



# **What can AMPS (& ERA-Interim) tell us about the warming in West Antarctica?**

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Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image U.S. Geological Survey  
Image PGC/NASA

# Outline

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1. Reconstructing the Byrd temperature record (1957-present)

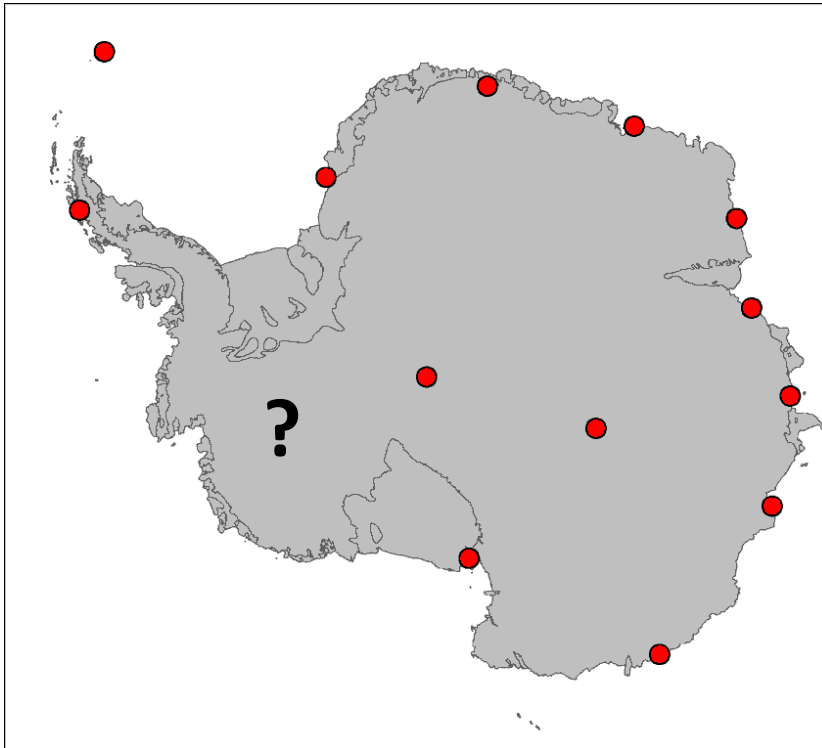
Thank you Matthew, Linda & George!!

2. Understanding the results: Are things different between Byrd and WAIS?
3. Improving the Byrd record: Can we account for the changes in sensor elevation?

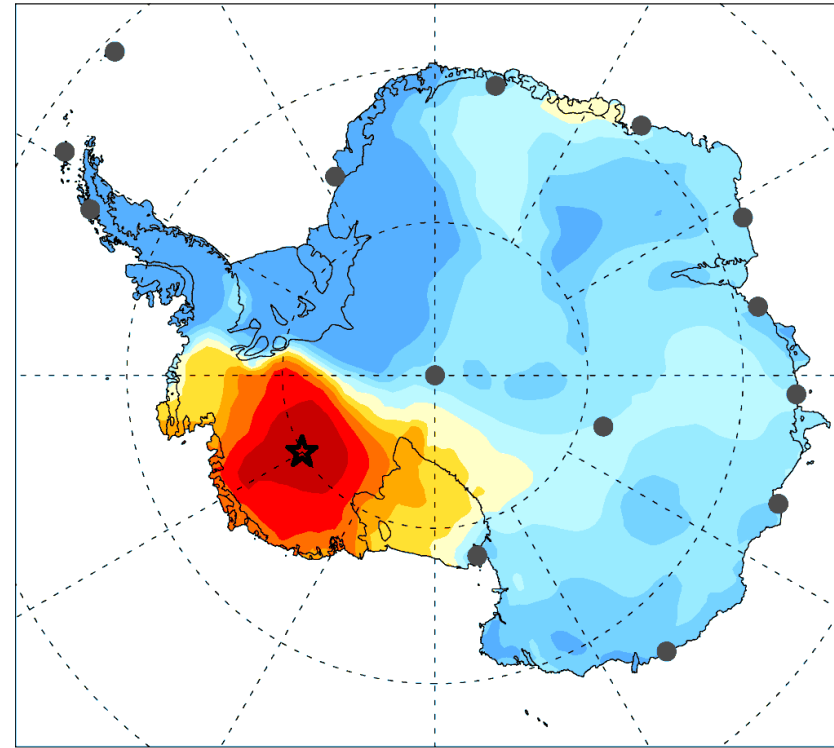
# Why Byrd Station matters

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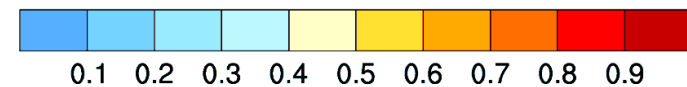
West Antarctic data void



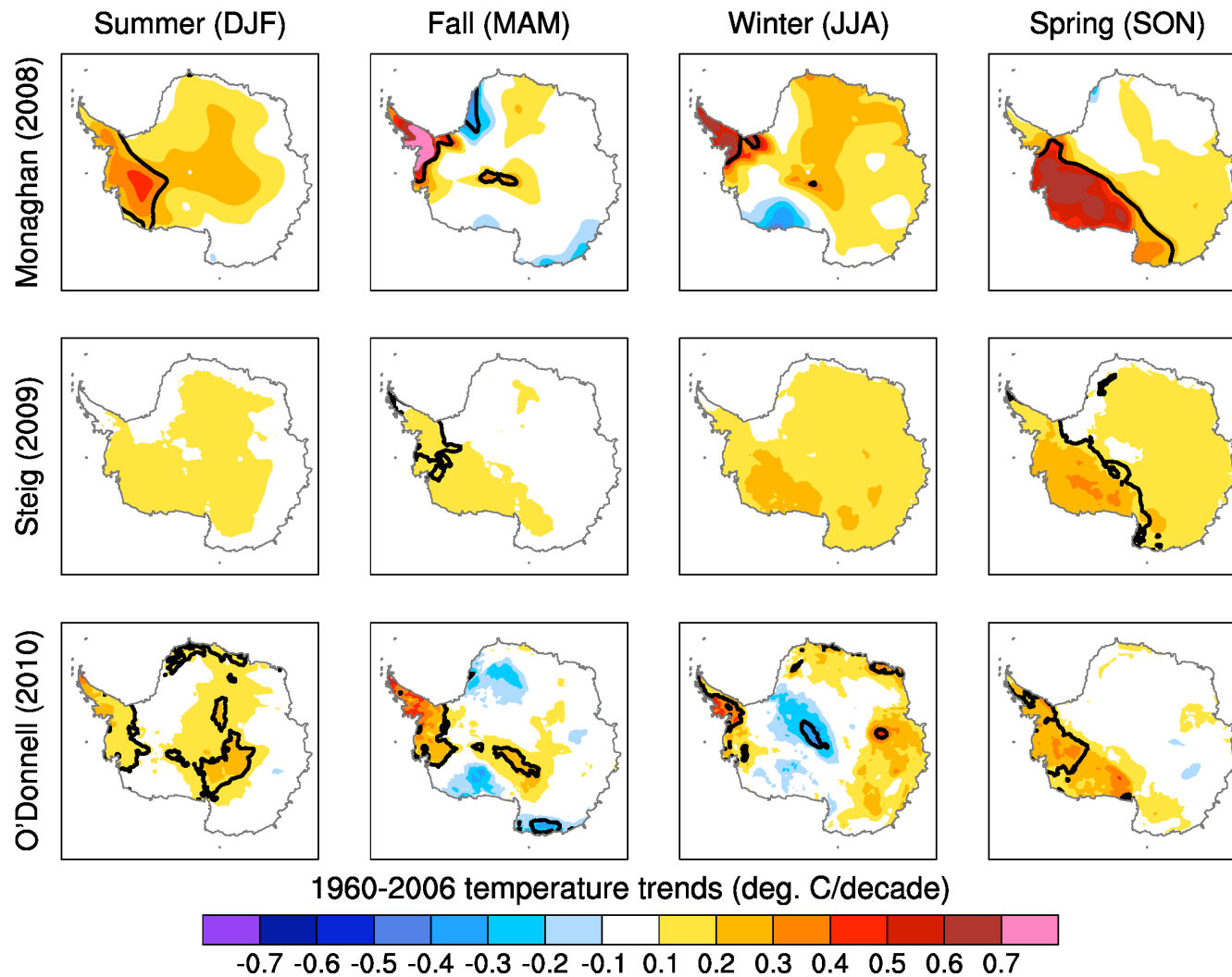
Byrd's temperature footprint



ERA-I temperature correlation with Byrd

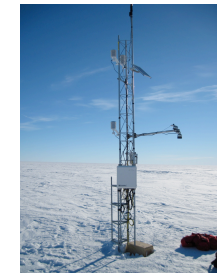
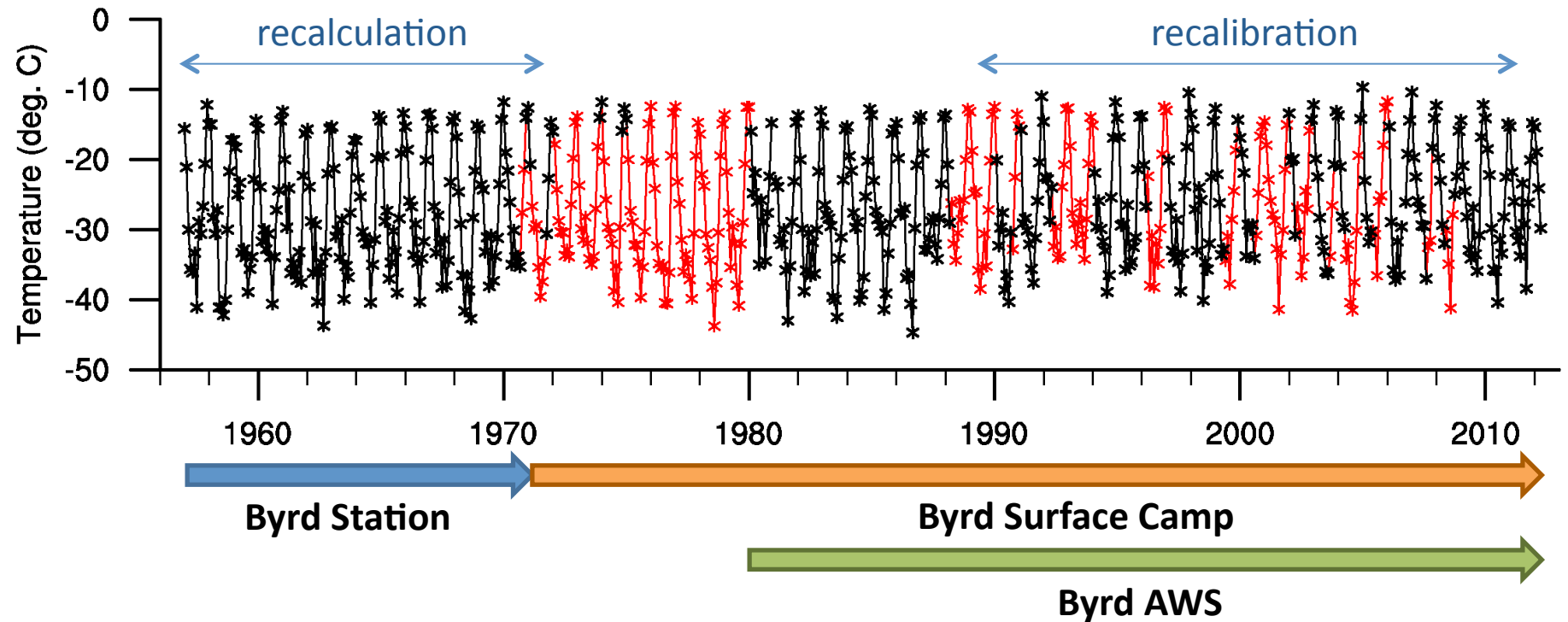


# Temperature trends: Who to believe?

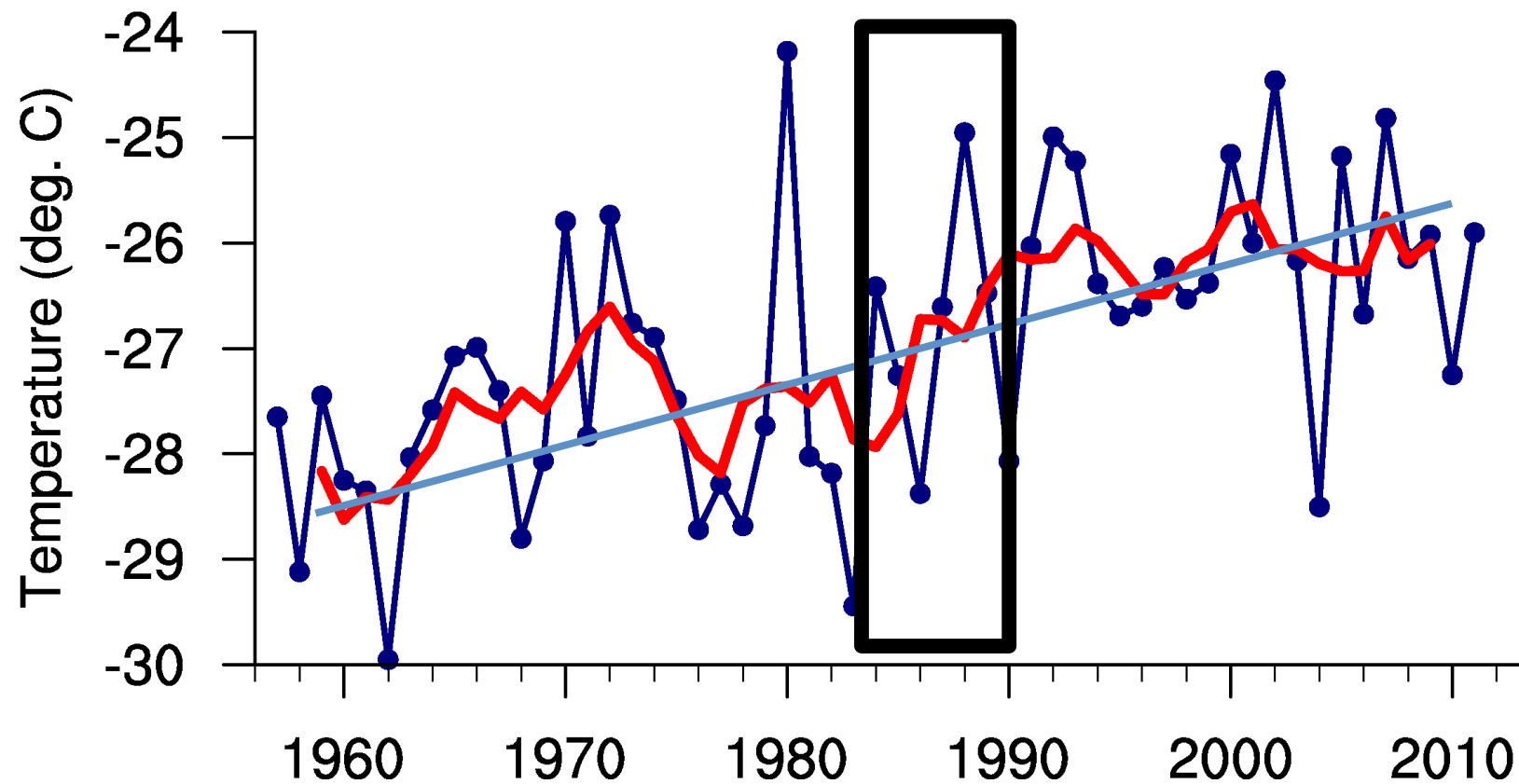




# Byrd record & data infilling

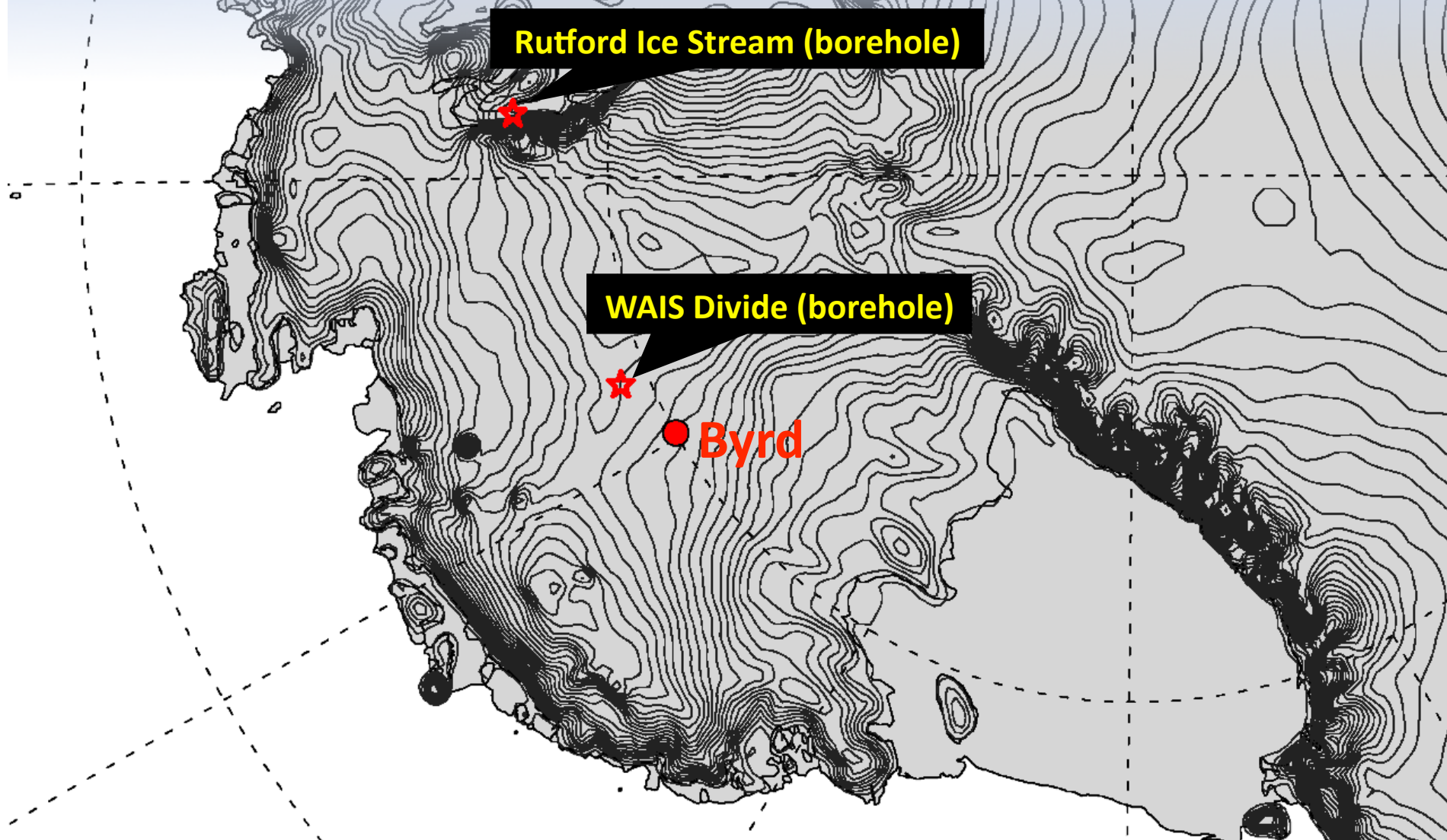


# Results: Strong warming since 1957



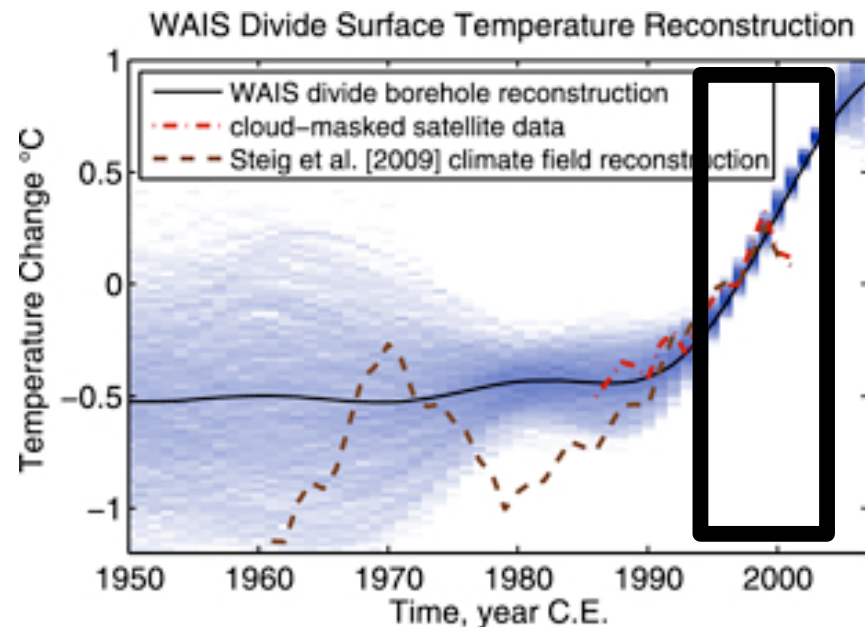
- **1958-2010** trend:  $0.43 \pm 0.23$  °C per decade
- Equivalent to  **$2.3 \pm 1.3$  °C** in 52 years

**Are these results consistent with other  
West Antarctic temperature records?**

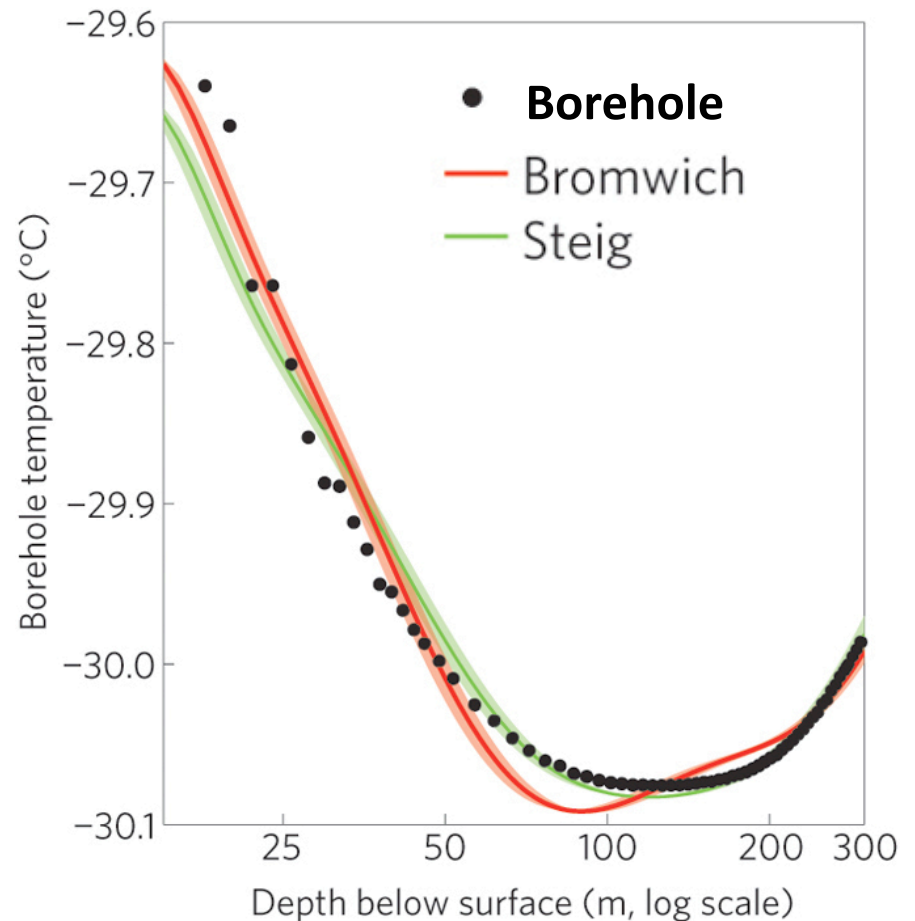




# WAIS Divide warming later than Byrd?

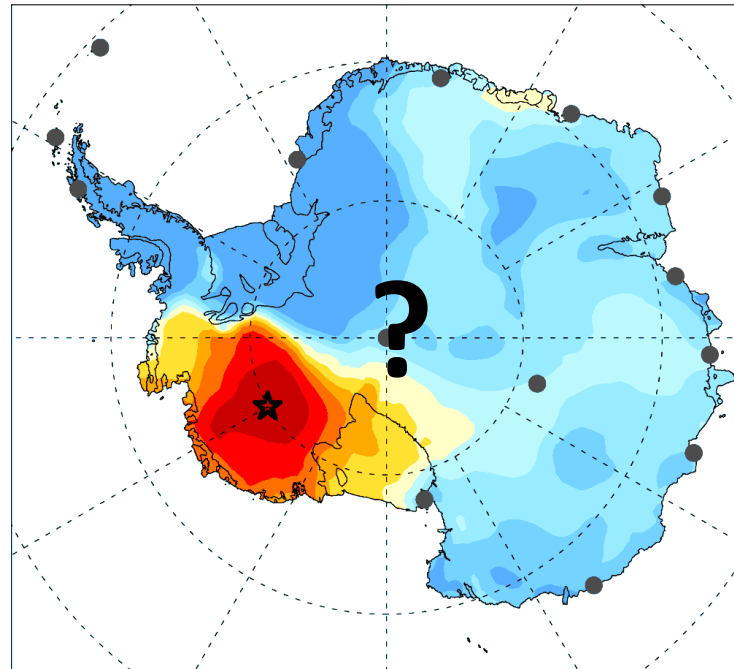


Orsi et al. (2012)



Steig and Orsi (2013)

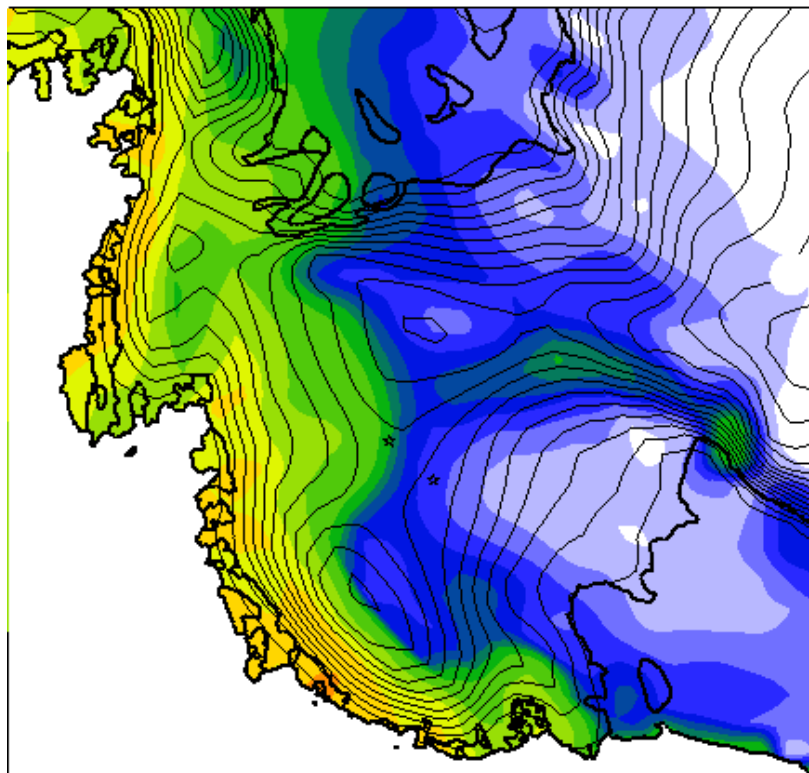
Can we explain the difference  
between Byrd and WAIS?



# Sharp precipitation contrast across the ice divide

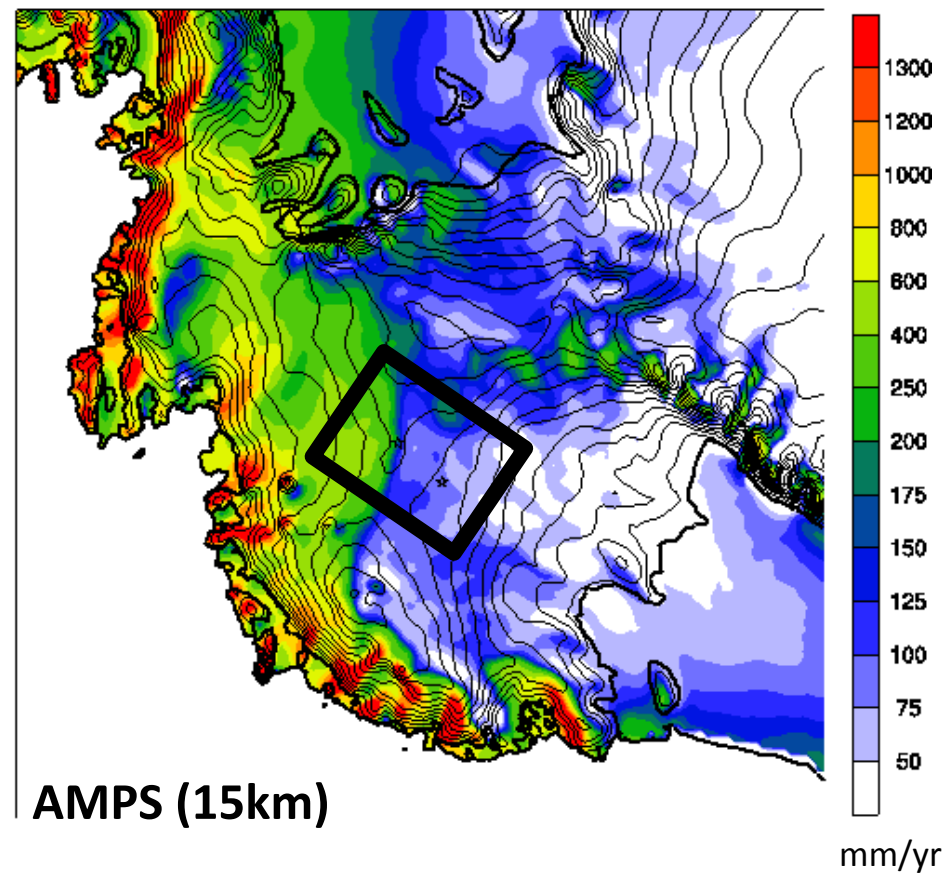
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Annual precipitation (1979-2012)



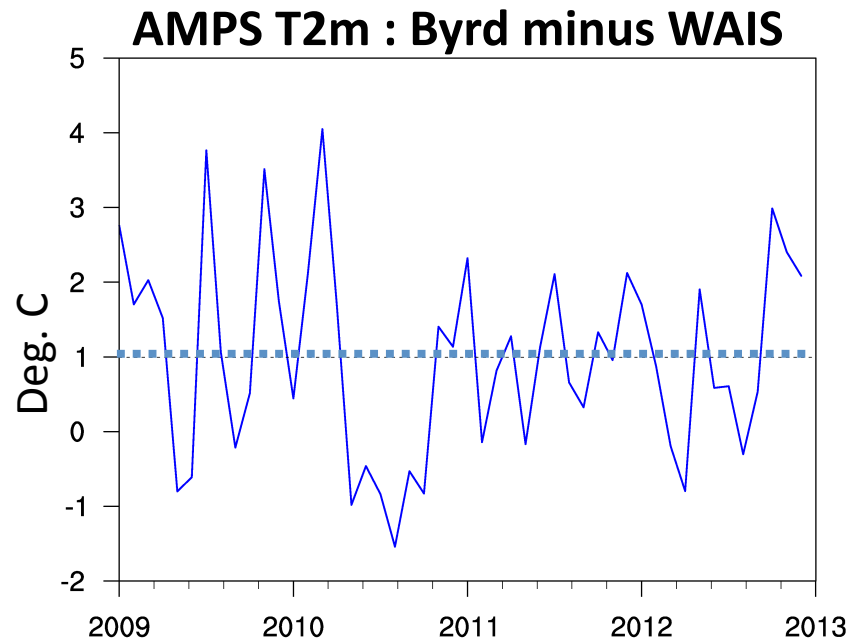
ERA-Interim

Annual precipitation (2009-2012)



AMPS (15km)

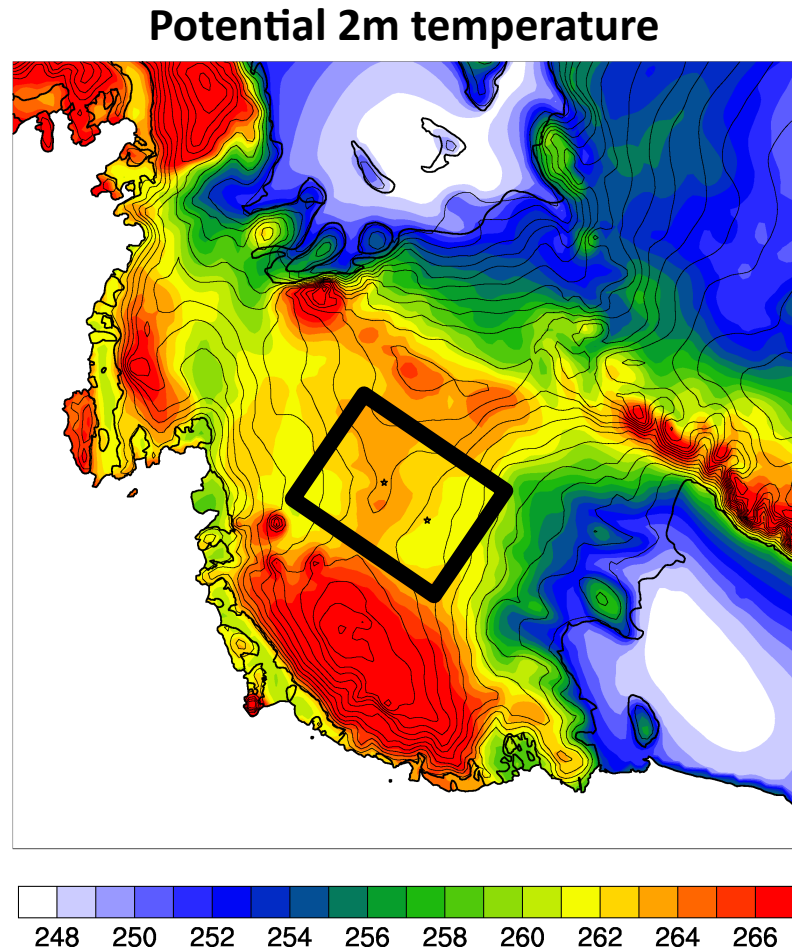
# Byrd vs WAIS Divide temperature differences



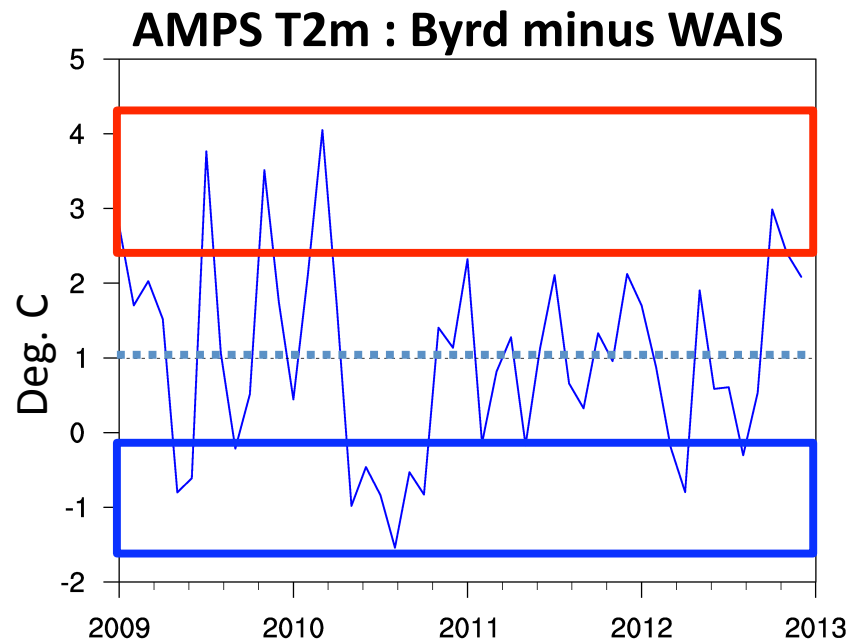
**Byrd:** 1530 m asl

**WAIS Divide:** 1766 m asl

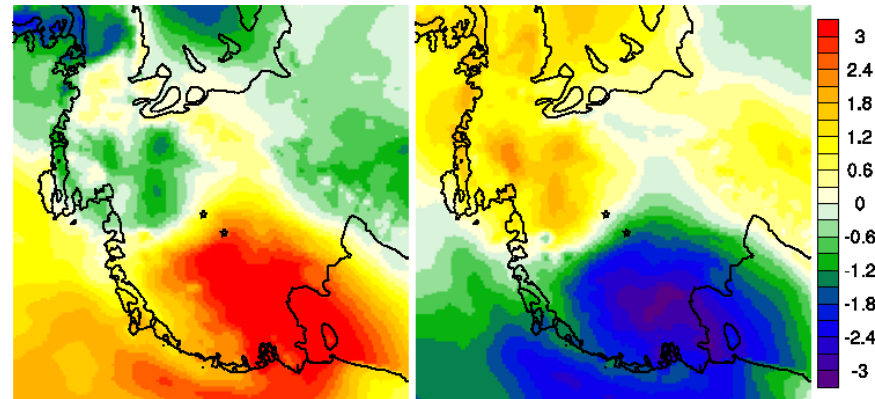
$\Delta H = 236$  m



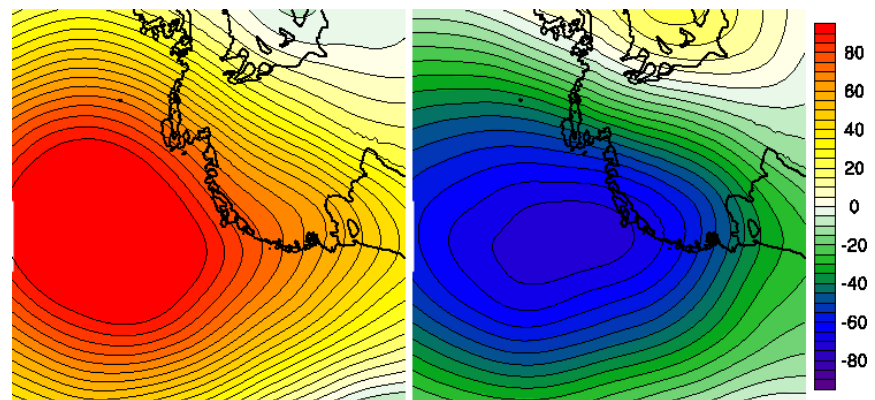
# Byrd vs WAIS Divide temperature differences



**Composite maps of T2m anomalies**



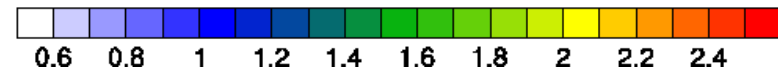
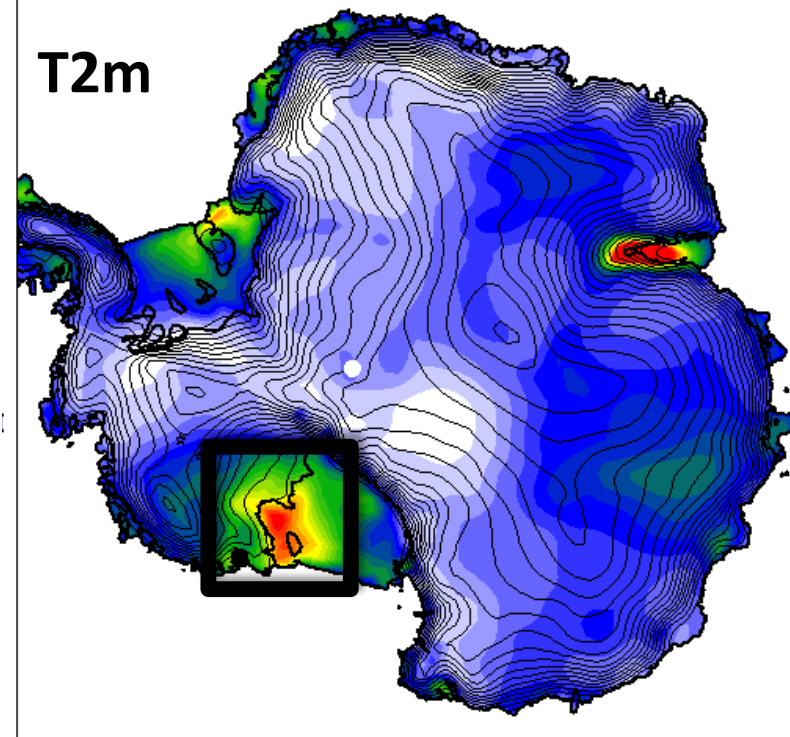
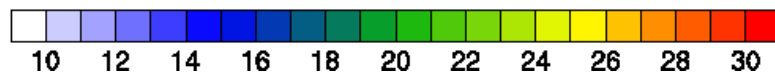
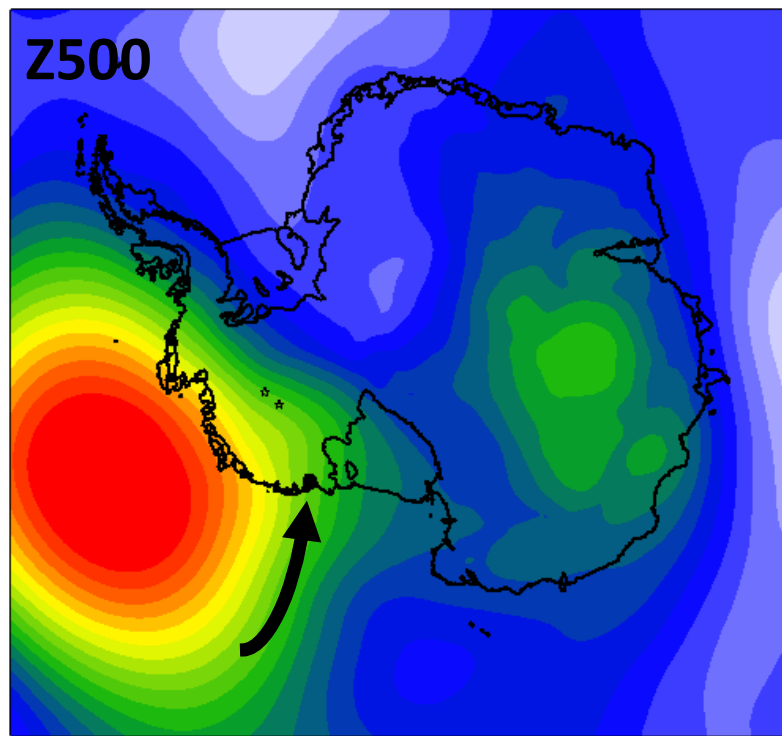
**Composite maps of Z500 anomalies**





# Large variability in Western West Antarctica

Annual standard deviations from ERA-Interim (1979-2012)



# Conclusions (I)

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- Byrd and WAIS are in a region of large meteorological gradients due both to topography and atmospheric circulation
- At this point, we cannot rule out that the recent warming was delayed at WAIS compared to Byrd
- A true validation of Byrd instrumental temperature record needs a borehole at Byrd!

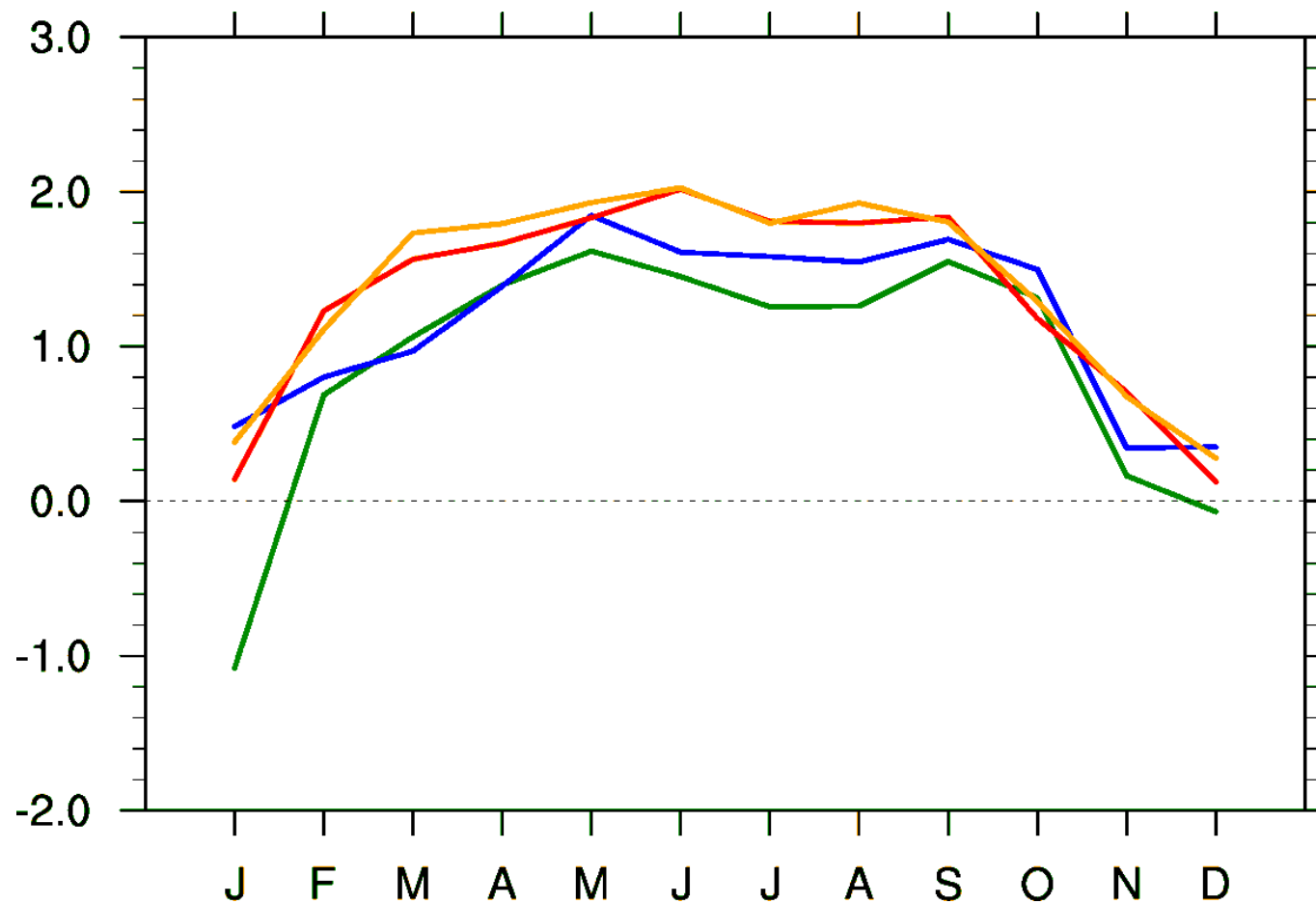
# Changes in sensor height above sfc



# Surface temperature stratification at Byrd

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**T2m minus Tsfc (AMPS 2009-2012)**



# Conclusions (II)

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- In summer, likely minimal impact of the changes in sensor elevation
- In non-summer months, raising the sensor (2m→3m) may have slightly amplified the long-term warming. Correcting for this effect would likely lead to a reduction in the warming.
- This correction will be a challenging undertaking and would require a detailed documentation of the changes of the sensor height.
- Uncertainty in the necessary temperature correction:
  - Initial estimates from AMPS but uncertain. Observed temperature profiles are the key to resolving this issue
  - The stratification is certainly weaker betw. 2 and 3 m than betw. the surface and 2m



# Questions?

## Additional information:

Bromwich, D. H., J. P. Nicolas, A. J. Monaghan, M. A. Lazzara, L. M. Keller, G. A. Weidner, and A. B. Wilson, 2013: Central West Antarctica among the most rapidly warming regions on Earth. *Nature Geoscience*, 6, 139-145.

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