Climate Data Records from Space

Chris Merchant
School of Geosciences, University of Edinburgh

STABILITY OF OBSERVATIONS

Stability = constancy of accuracy over time

Crucial for work related to long-term trends or amplitude of variability (e.g., seasonal)

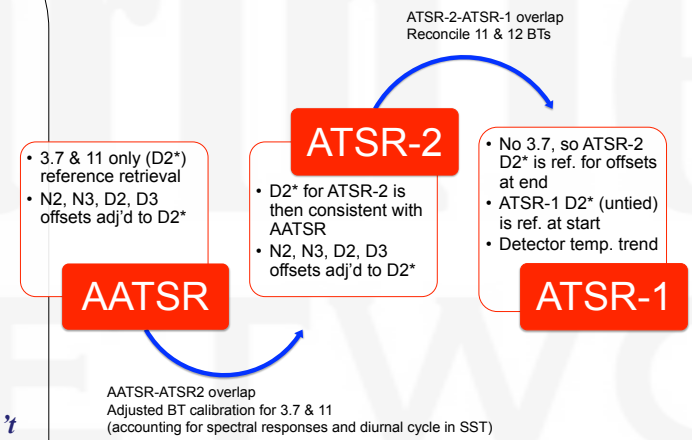
Requires "Climate Data Record" producer to

- **HOMOGENISE TIMESERIES OVER A SERIES OF SENSORS**
- **MINIMIZE DIURNAL CYCLE ALIASING**
- **QUANTIFY STABILITY (TREND ERROR DISTRIBUTION)**

Personal opinion no. 1:
Without these measures, it might be a useful data set, but shouldn't be described as a "climate data record"

Personal opinion no. 2:
Without these measures, it isn't justified to make strong assertions about climatic trends based on the data set

HOMOGENEITY MEASURES IN ATSR REPROCESSING FOR CLIMATE (ARC SST)



The ARC SST project produced an SST timeseries from the Along Track Scanning Radiometers

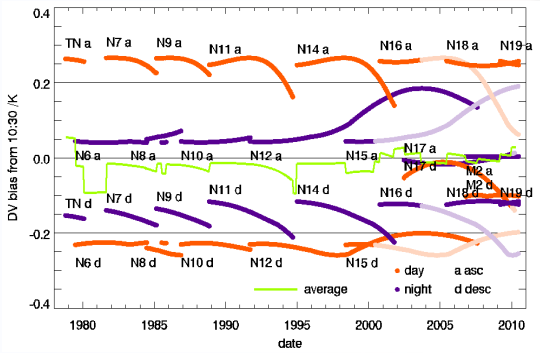
Targets: 0.1 K accuracy all regions, stability within ±5 mK/yr

Available from **neodc.nerc.ac.uk**

Being extended in time in ESA Climate Change Initiative

Owen Embury made record homogeneous **at Brightness Temperature level** (not SST, ask us why) using overlap periods between sensors (see figure on left)

WHY WOULD DIURNAL CYCLE MATTER?



The overpass time of satellites is not necessarily constant

Sampling a different part of diurnal cycle can therefore introduce climatologically relevant trends, as (left, green line) in AVHRR SSTs

For land or lakes, the effect would be larger

Using only day or night data for a trend will also increase the alias

QUANTIFYING STABILITY AND TREND ERRORS

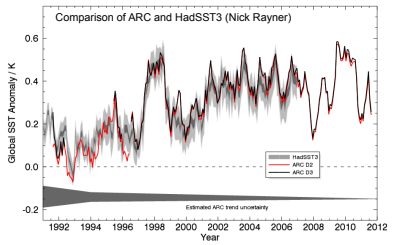
Region	Period	Time of day	Trend / mK yr^{-1}	95% conf. int. / mK yr^{-1}
Tropics	1993 - end	Day	-0.6	-2.6 < trend < 1.5
Tropics	1993 - end	Night	1.0	-1.4 < trend < 3.4

For ARC SSTs, Dave Berry quantified the stability (i.e., the trend error distribution in the timeseries) by looking at de-seasonalised discrepancies between ARC SST 1 m and GTMBA (results left).

The lack of verfied-stable reference sites for ocean and lakes is an issue here. GTMBA seems to be the best, possibly only, option for the 1990s to present.

When calculating a trend from the global ARC SST anomaly (right), for example, the uncertainty in the trend is not just the "fitting error" (purely statistical), but should correctly include the observational contribution – the degree to which the steps to calibrate and homogenise the record are themselves uncertain over the length of the record

This latter component is too often neglected in the literature!



QUESTION: how should observational trend uncertainty be represented? Does the representation above work for you?