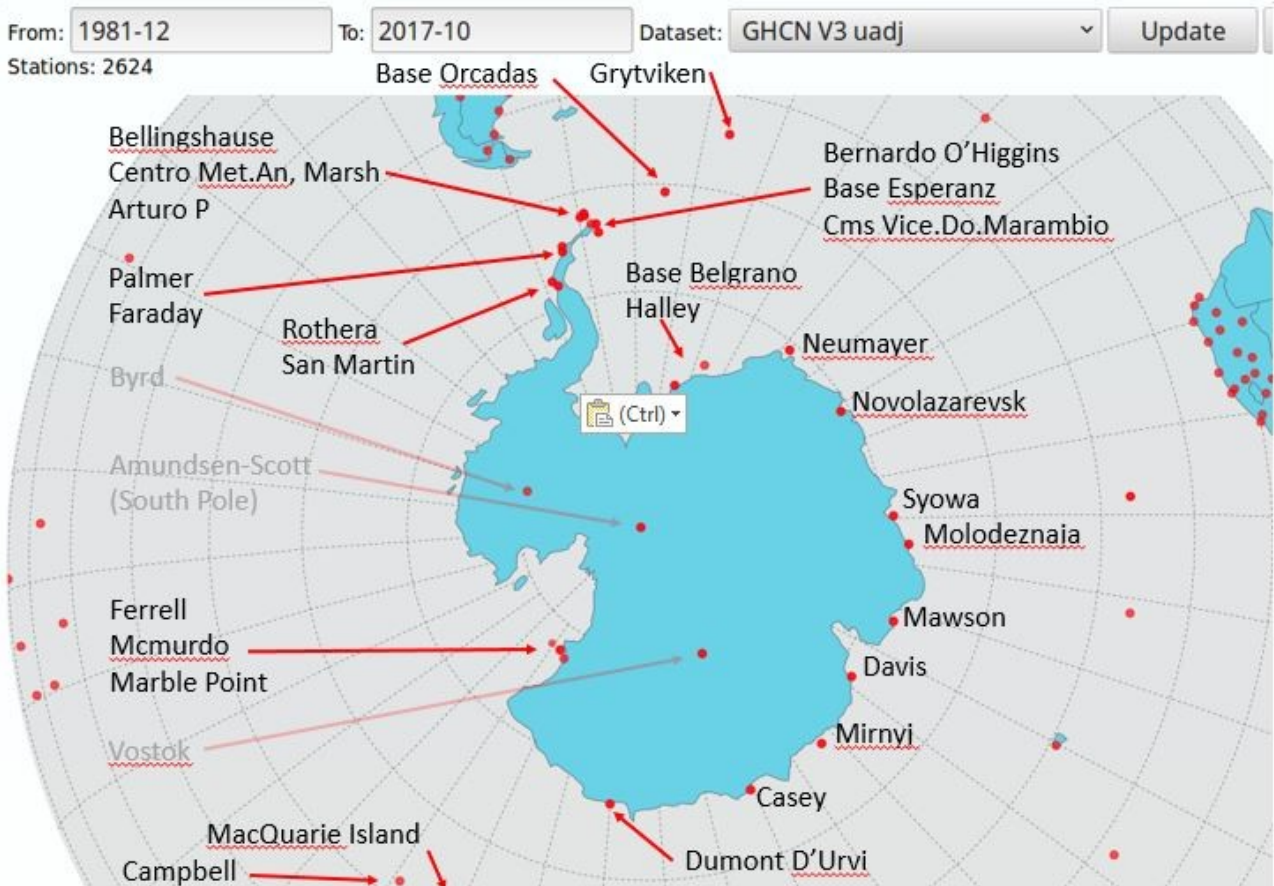
Scatter plot of linear temperature trend against latitude. Apart from one station (\*Ferrell, as discussed earlier), there is little or no sign of the projected enhanced warming.

Scatter plot of linear temperature trend against longitude. The coast from longitude 150 to 330 looks interesting, but (a) most of it has no data, and (b) the average trend is only 0.0085 deg C/yr, of which most is contributed by one station (\*Ferrell).

## Land stations - Temperature Trend vs Longitude

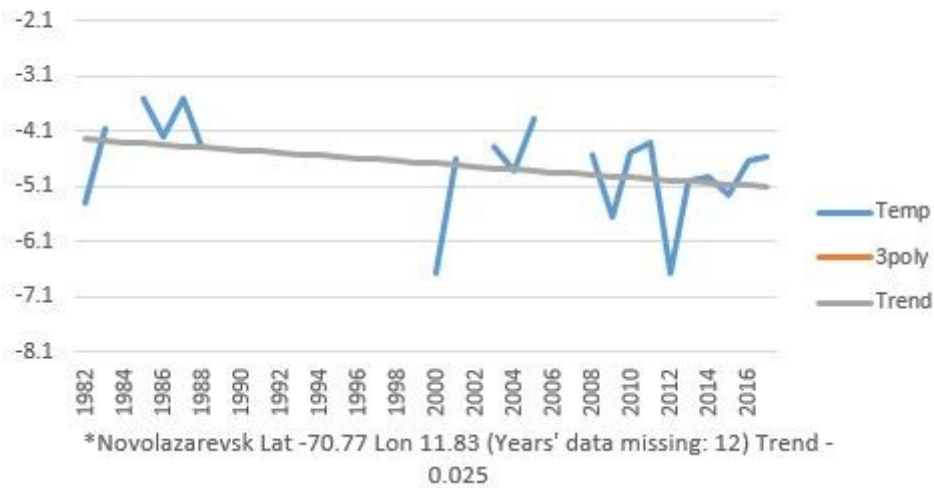


Longitudes 150 to 330 are about where the volcano range is (see main paper, **6.2 Volcanoes**).

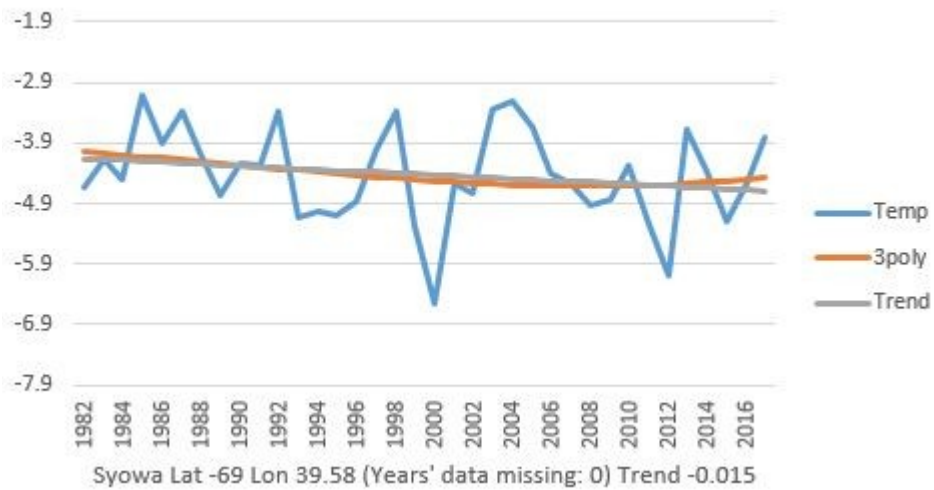


Map of GISTEMP stations – from GISTEMP (2017) with station names added.

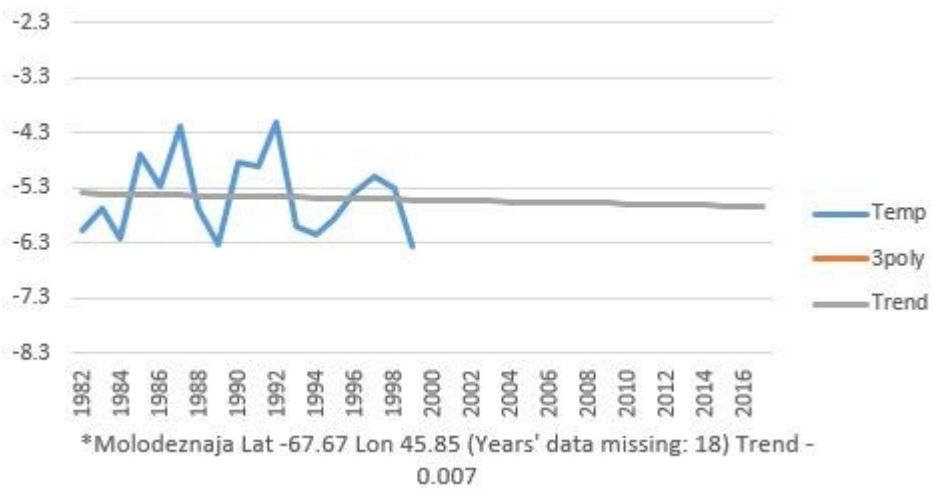
### Land Station Temperature



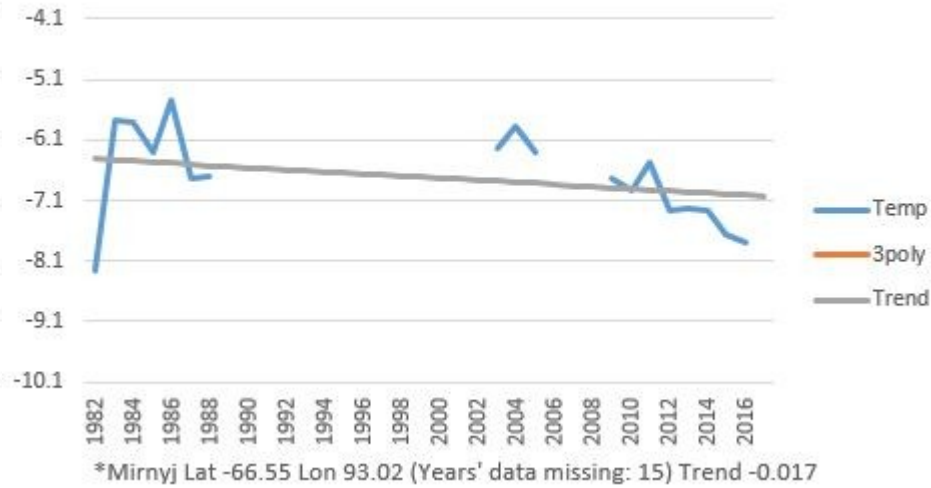
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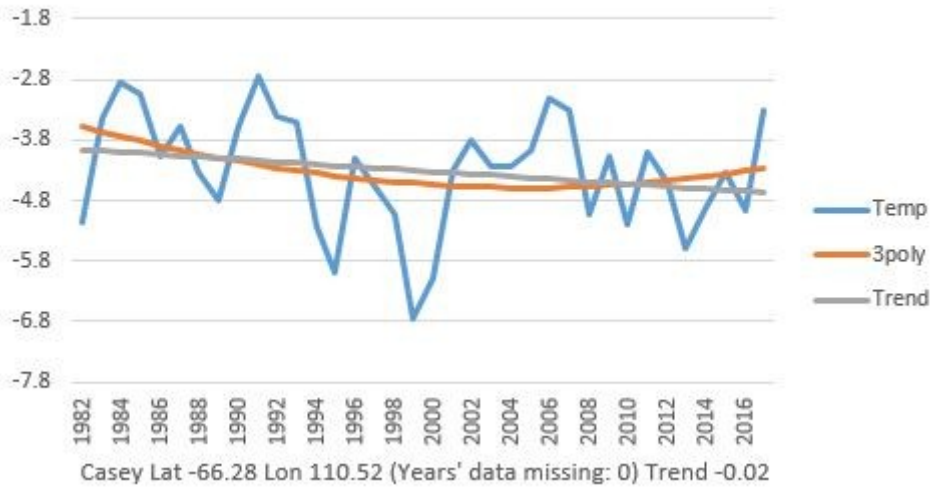
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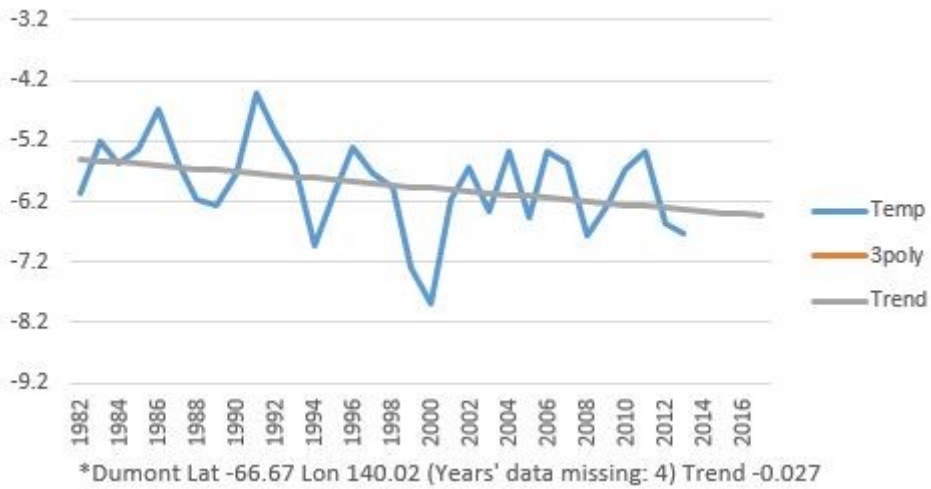
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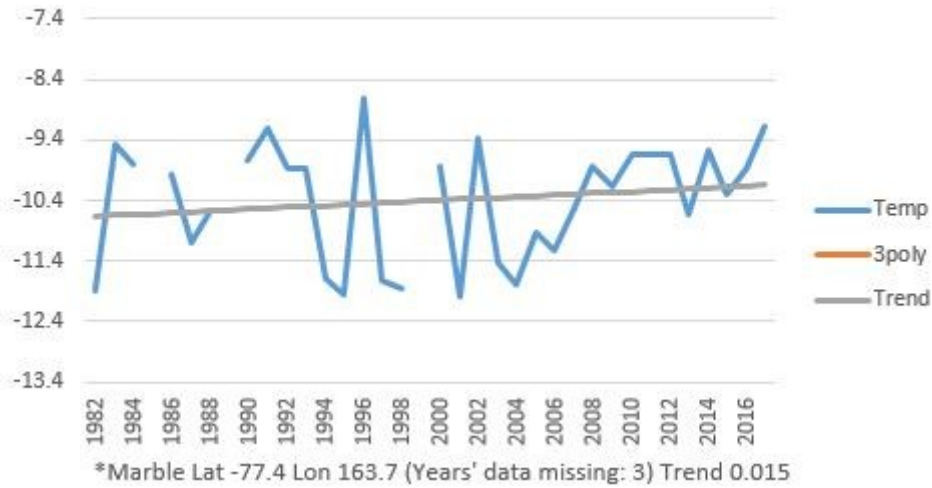
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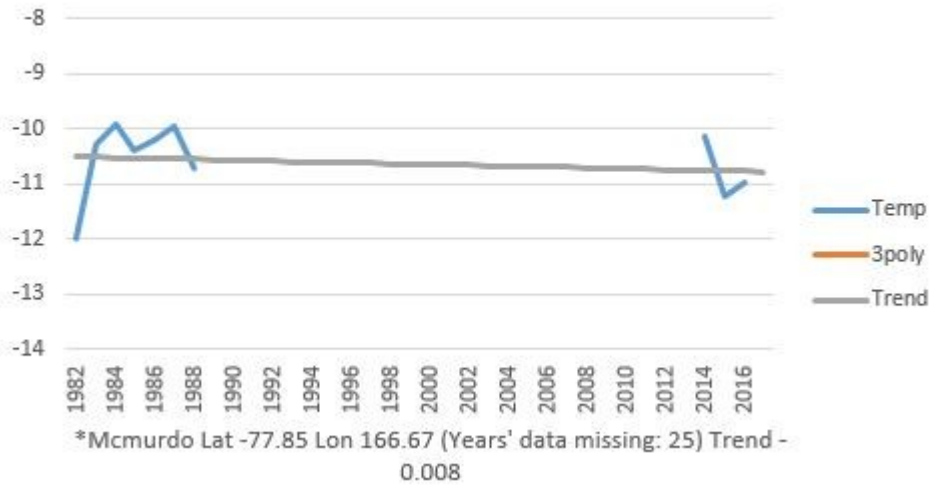
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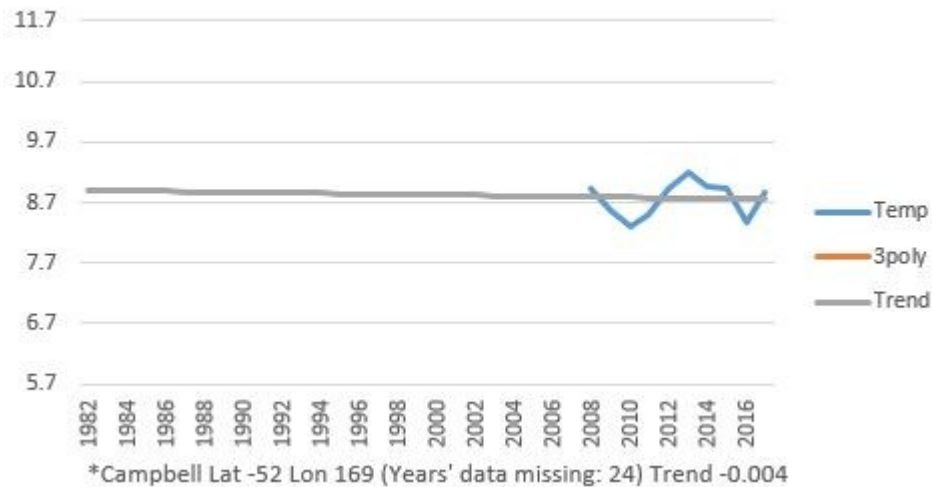
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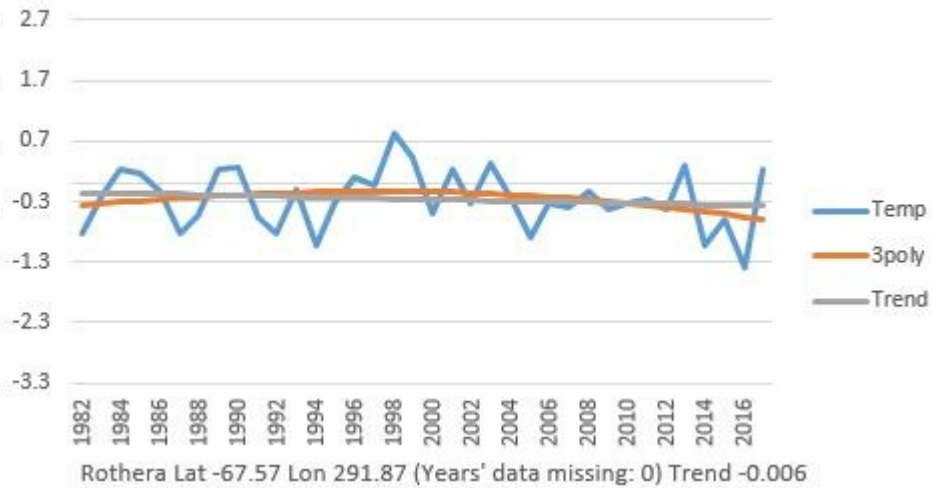
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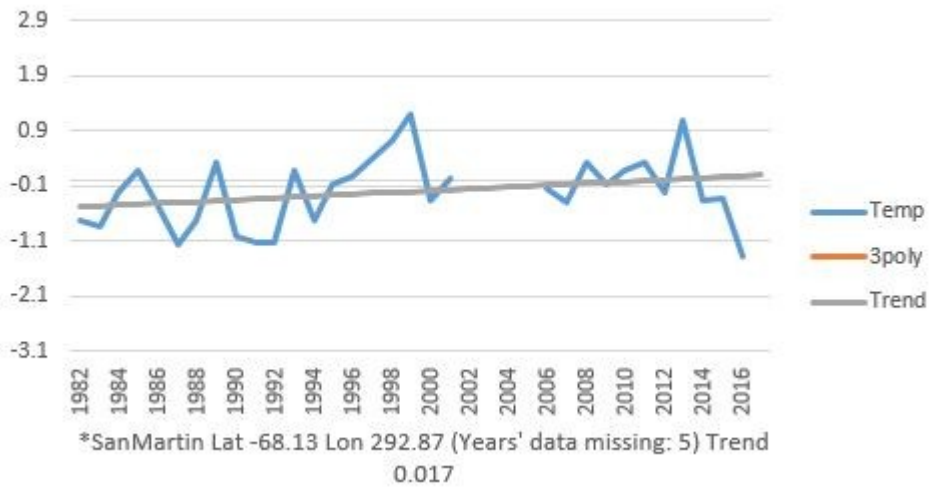
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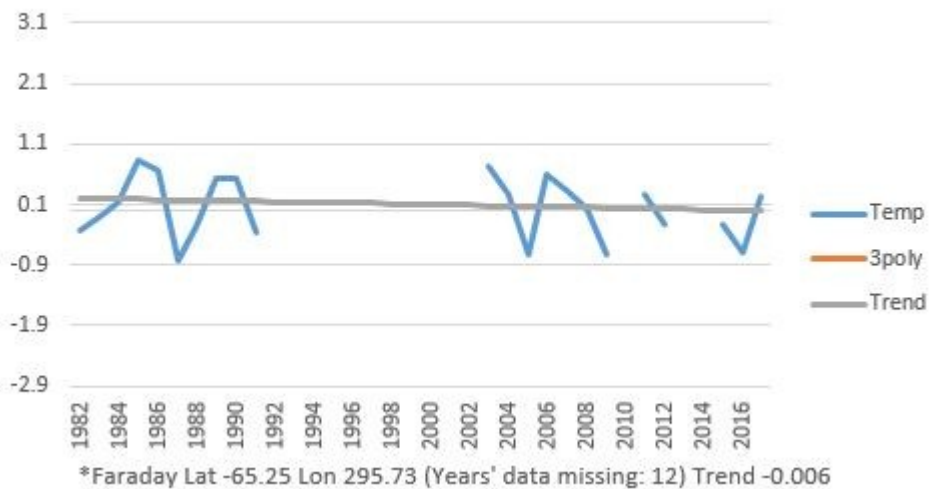
### Land Station Temperature



### Land Station Temperature



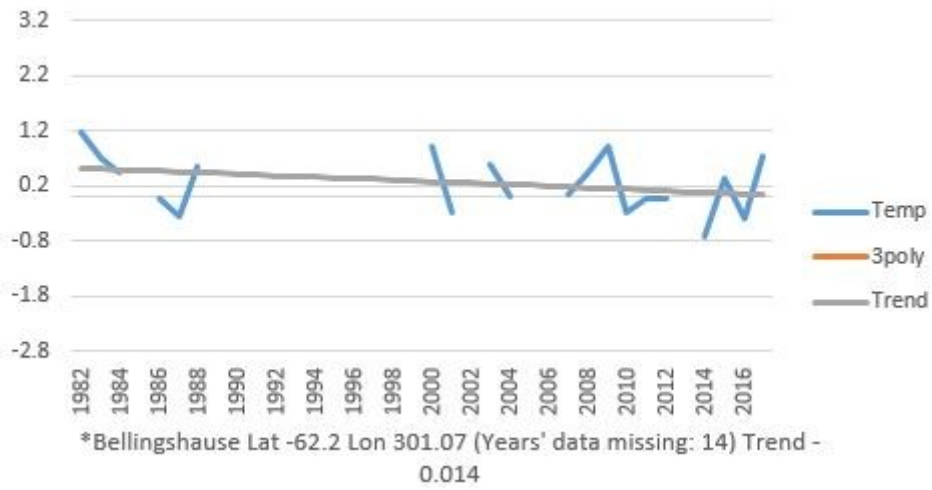
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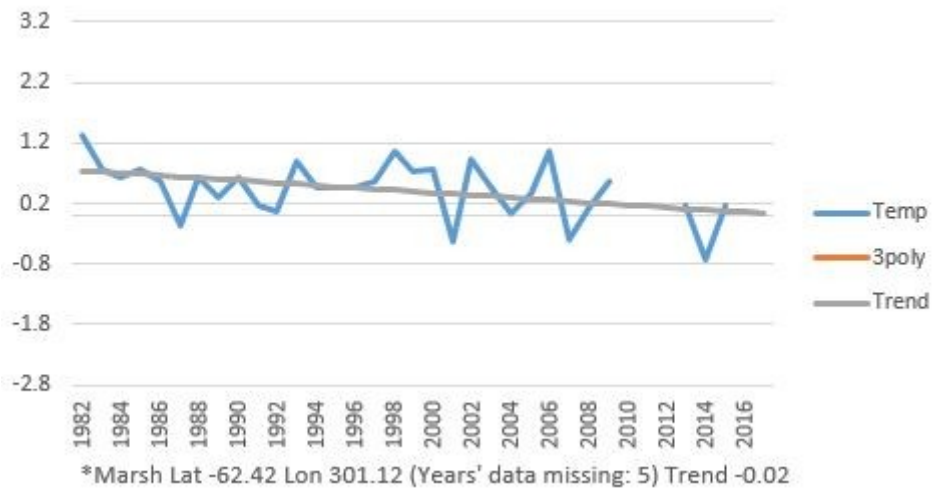
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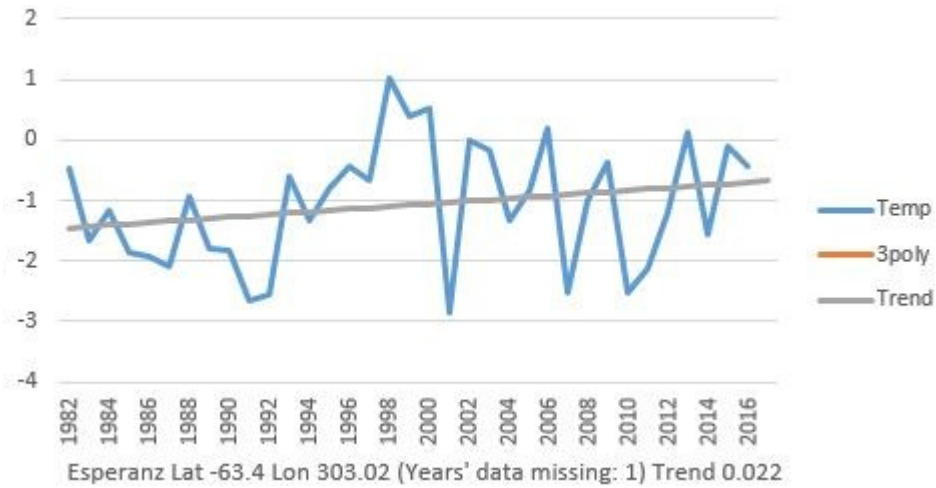
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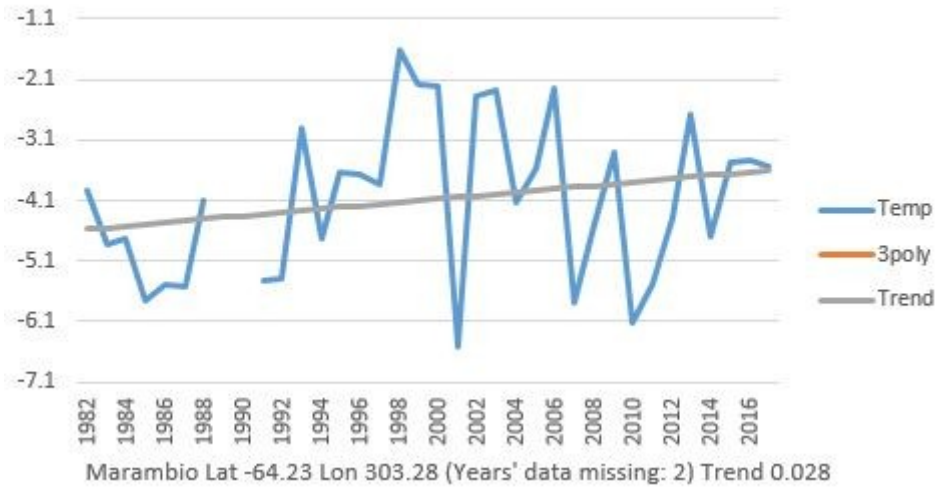
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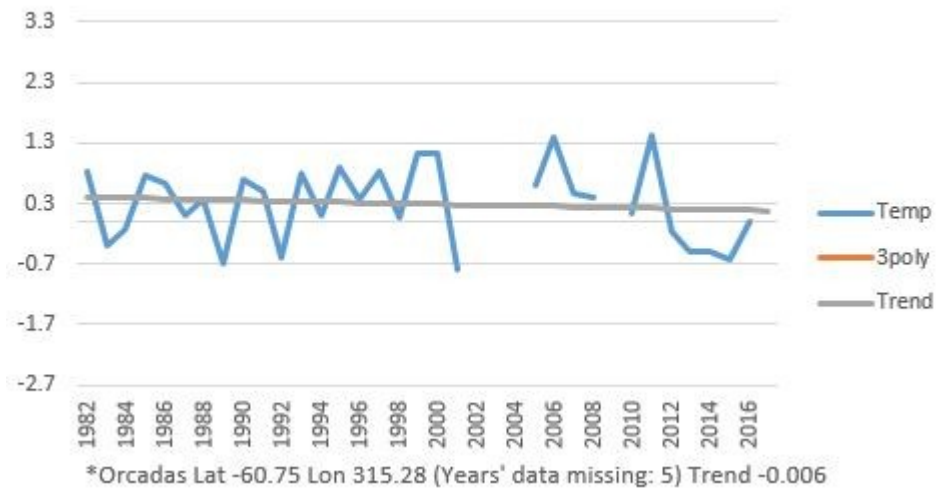
### Land Station Temperature



### Land Station Temperature

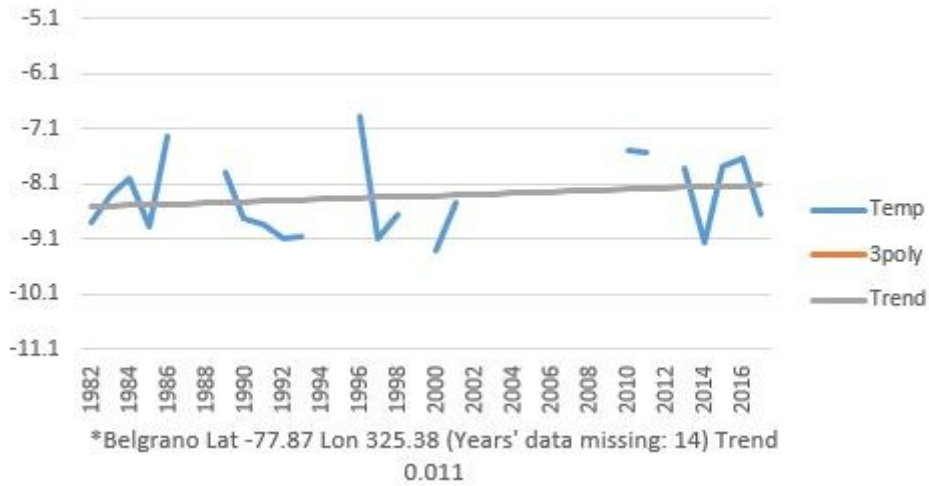


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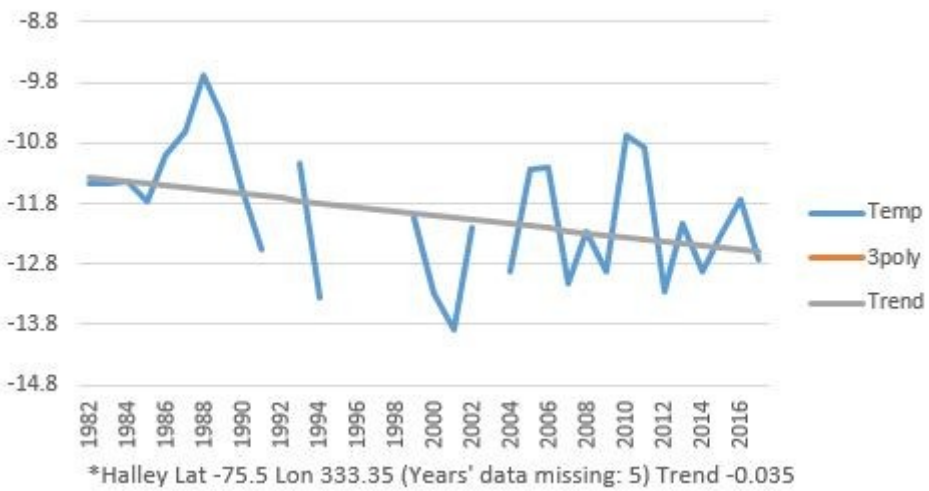




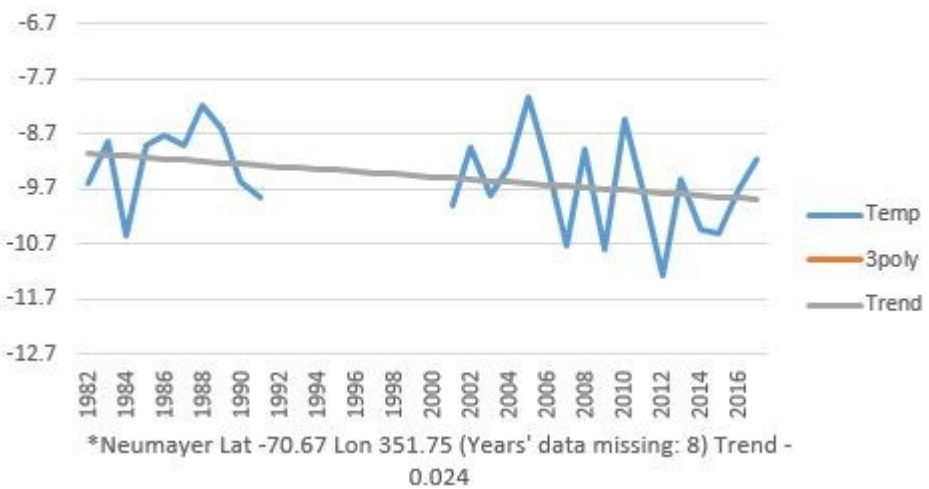
### Land Station Temperature



### Land Station Temperature



### Land Station Temperature



## References

BOM (2017). Climate Data Online, *Australian Bureau of Meteorology*. Accessed Dec 2017 at <http://www.bom.gov.au/climate/data/index.shtml>

Das SB, Alley RB (2005). Characterization and formation of melt layers in polar snow: observations and experiments from West Antarctica, *Journal of Glaciology*, Vol. 51, No. 173, 2005, doi:10.3189/172756505781829395.

GISTEMP (2017) GISS Surface Temperature Analysis (GISTEMP). *NASA Goddard Institute for Space Studies*. Accessed Jan-Feb 2018 at <https://data.giss.nasa.gov/gistemp/>. See Hansen (2010) for the most recent scholarly publication about the data.

Google Earth Pro (2018). Google Earth Pro software, from Google, Inc. Imagery dated Dec 2015. Available at <https://www.google.com/earth/download/ge/>

Hansen J et al (2010). Global surface temperature change, *Reviews of Geophysics*, 48, RG4004, doi:10.1029/2010RG000345.

SCAR (2002). Map of Antarctic Base Stations. Accessed Feb 2018 at [https://www.geoscience.scar.org/stations/stn\\_map02.htm](https://www.geoscience.scar.org/stations/stn_map02.htm)