

Antarctic Peninsula Climate Variability:

Observations, Models, and Plans for IPY Research



Climate tendencies in the
South Shetlands: was 1998
a climate divider ?

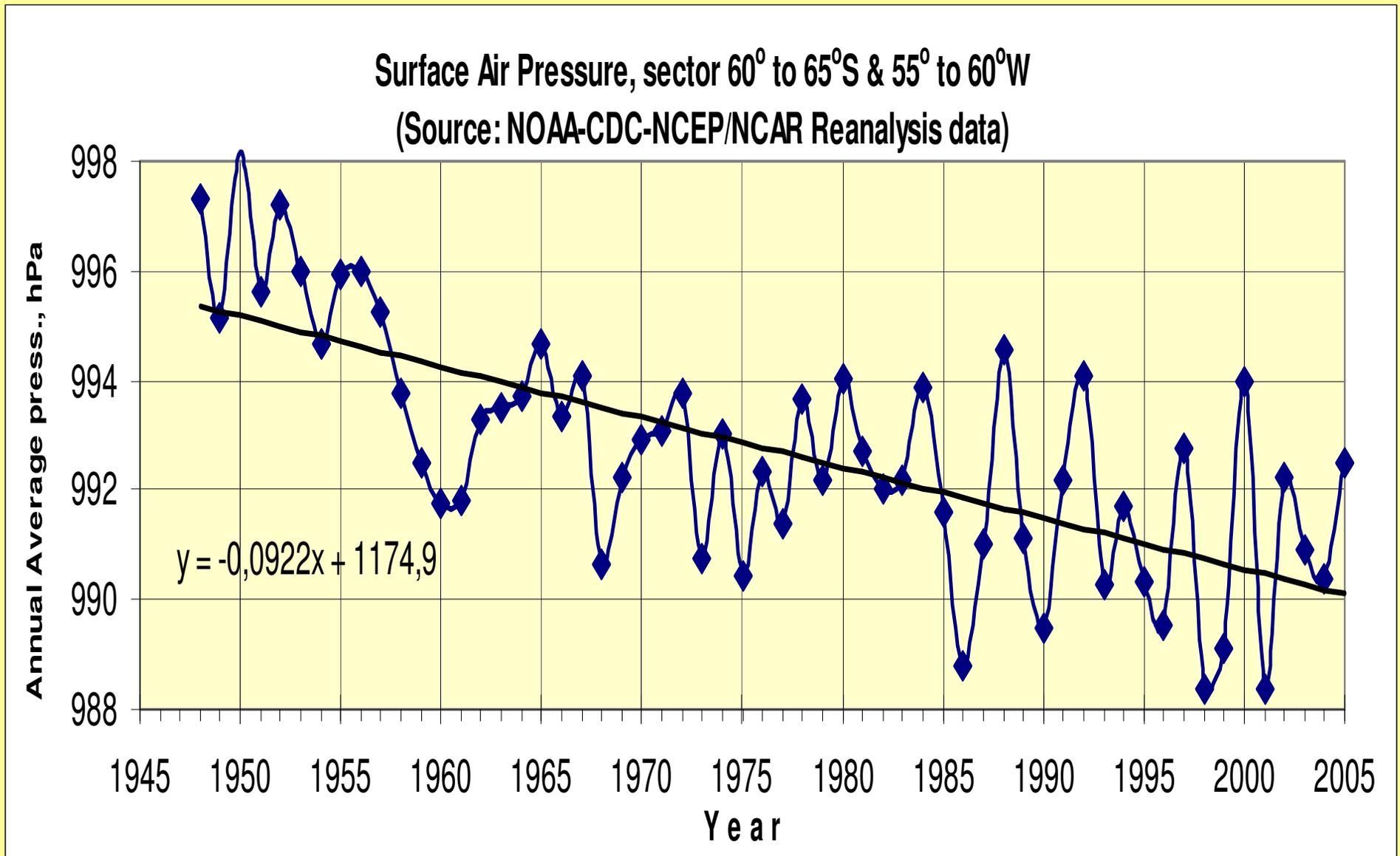
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CPTEC - INPE - Brazil

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University of Colorado • Boulder, CO, USA
http://insidc.org/events/IPY_APCV/

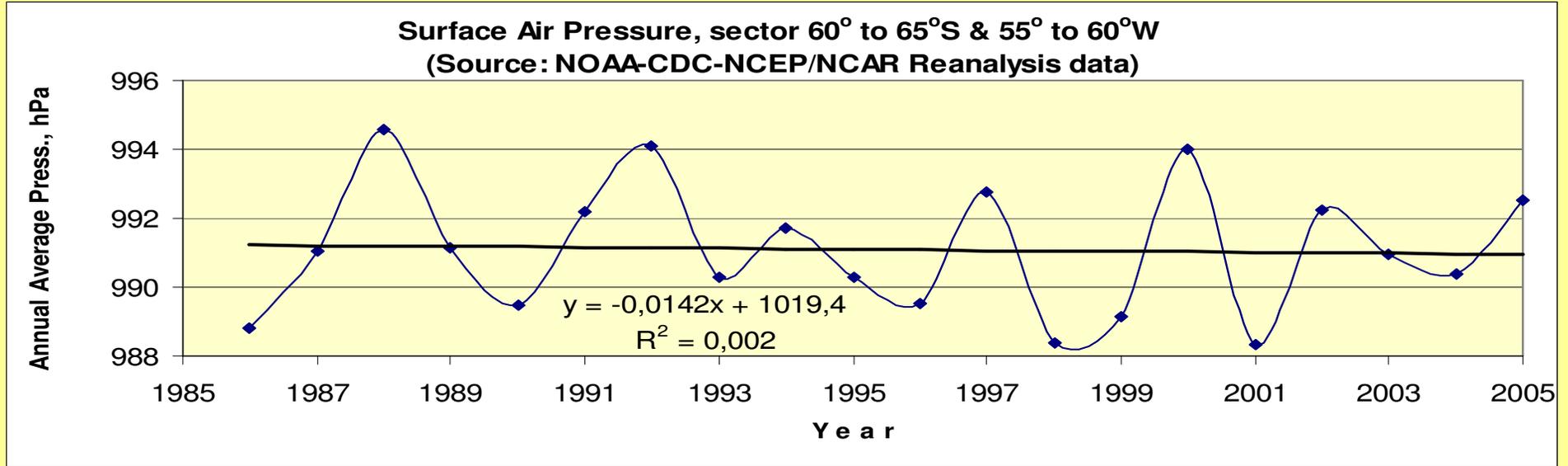
A b s t r a c t

Temporal series of meteorological data for the South Shetland Islands in widely distributed data basis show air temperature increase and pressure drop at surface level during the last decades. These patterns are particularly clear in reanalysis data that start in 1948, and a large number of papers is found describing and interpreting these tendencies, and using them to support future scenarios and to correlate them with assorted environmental variables. However, **a closer look at more recent station records in the region present a puzzling contradiction to the long term series and reanalysis tendencies.** Surface pressure raised more than 2 hPa in the last 10 years and appears to be currently at a maximum; since **1998-1999, therefore for seven years, air temperature declined about 1 °C.** Surface winds in the last years are also decreasing, as a possible indication of a change of weather pattern in the region. **This paper presents the evidence to the contradictions in the data sets** and points to relevant effects in generating wrong analyses of Antarctic climate. For instance, an incorrect reference of surface pressure results in wrong temperatures at standard pressure levels in the atmosphere leading to non existing temporal variations

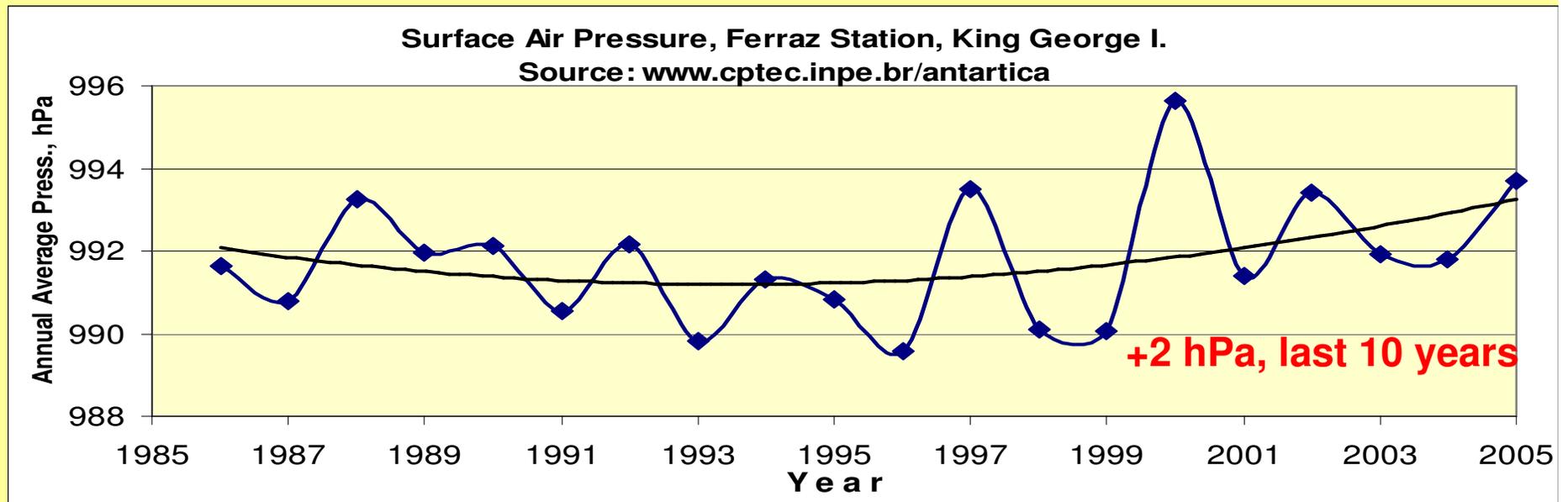
The general picture: surface **air pressure is falling** at about 5 hPa/50 years in the north of the Antarctic Peninsula



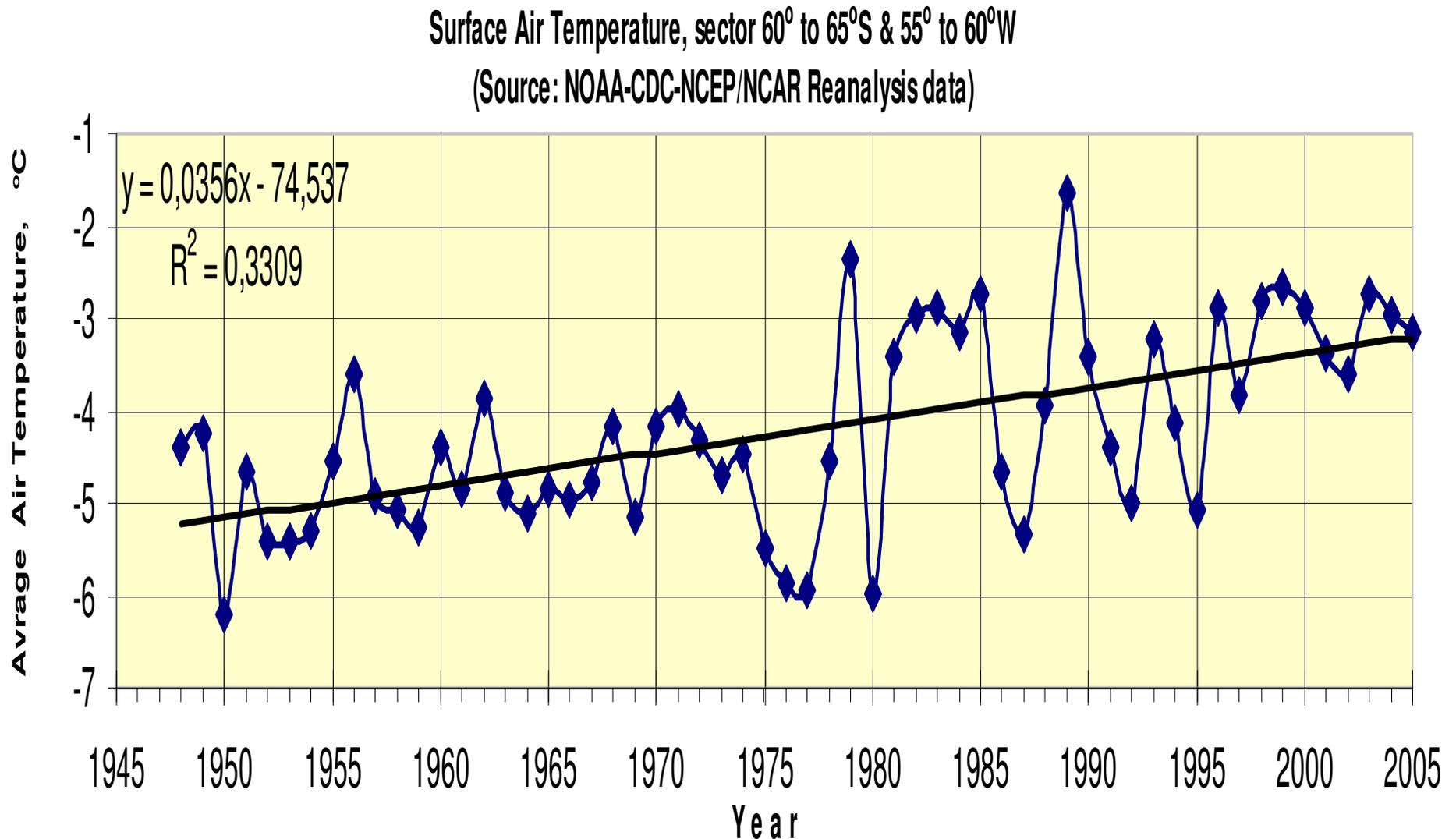
The real picture, last 20 years: surface air pressure is NOT falling



Actually, stations indicate that surface air pressure IS RISING !

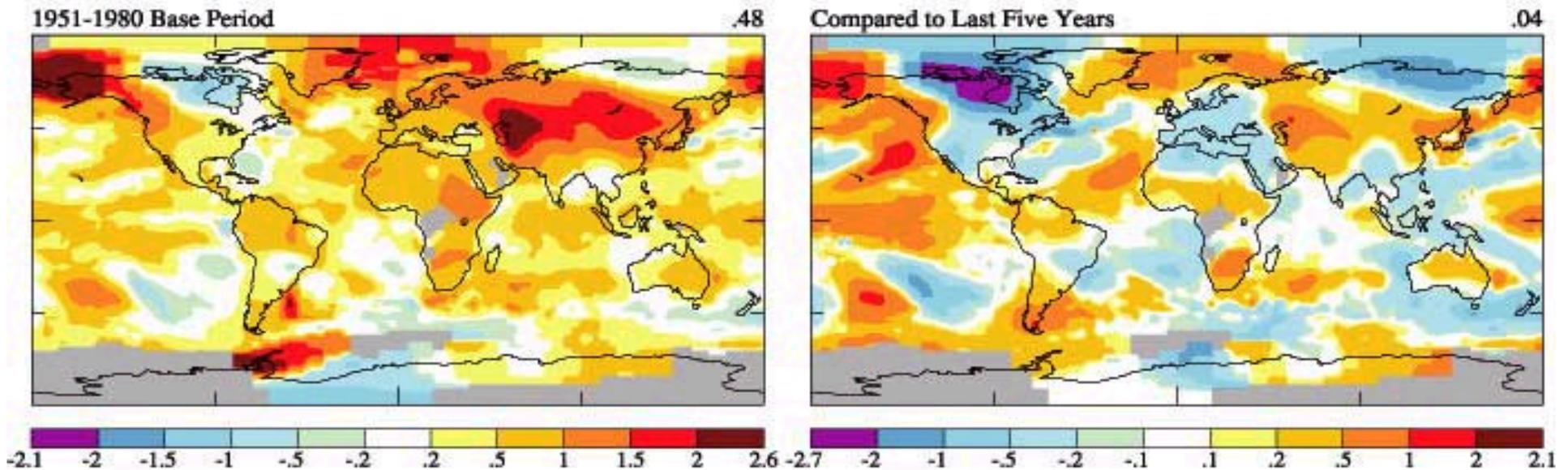


The general picture: surface **air temperature is rising** at about 2°C/50 years in the north of the Antarctic Peninsula



North Antarctic Peninsula is supposedly a hotspot in present climate variations

2004 Annual Mean Surface Temperature Anomalies (°C)

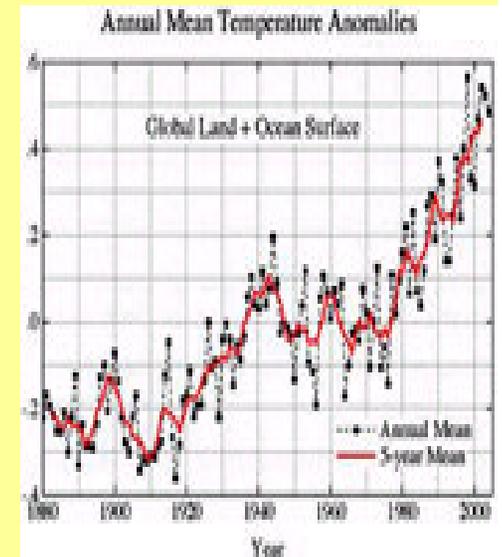


“The 2004 meteorological year was the fourth warmest year in the period of accurate instrumental data (since the late 1800s).”

The annual-mean global surface temperature is 0.48 °C above the climatological mean (1951-1980 average) in the GISS analysis, which uses meteorological station measurements over land and satellite measurements of sea surface temperature over the ocean.

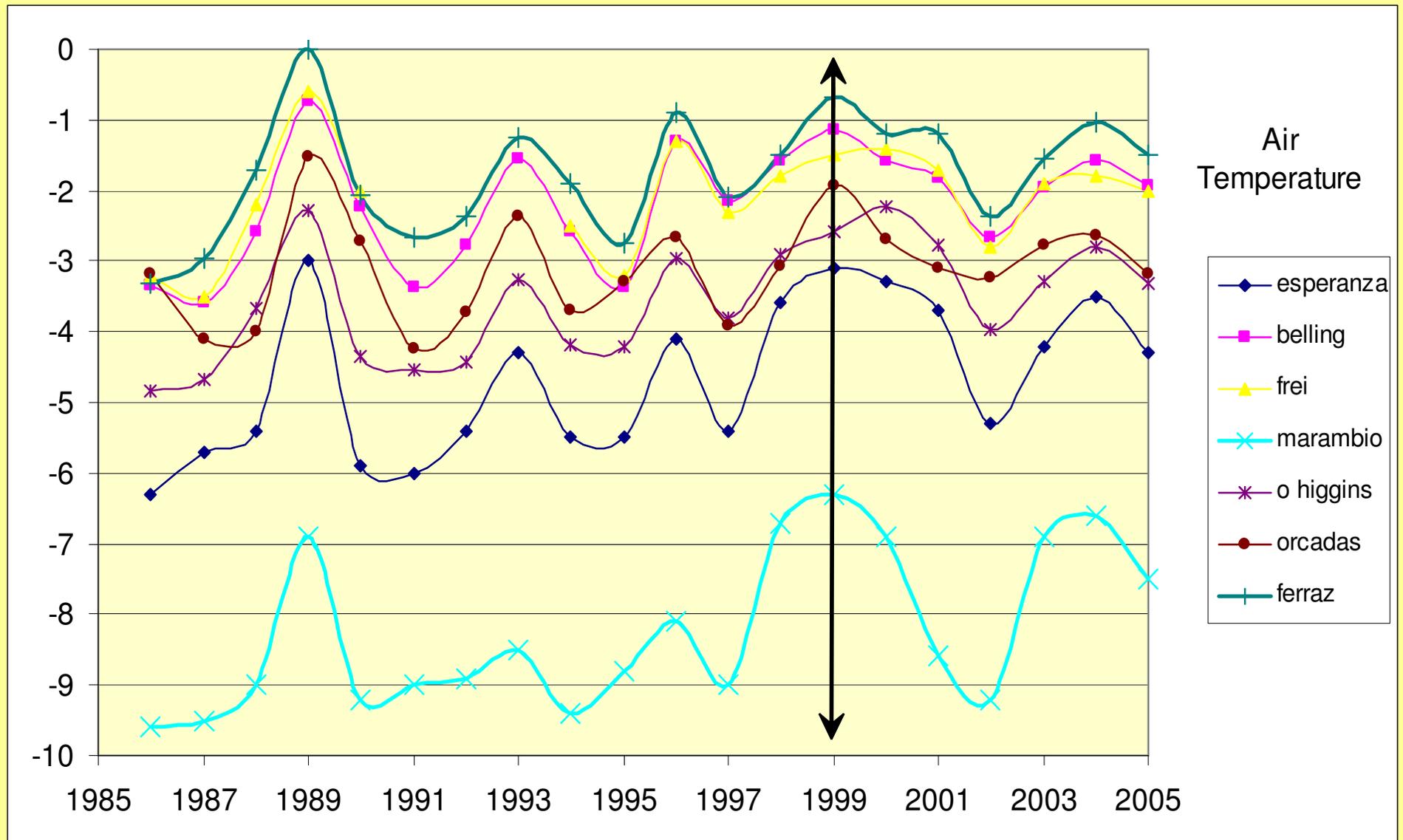
James Hansen and Makiko Sato at

<http://www.giss.nasa.gov/data/update/gistemp/2004/>

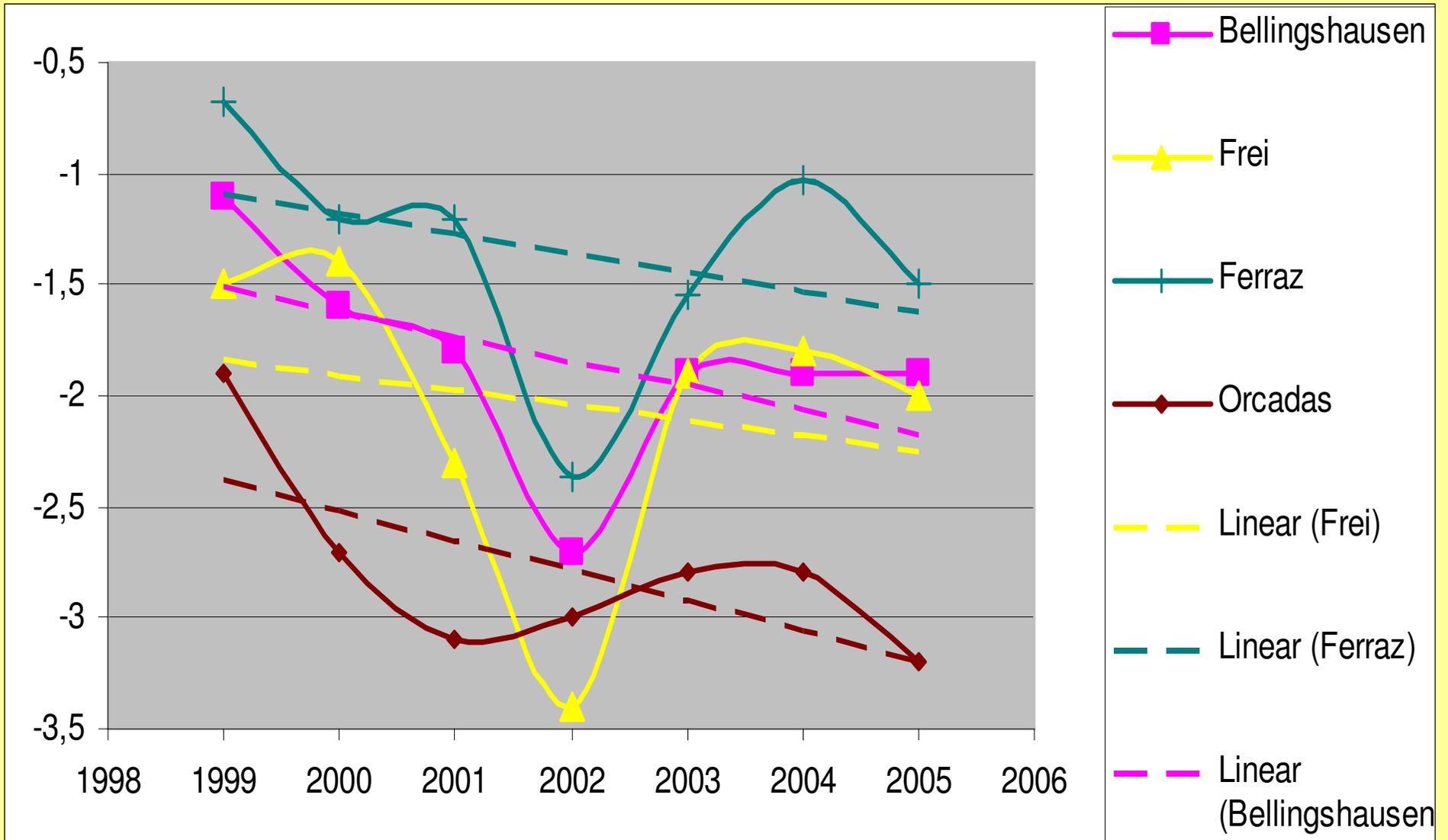


In 1999 temperatures started to decline at all stations in the north of the Antarctic Peninsula and also at Orcadas.

(Source: <http://www.antarctica.ac.uk/met/READER/data.html>)



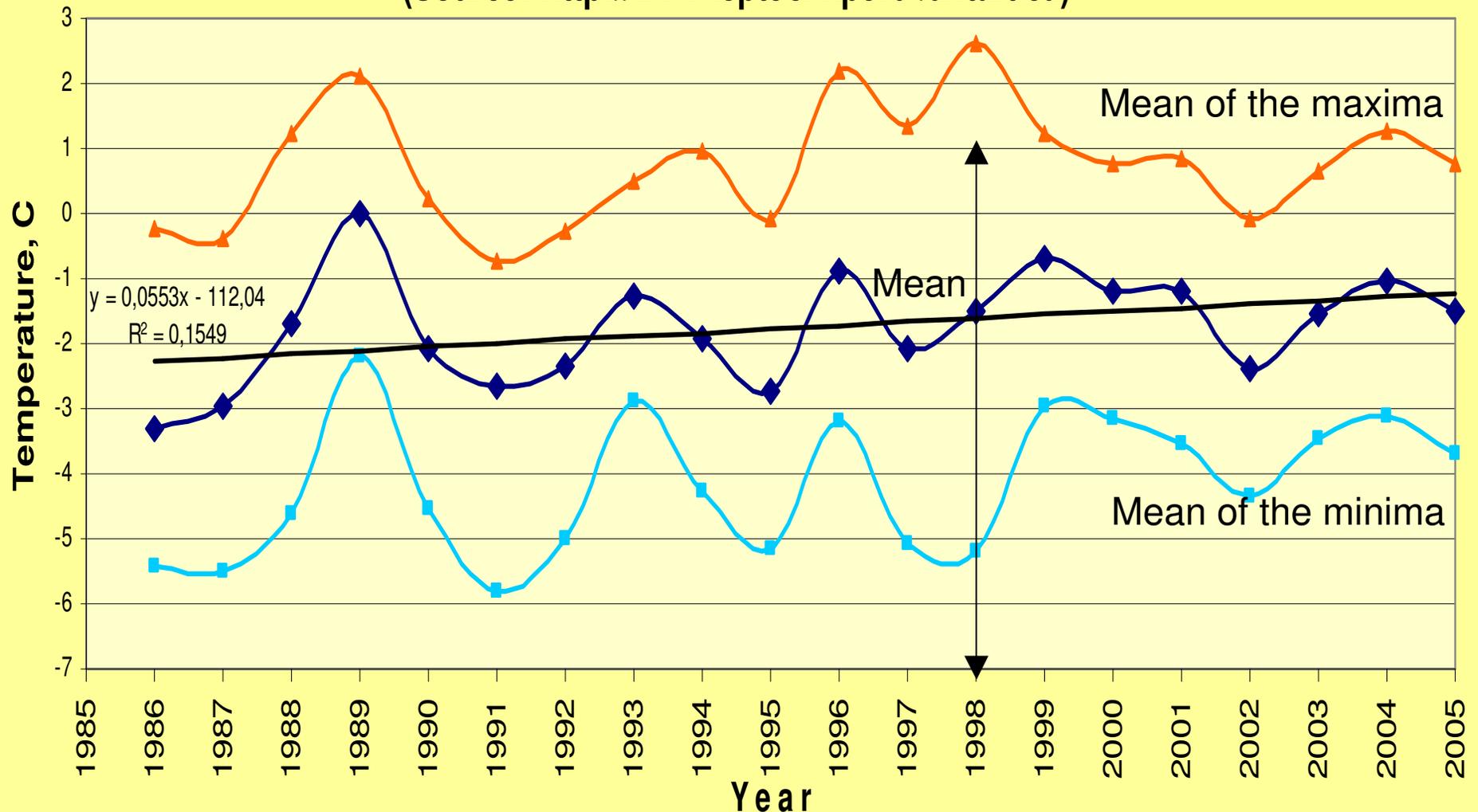
Detail of the cooling in the north of the Antarctic Peninsula and Orcadas. Average yearly temperatures show linear decrease over 0.5°C in 6 years. (Source: <http://www.antarctica.ac.uk/met/READER/data.html>)



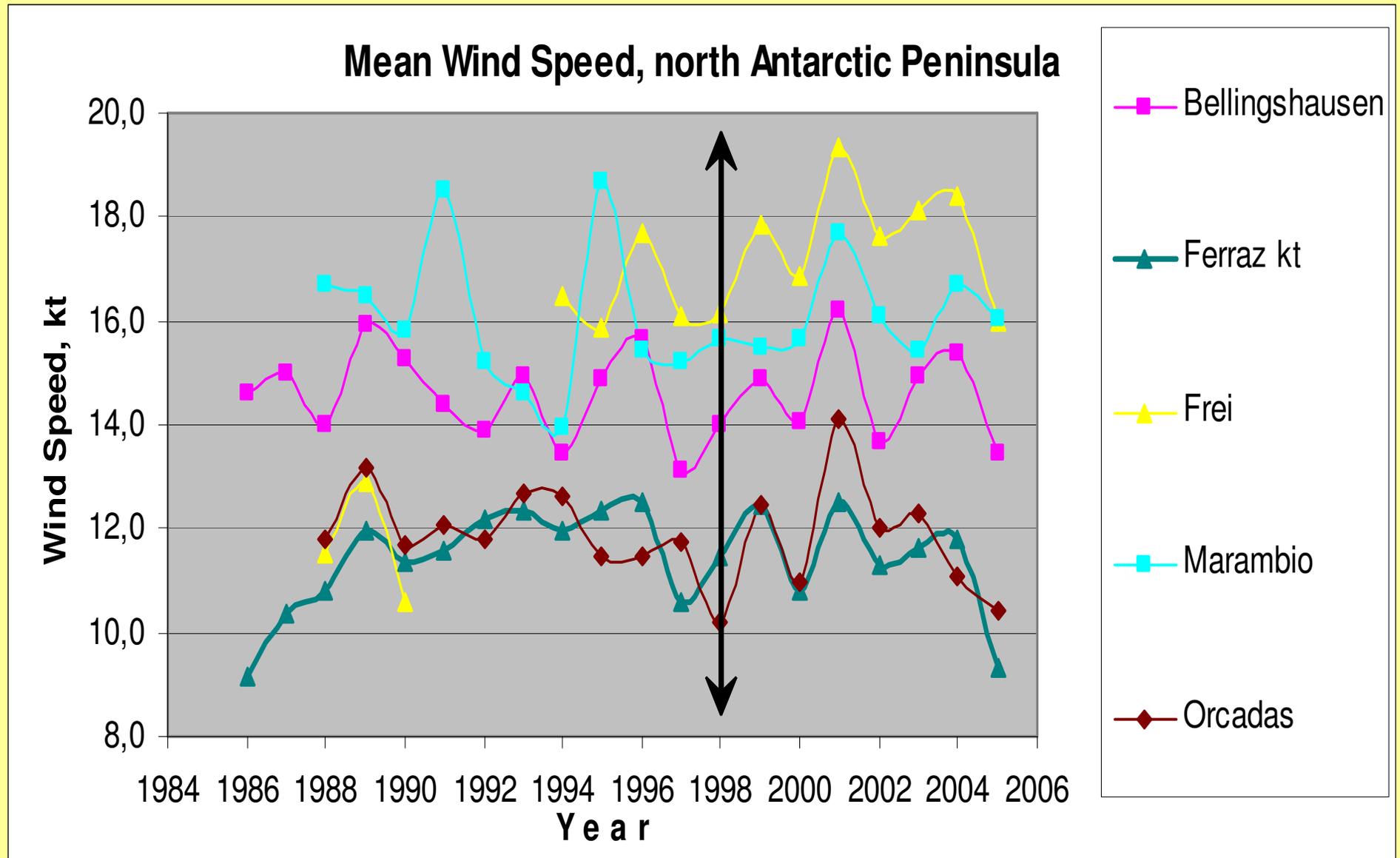
Reduction in the air temperature is noticed also at the means of the daily maxima and minima, starting in 1998 for the maxima.

Mean annual air temperatures at Ferraz Station (1986-2006)

(Source: <http://www.cptec.inpe.br/antartica>)



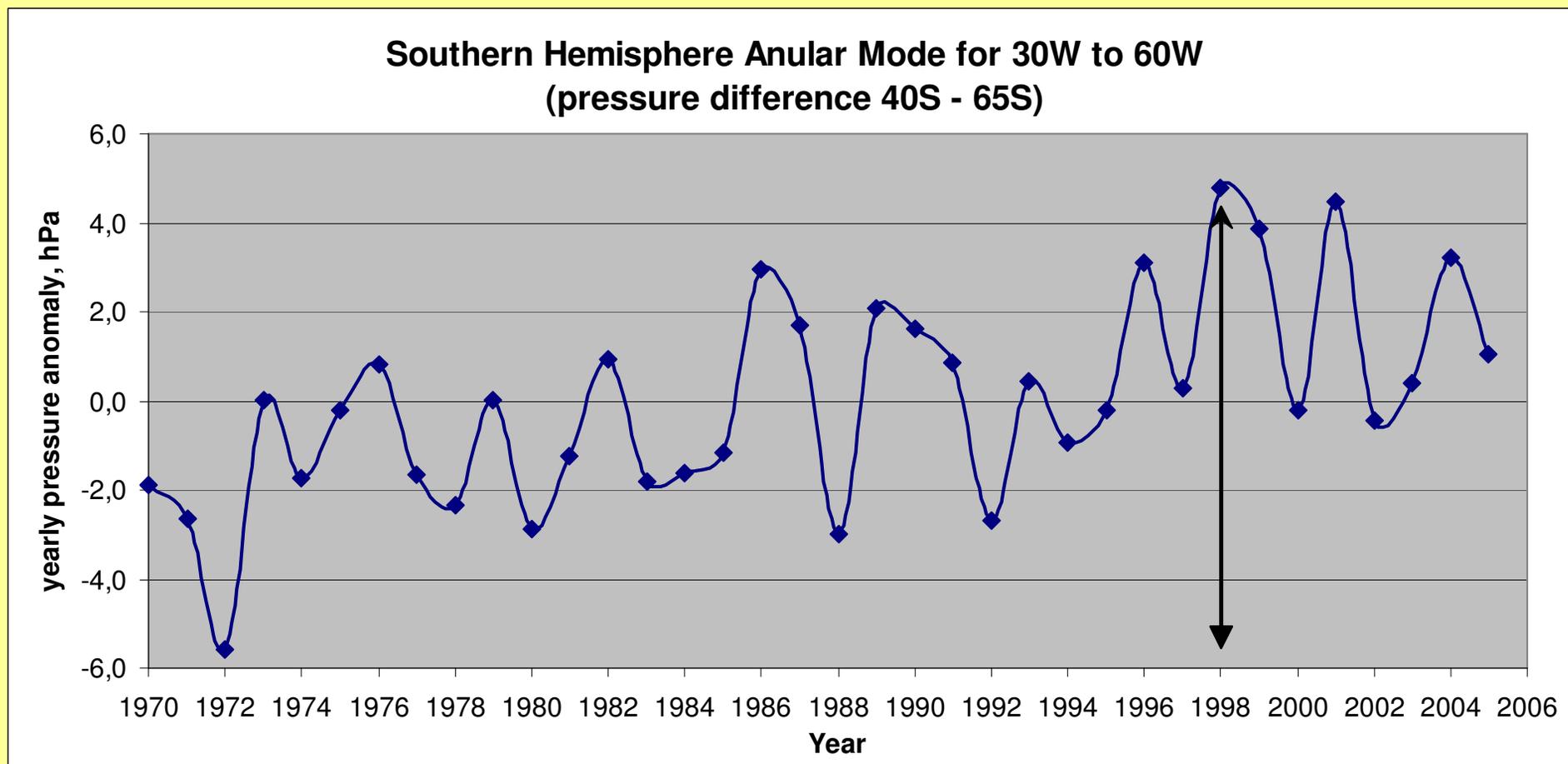
Since 1998 wind speed at weather stations increased in the region; however, 2005 was a “calm” year.



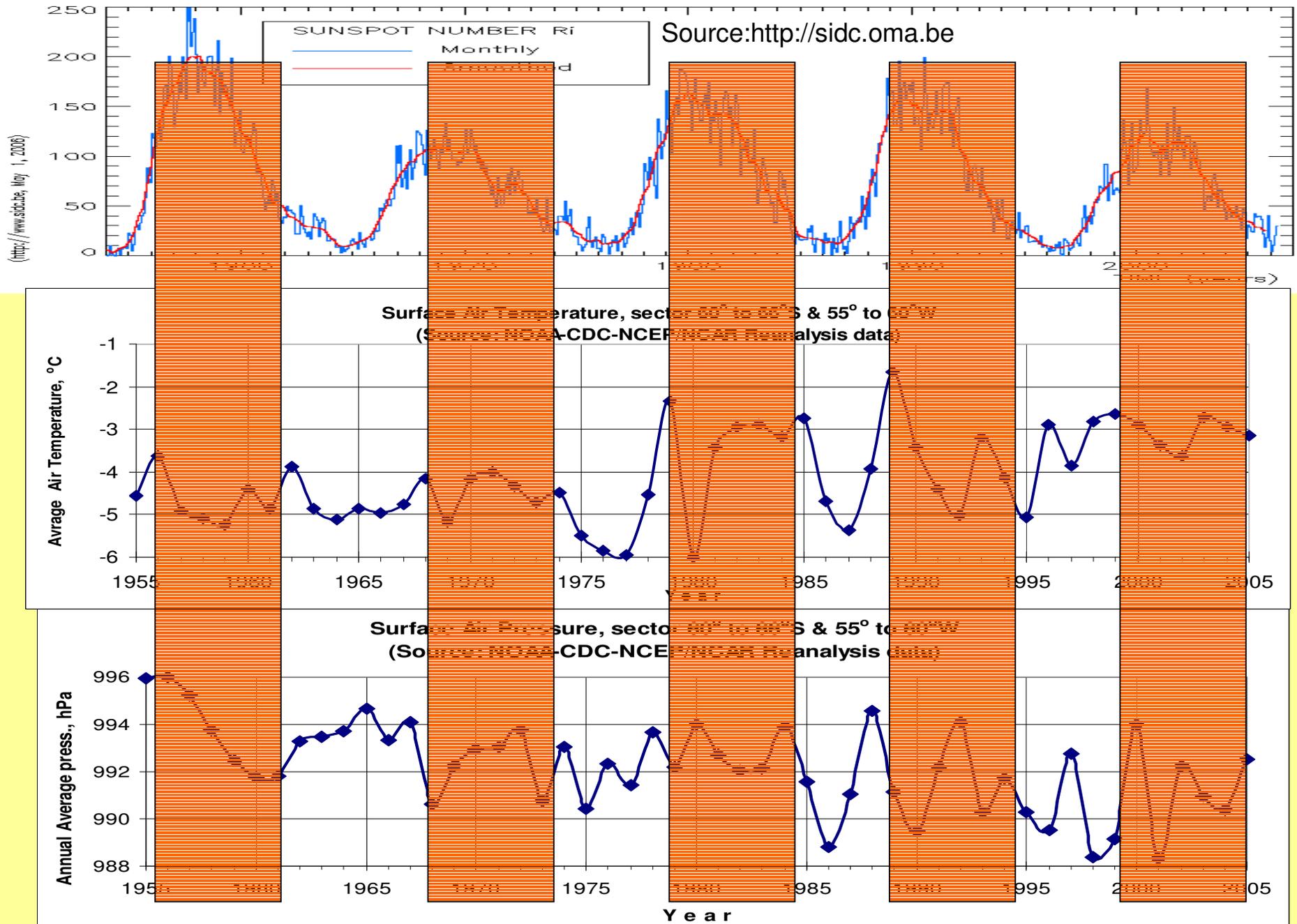
At about 1998 the pattern of sea level pressure also changed in the north of the Antarctic Peninsula.

The figure below shows a regional SAM (Southern Hemisphere Anular Mode), which is the sea-level atmospheric pressure difference between the latitudes of 40°S and 65°S, but calculated only for the sector of 30°W and 65°W.

(Source: NOAA-CDC-NCEP/NCAR Reanalysis data)



Decrease in temperature seem to match the maxima and reduction in sunspots



Some consequences of the sea-level pressure variation.

A difference of 02 hPa, which actually happened in the last 10 years, has the following result in temperatures calculated at different heights:

$$(p_1 * v_1 / T_1) = (p_2 * v_2 / T_2)$$

Using $p_2 = (p_1 + 2\text{hPa})$ and $v_1 = v_2$ (constant air density), the temperature at 500 hPa increases by 0.4%, or $\sim 1^\circ\text{C}$; the temperature at 250 hPa increases by 0.8%, or $\sim 2^\circ\text{C}$.

Atmospheric modelling does not include such effects. Therefore, current indications of **increases in the air temperature of the troposphere in sub-Antarctic and Antarctic regions could be the results of pressure cycles and not of regional or global warming.**