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Measuring and interpreting Land Surface Air Temperatures over Africa

PETER THORNE (PART 2 OF 2)

WITH THANKS FOR CONSULTATIVE INPUT TO GIL COMPO, DICK DEE, ADRIAN SIMMONS

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Overview

- Insights from the available global big beasts HadCRUT, GISS and MLOST
  - Trends
  - Data gaps
- Insights from reanalyses
  - Climatology
  - Regionally averaged series
  - Trends
- Data innovations (see poster by Rennie et al.)

Trends and insights from traditional global analyses

- Analysis here is based upon that in AR5
- AR5 did not specifically assess regional changes
- Look exclusively at temperature trends in interests of time

- There are the CLIMDEX indicies that I do not have time to get into here (and which Albert in his slides also raised) but note:
  - A large number of these indicies are based off temperatures
  - There have been more data shared to build indicies than temperature series
  - Indicies are more relevant for understanding the environmental, economic and societal impacts of climate change.

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Figure 2.21 trends per decade over 1901-2012 with only gridboxes reporting >70% and early and late.

HadCRUT undertakes no infilling / interpolation whereas the other two do.

HadCRUT better reflects our ability to reflect centennial scale change through direct observational records

Which is to say most of Africa is pretty much unknown …

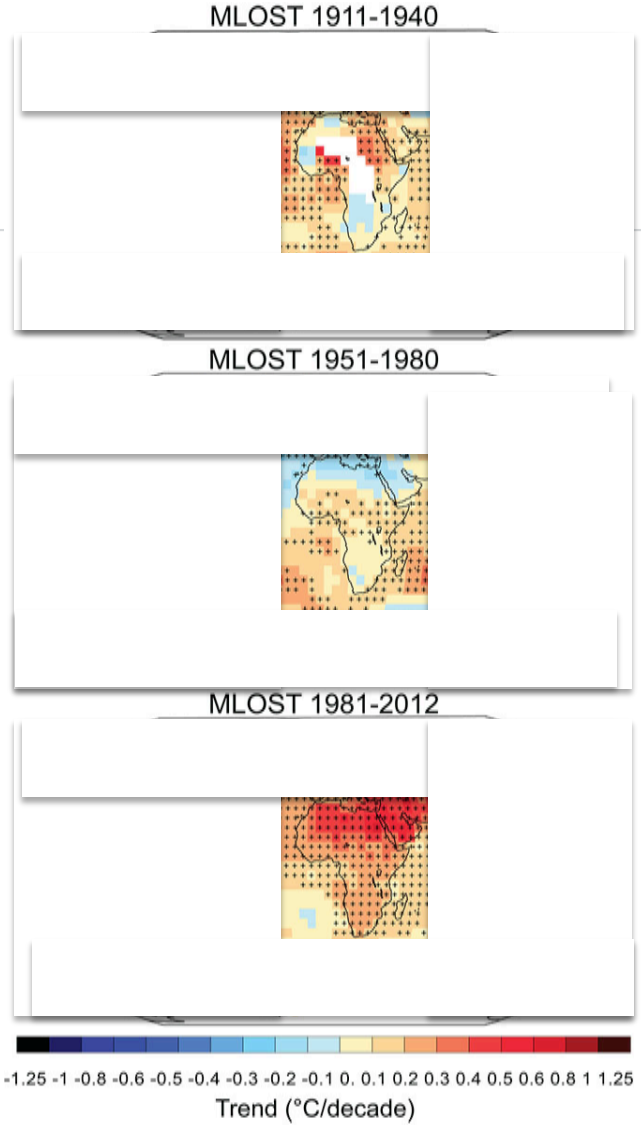

Figure 2.22 Change has not been linear over time.

Taking three non-consecutive slices with NCDC MLOST product highlights multidecadal variability in apparent African trends

If MLOST is correct then there has been rapid warming post-1981 compared to earlier similar length periods throughout the continent.

Question is how good are the global estimates given the sparse record they build upon?

Reanalyses

- Data assimilation run in historical delayed mode
- Fit totality of observational constraint plus the dynamical model forecast to yield best estimate at each timestep
- Huge volume of usage for African surface temperatures analyses
  - Google scholar on Dee et al. ERA-Int paper + Africa + temperature yields 615 results
  - Not even a mite jealous, honest … :-s
- As for traditional data analyses reanalyses will:
  - Have issues in data sparse regions
  - Have issues where the observational constraint changes a lot
  - Improve over time as new insights and innovations are accrued so users should use the most recent

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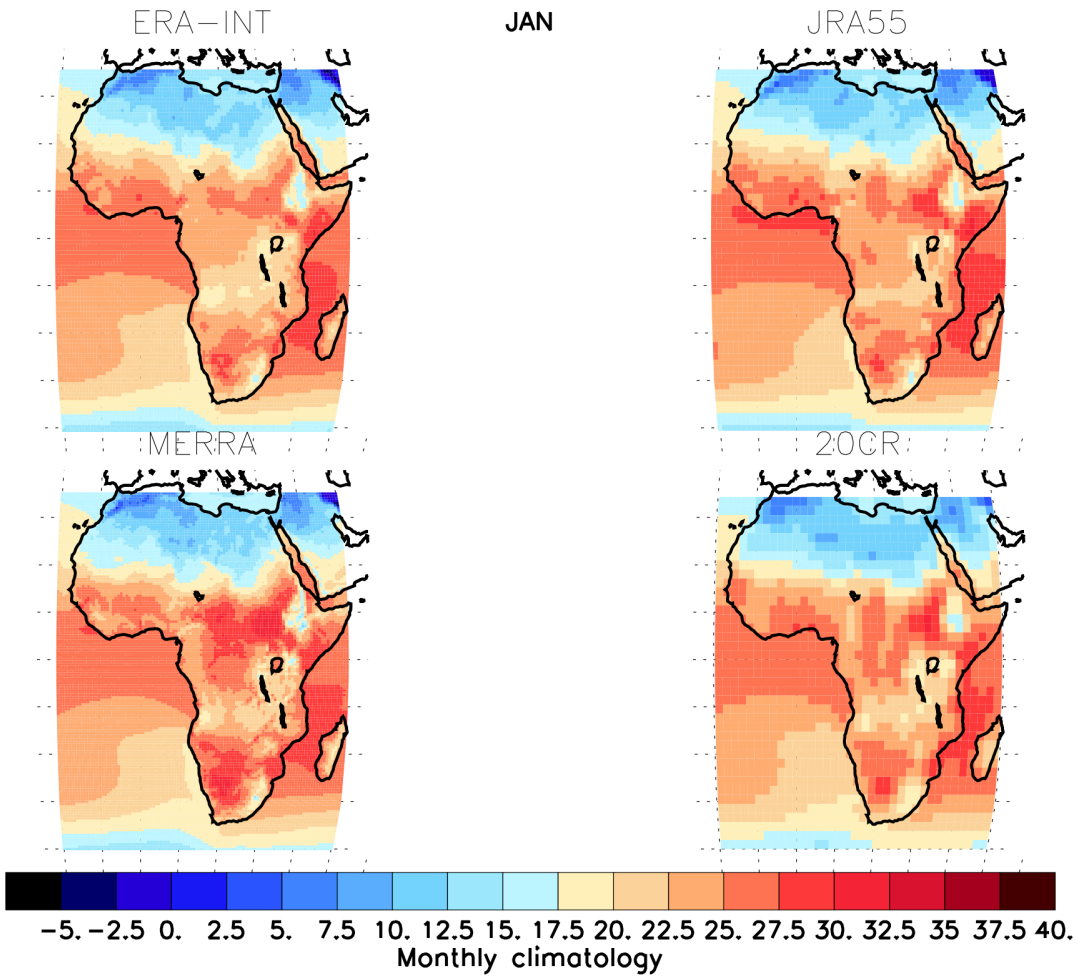
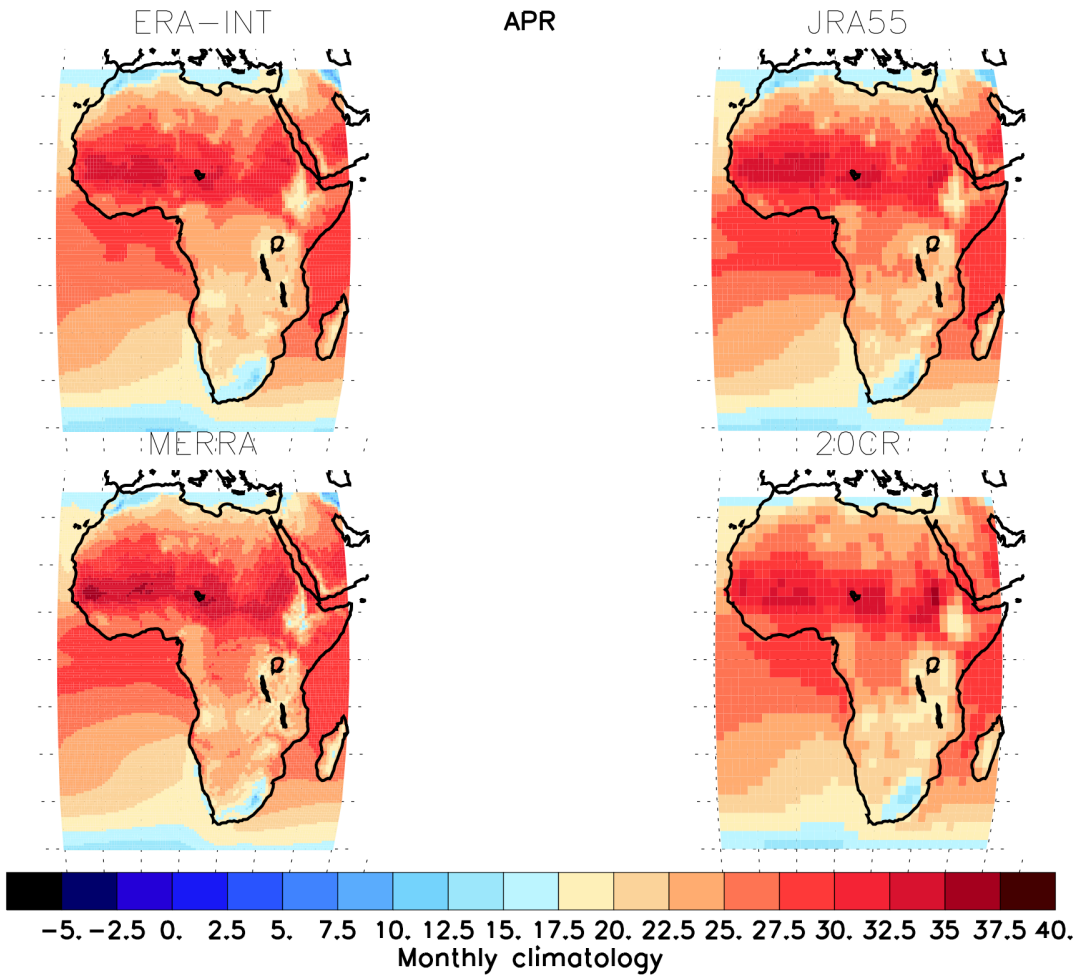
Reanalyses and observations used here

- Mea culpa I only had a couple of days lapsed time to pull this all together
- HadCRUT4 observations (yes, Colin, to my shame I used just the median, sorry …)
- 20CR reanalysis
- JRA55 reanalysis
- MERRA reanalysis
  - "MERRA has very bad temperature trends at low level over central Africa (and South America) and there is a likely related problem in its soil moisture"
- ERA-INT reanalysis

Most basic check is climatologies which look reasonable

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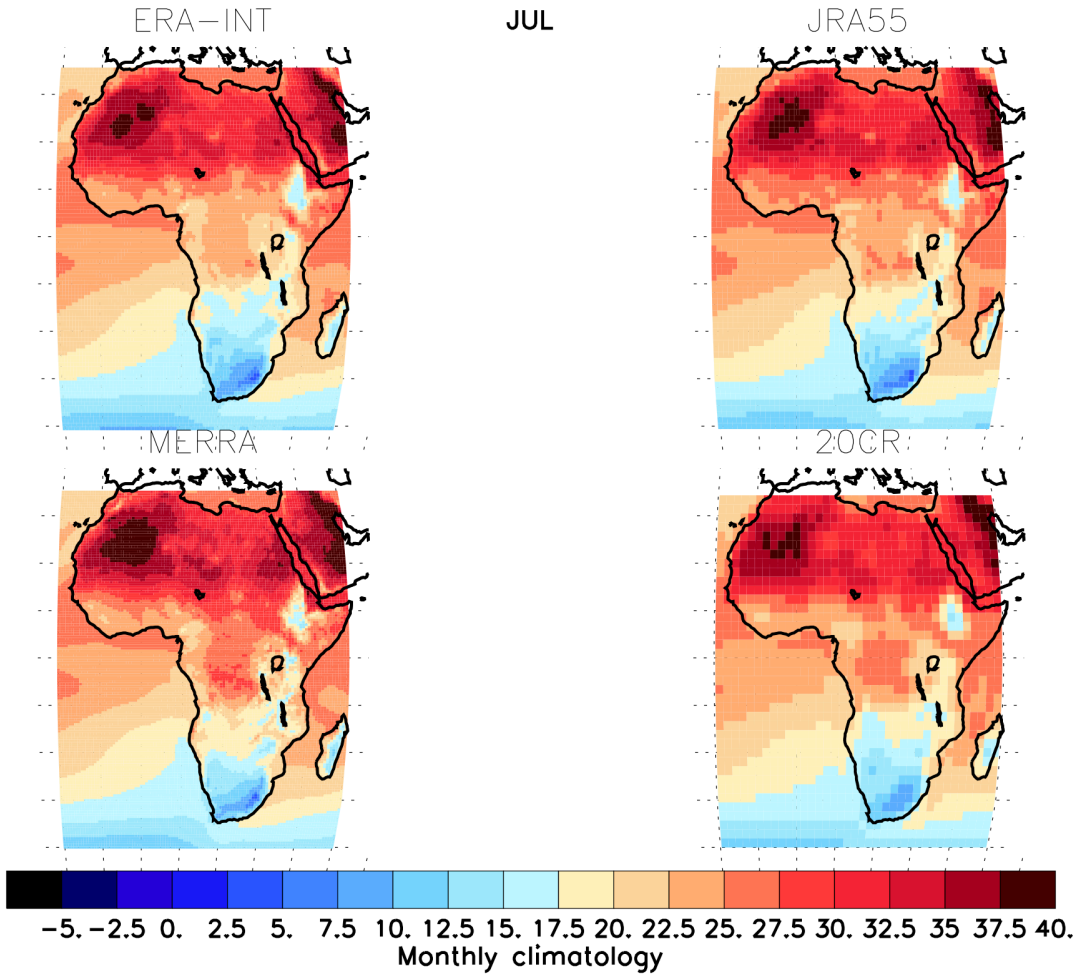
Monthly climatology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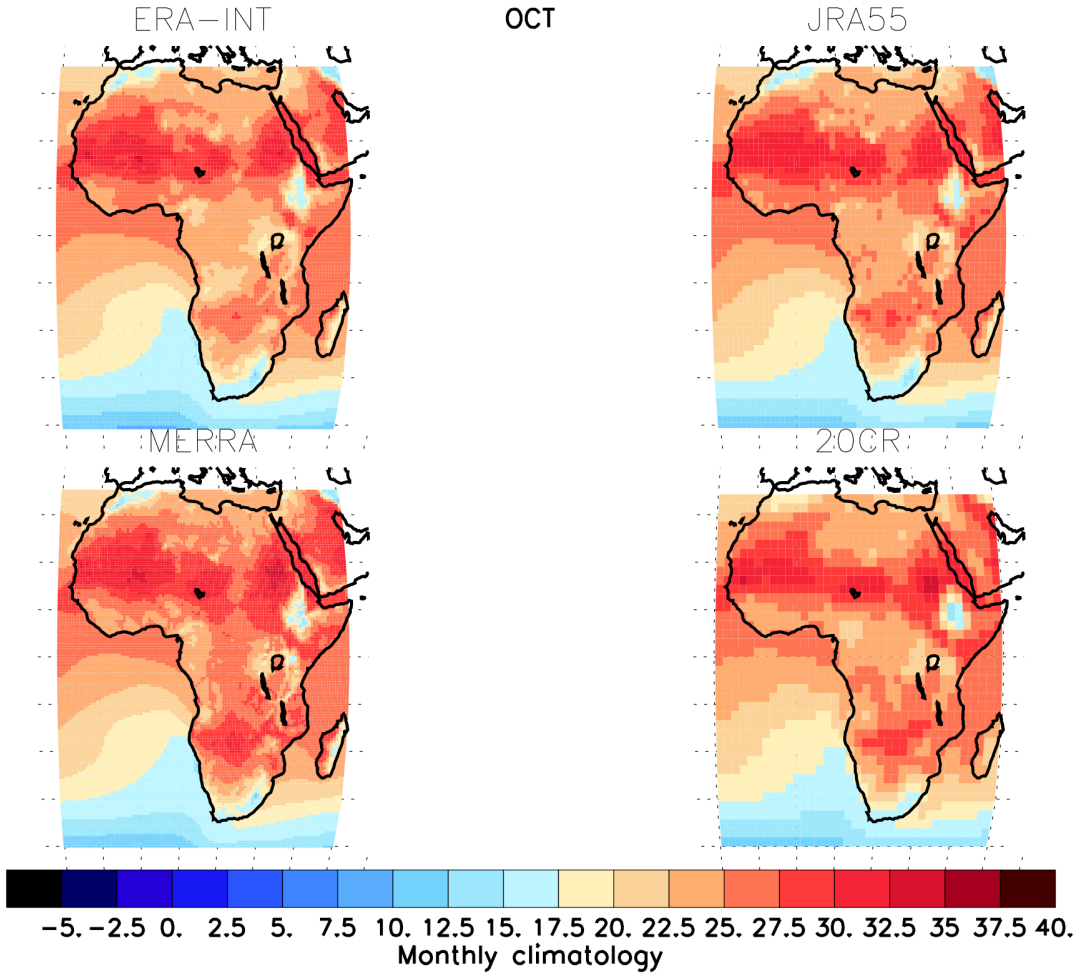
Monthly climatology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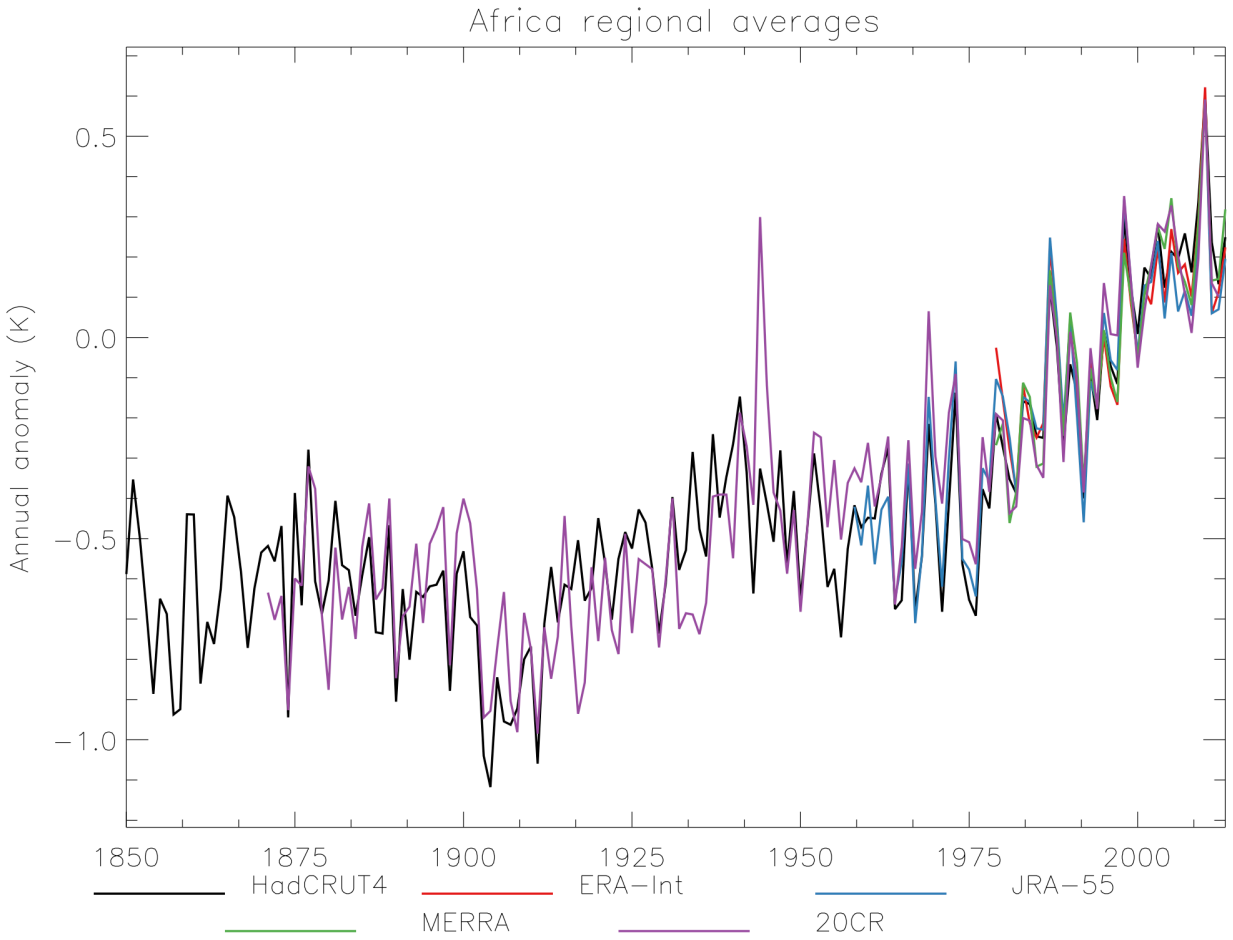
Monthly climatology

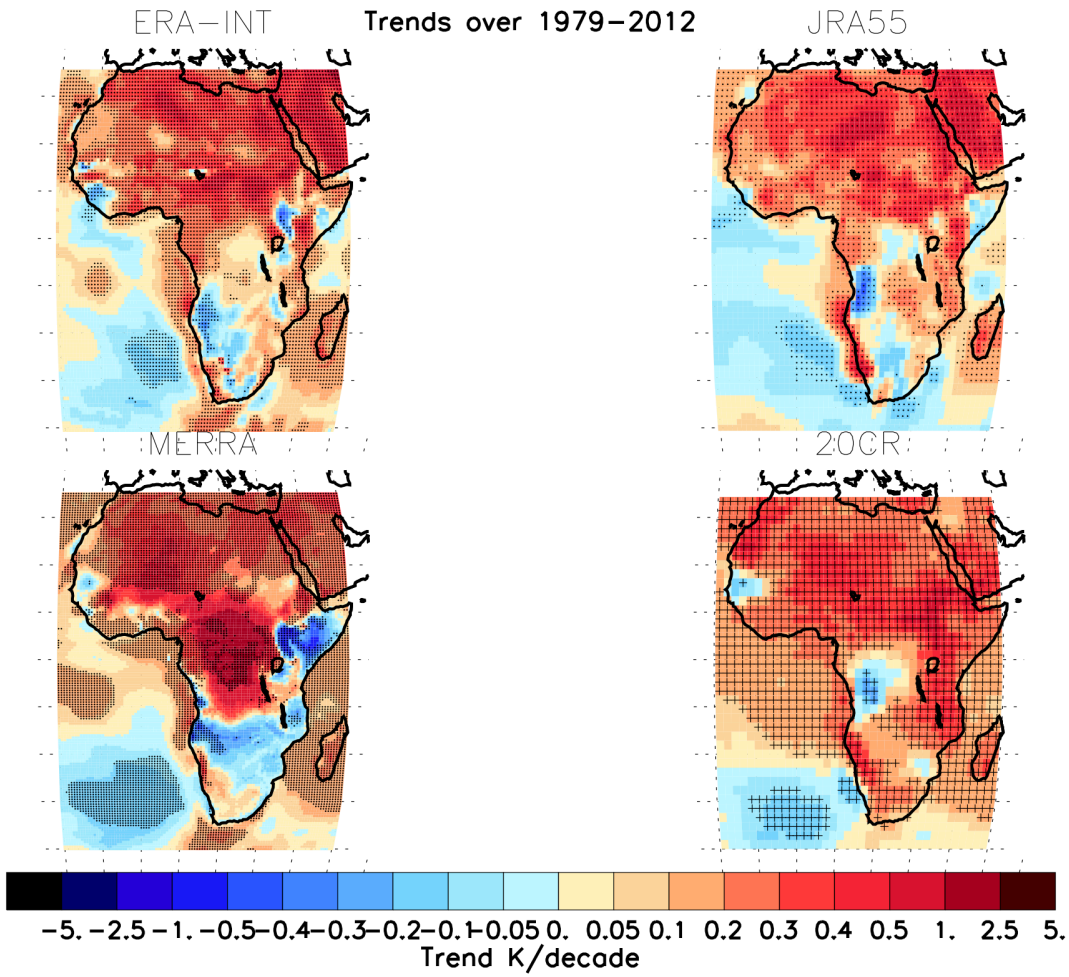
African average anomalies relative to 1981-2010

4 reanalyses (colour) plus HadCRUT 4 (black)

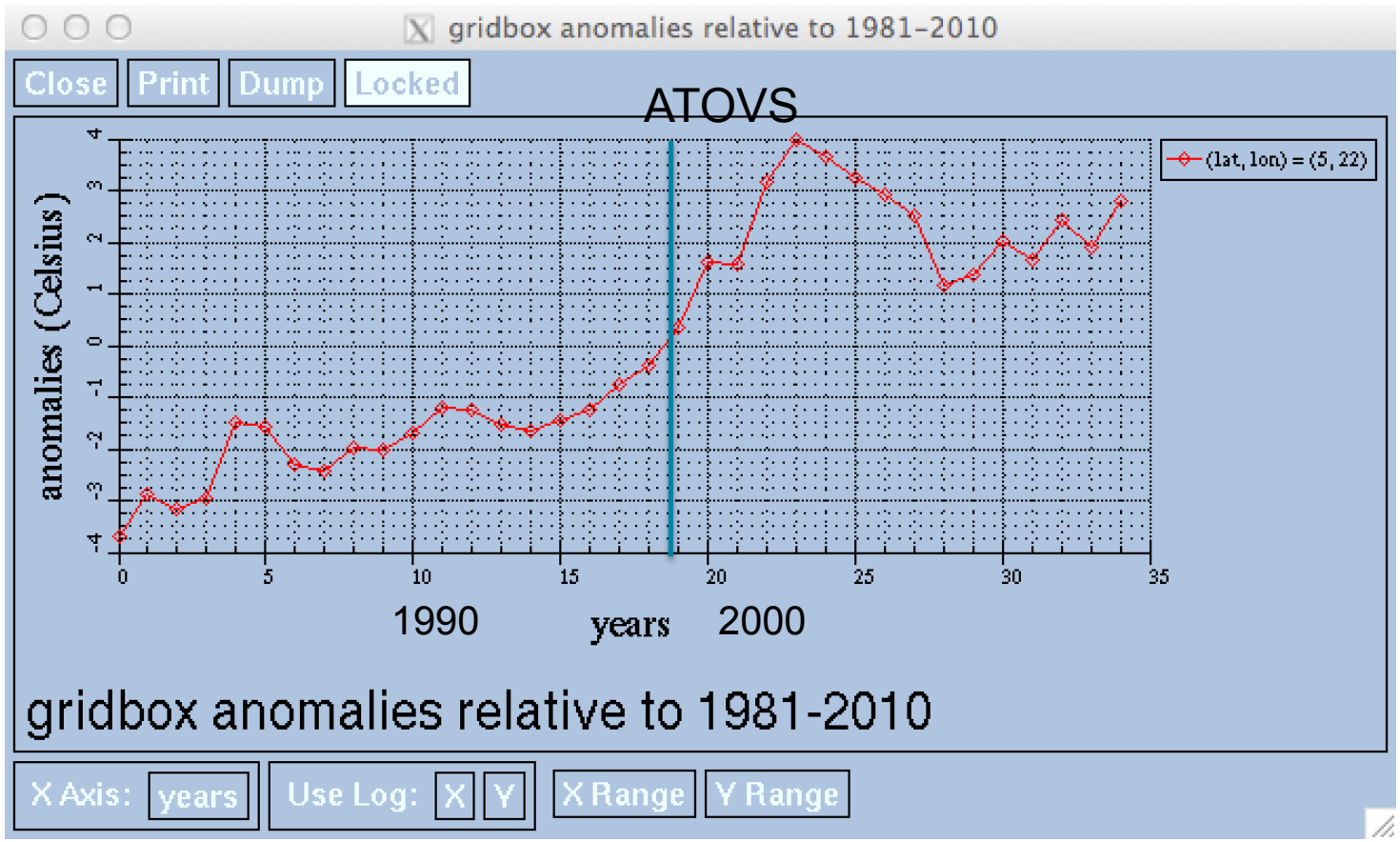
No sub-sampling



MERRA is obvious odd man out for surface trends in central Africa



MERRA Central Africa shifts 5K approx. coincident with ATOVS introduction



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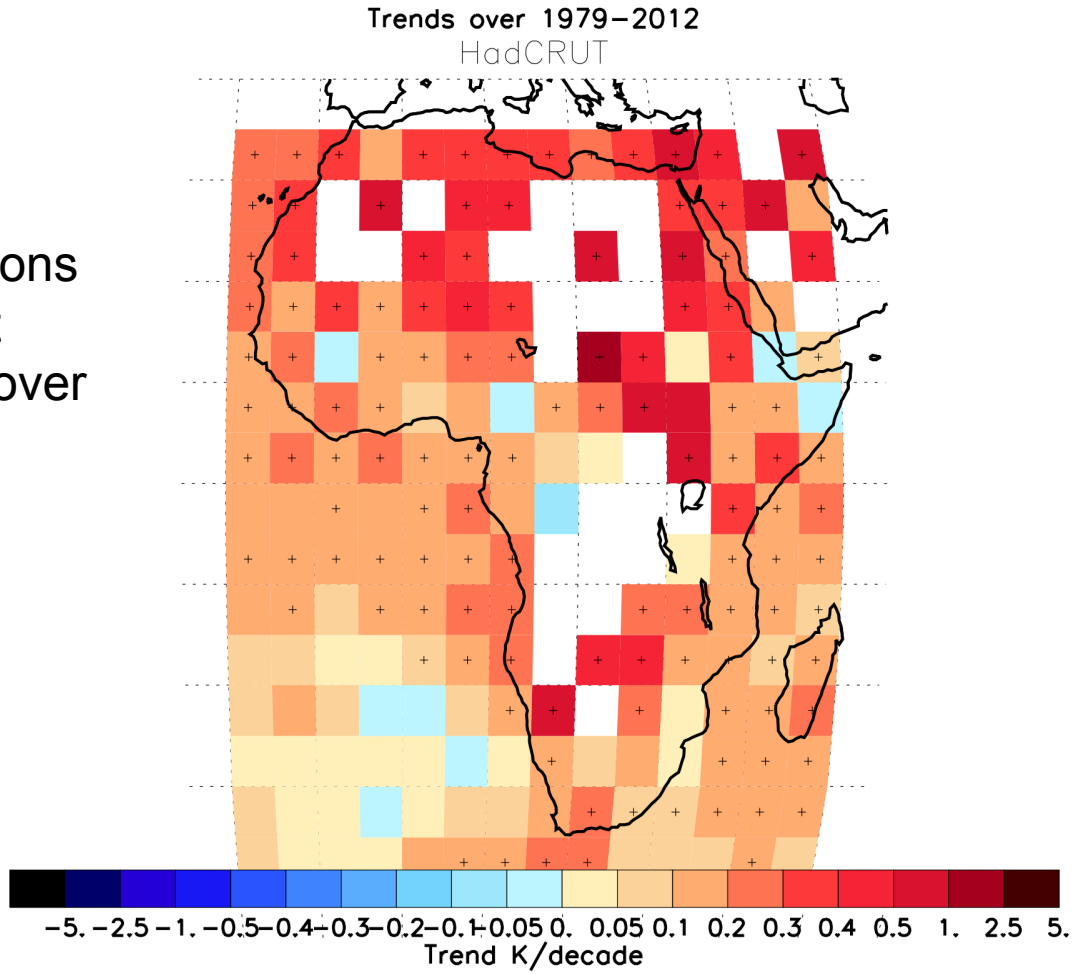
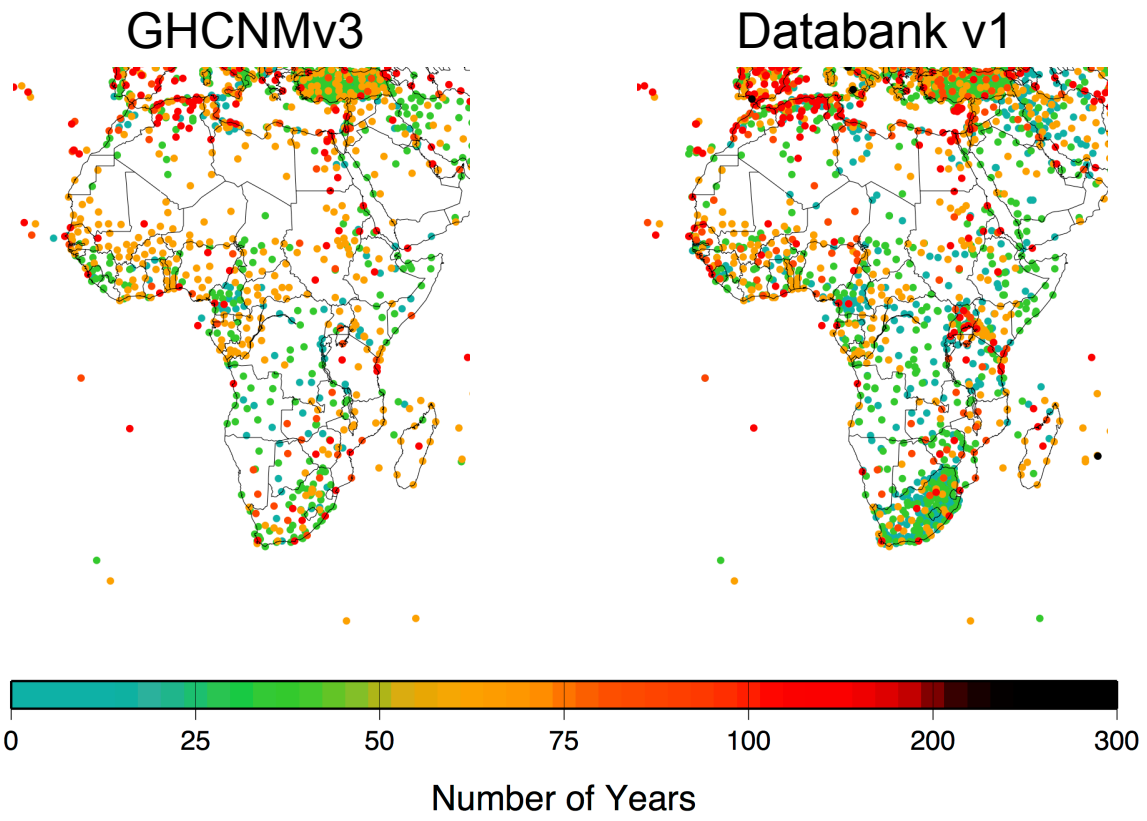
Direct observations constraint is not complete even over this period



Data Innovations

Come see Jared's poster ☺



Summary

- Data sparse land areas are a challenge for land surface air temperature characterisation whether you undertake traditional analyses or make recourse to reanalyses
- Biggest single benefit would be access to more data to base analyses off
  - Of course, in many cases the data do not exist
- Reanalyses, particularly post-1979, show good pan-African agreement in surface temperatures both with each other and with HadCRUT4 median estimate
- We can and shall improve both traditional analyses and reanalyses within this domain as part of ongoing or planned activities.