Climate Change 2013: The Physical Science Basis

Working Group I contribution to the IPCC Fifth Assessment Report

Observing Temperature Change

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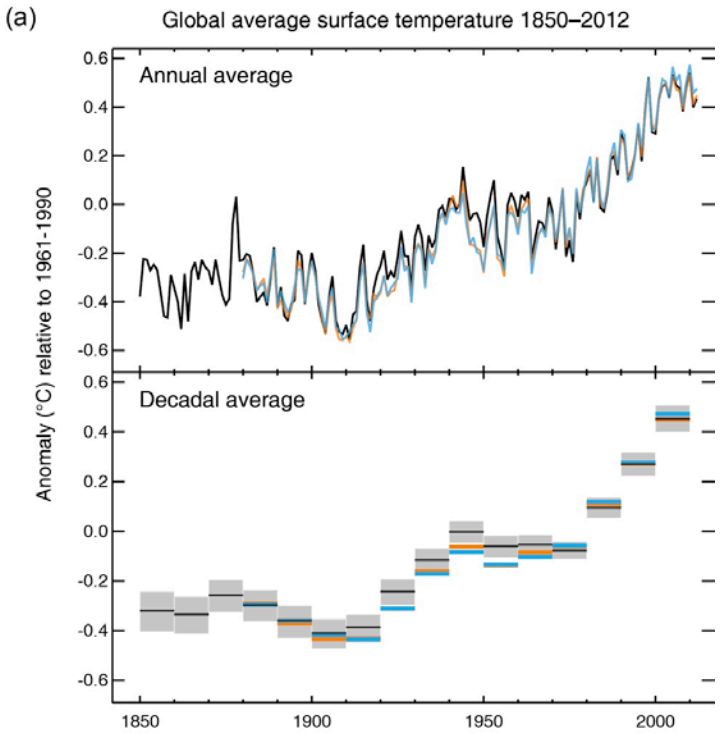
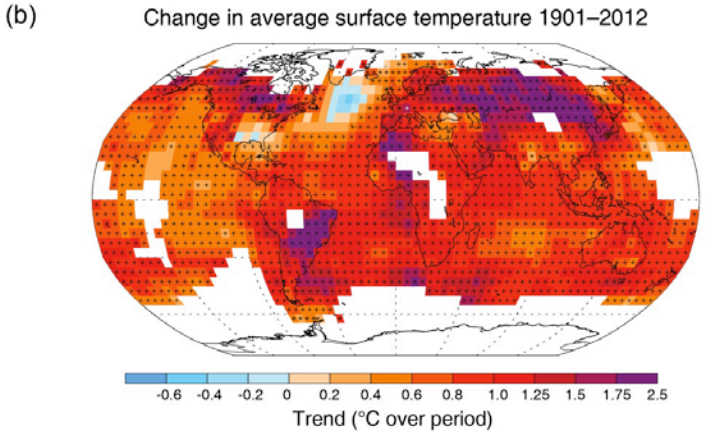
Chapter 2: Observations of Atmosphere and Surface

SPM Figure 1





Three global land and ocean annual mean temperature series are shown

Why decadal averages?
Why uncertainty ranges (gray boxes) are shown only for one data set.

For regional trends only one data set is shown.

Why show 3 data sets?

Construction of data sets is not a simple process of averaging.

- Historical measurements over both land and oceans have changed dramatically over time
  - Spatial locations / observational density
  - Instrumentation
  - Methods of observation
- Three data sets were constructed using different approaches to these challenges

Combined Land and Ocean Surface Temperature Data Sets

HadCRUT4 - Hadley Center and Climatic Research Unit Temperature version 4 (HadCRUT4)

NOAA/NCDC MLOST – NOAA/NCDC Merged Land and Ocean Surface Temperature Analysis (MLOST)

NASA GISS - NASA Goddard Institute of Space Studies Surface Temperature Analysis (GISTEMP: GISS)

Three data sets are consistent in showing warming. Annual means agree very well since about 1970.

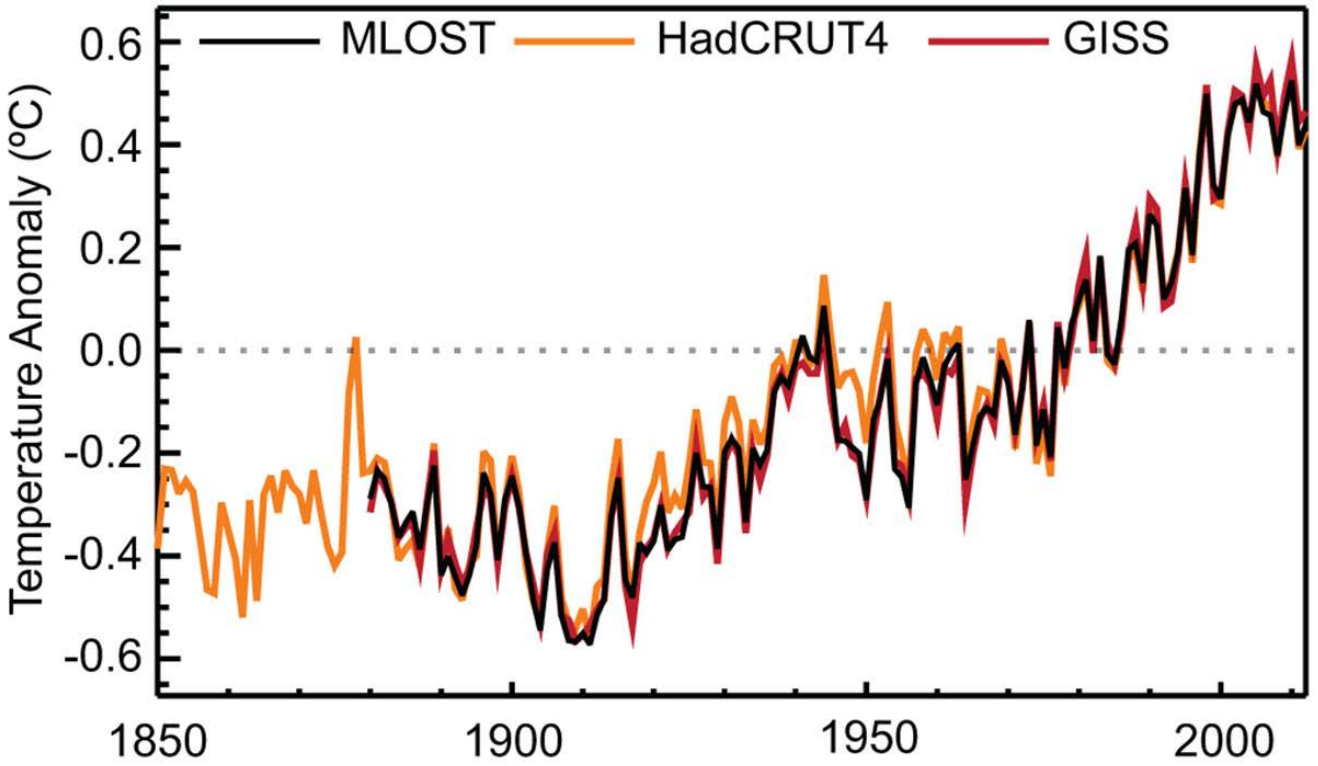


Figure 2-20

Land Surface Air Temperature and Sea Surface Temperature also have several global and annual data sets developed using different methods.

Land Surface Air Temperature

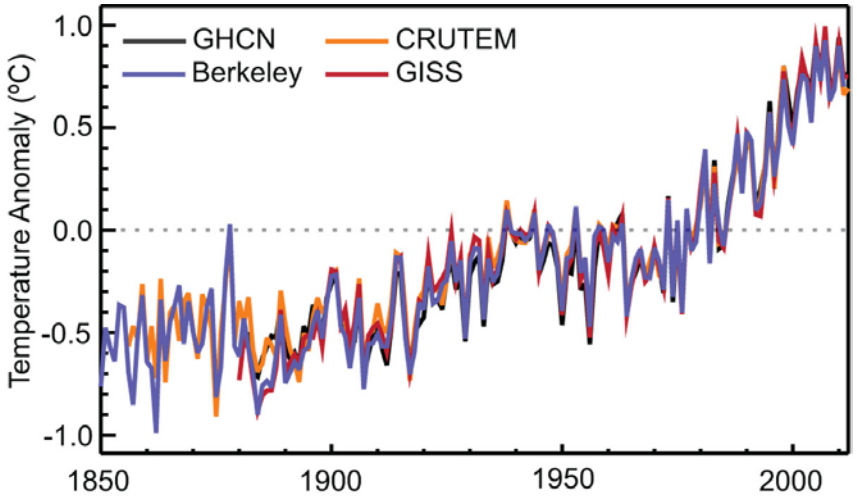


Figure 2-14

Sea Surface Temperature

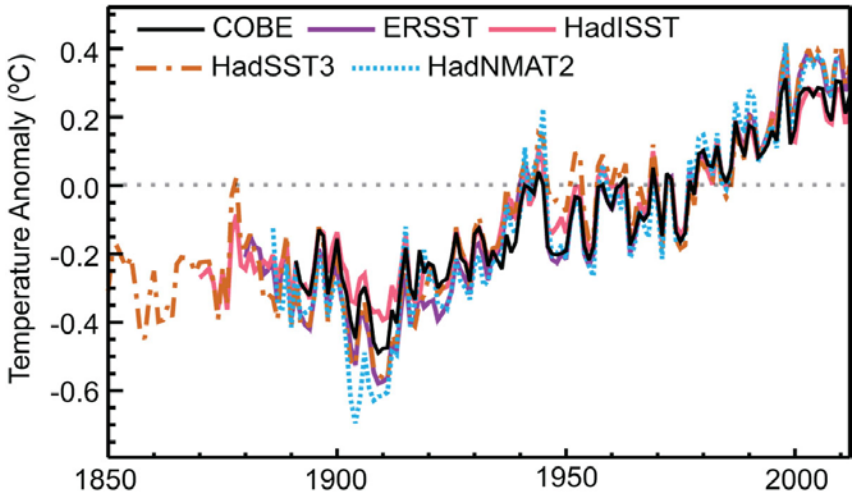
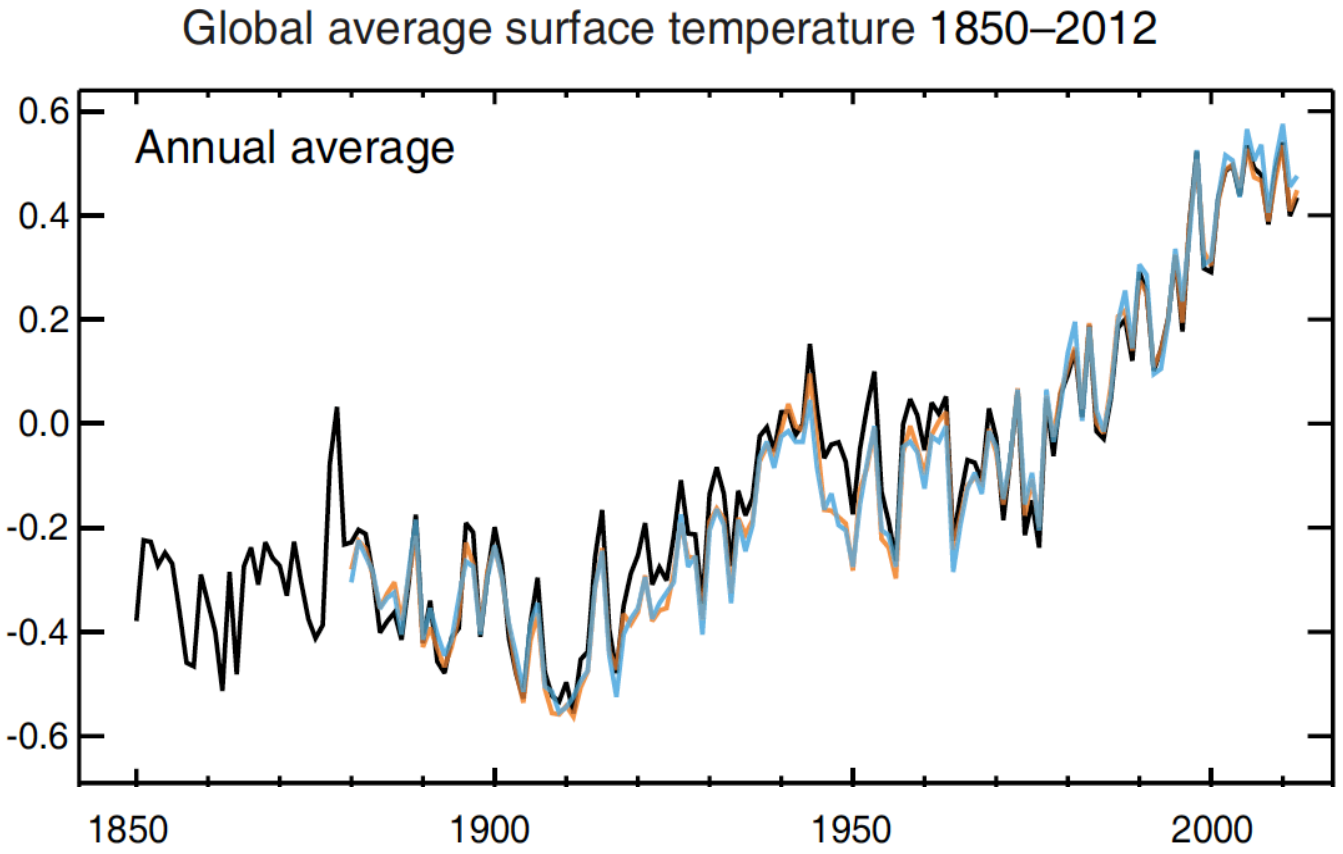


Figure 2-18

Assessment of uncertainty in annual global means is also done differently by the three groups.

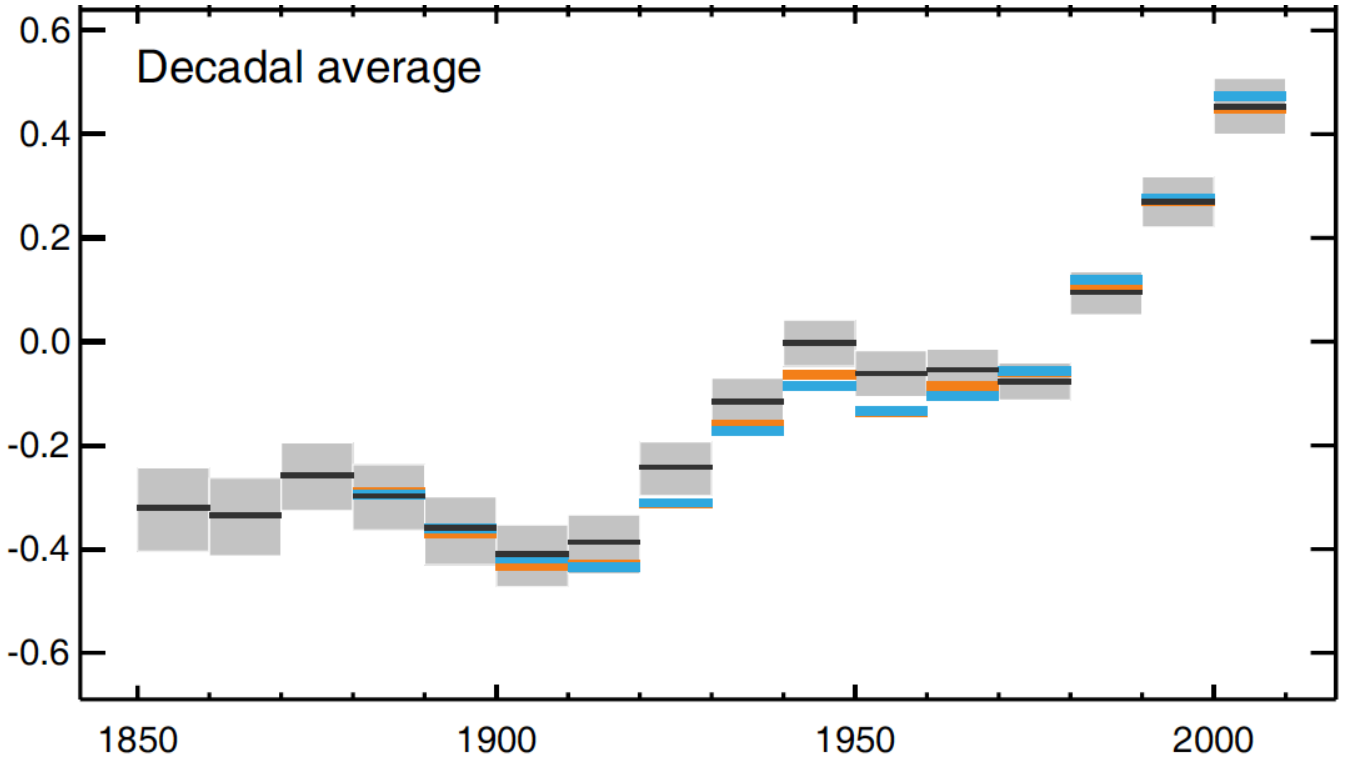
Source / facet of uncertainty	HadCRUT4	NCDC MLOST	NASA GISS
Uncertainty model well documented	Yes	Yes	**No**
Spatial completeness effects quantified	Yes	Yes	Yes?
Marine adjustment uncertainties	Yes (particularly post-1942)	Only before 1942	**No**
Land adjustment uncertainties	Yes	**No**	**No**
Random sampling effects	Yes	Partially (implicit in spatial completeness)	**No**
Quantified global mean timeseries uncertainties available	Yes	Yes	**No**

Annual Global Combined Land and Sea Temperature



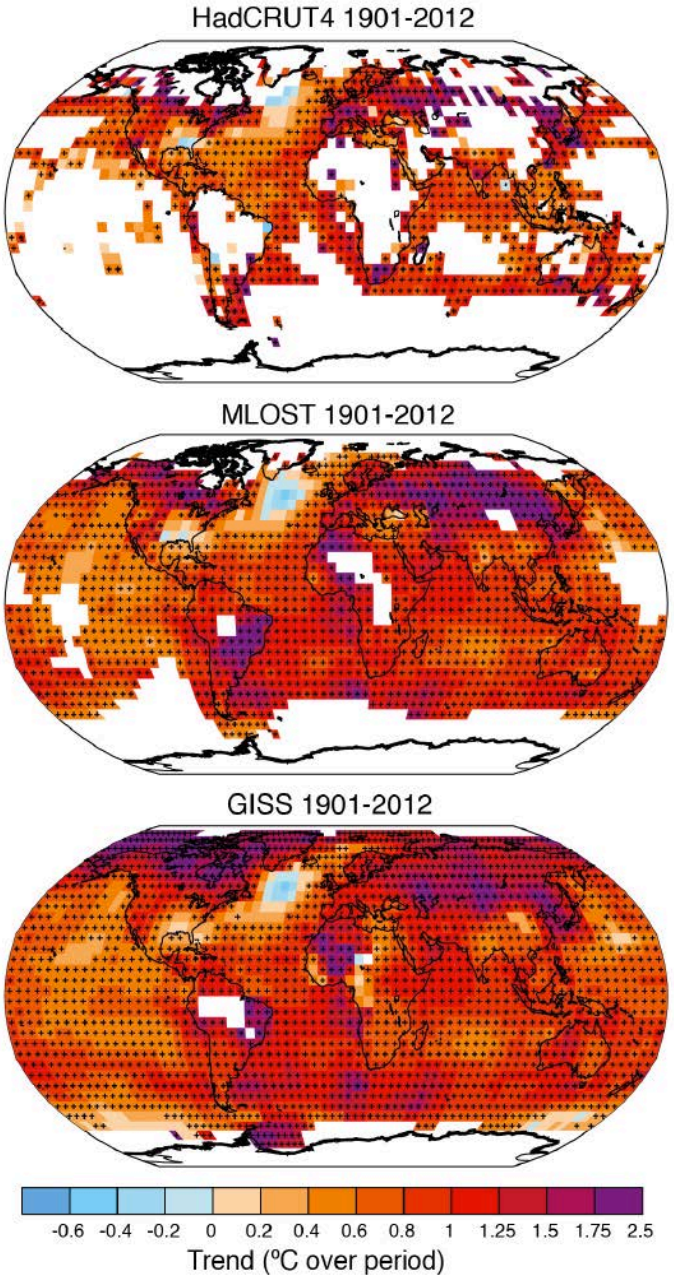
HadCRUT4 (black), MLOST(orange) and GISS (blue) are shown.

Decadal Means with Uncertainty: Average over year-to-year variations and focus on longer time scales.



HadCRUT4 (black), MLOST(orange) and GISS (blue) are shown.

Grey shading indicates HadCRUT4 parametric uncertainty.



Spatial interpolation

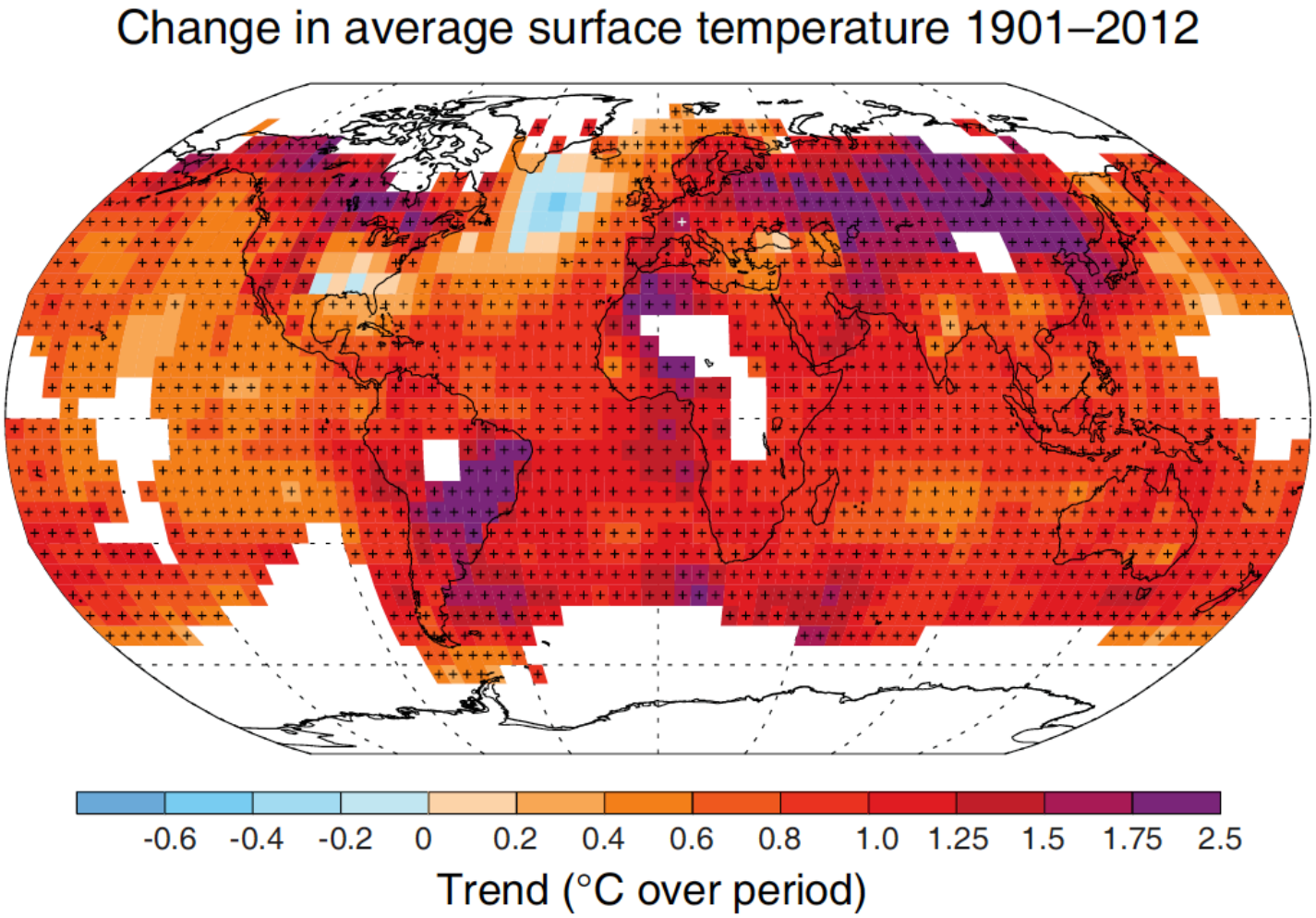
No Interpolation

Interpolation using observed spatial structures

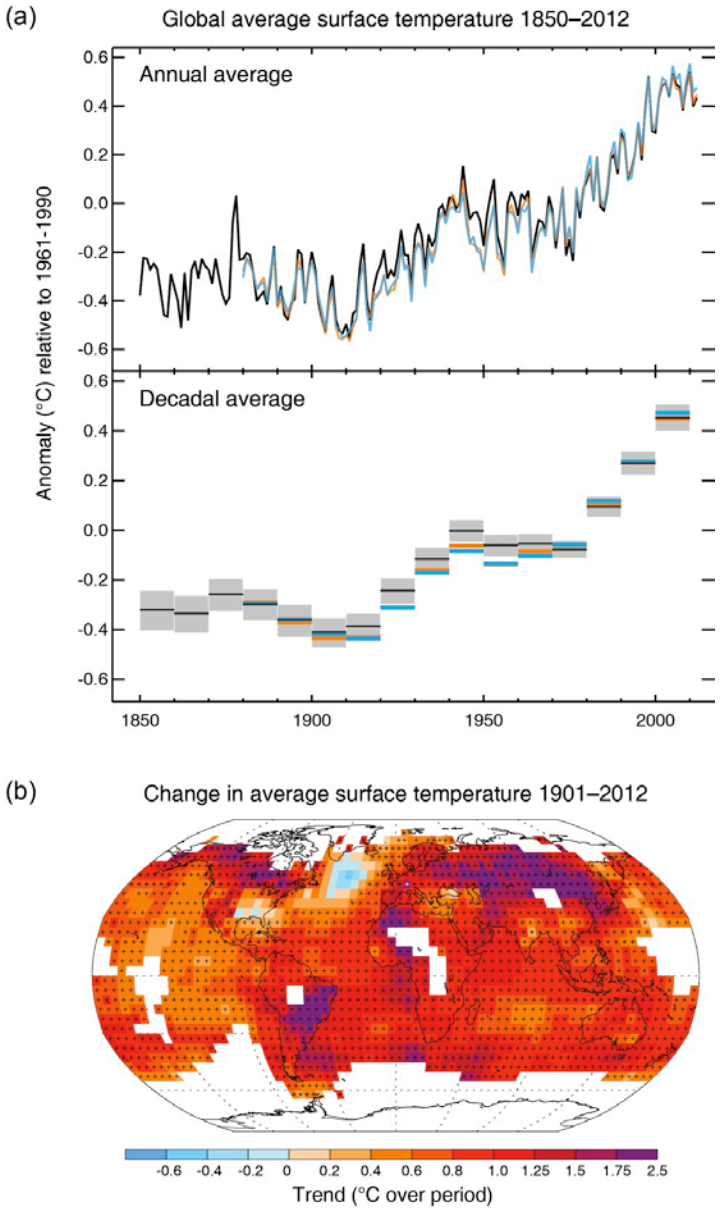
More Interpolation

Figure TS.2 and 2.21

Geographical variations of surface temperature trends
SPM Figure-1 shows only MLOST data



SPM: Figure 1



- We show multiple global annual mean surface temperature data sets – conclusions not sensitive to method.
- We show decadal averages to emphasize longer period change over year-to-year fluctuations.
- We show decadal uncertainty estimates for the data set with the most advanced uncertainty estimates.
- We show geographic distribution of surface temperature change for the data set with most physically-based spatial interpolation.
- Chapter 2 in full report shows much more detail for all data sets.

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Further Information

www.climatechange2013.org

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INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP