WCRP Grand Challenge on Extremes data
February 25th Sydney Australia

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science for a changing world

Climate and Land Use Change
Earth Resources Observation and Science (EROS) Center

African Regional Data Issues

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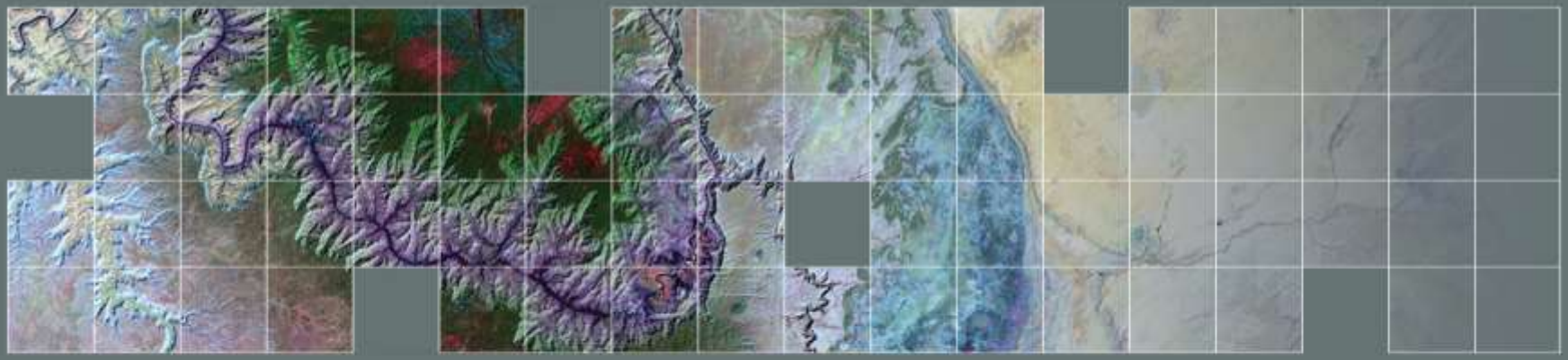


U.S. Department of the Interior
U.S. Geological Survey

FEWS NET
FAMINE EARLY WARNING SYSTEMS NETWORK

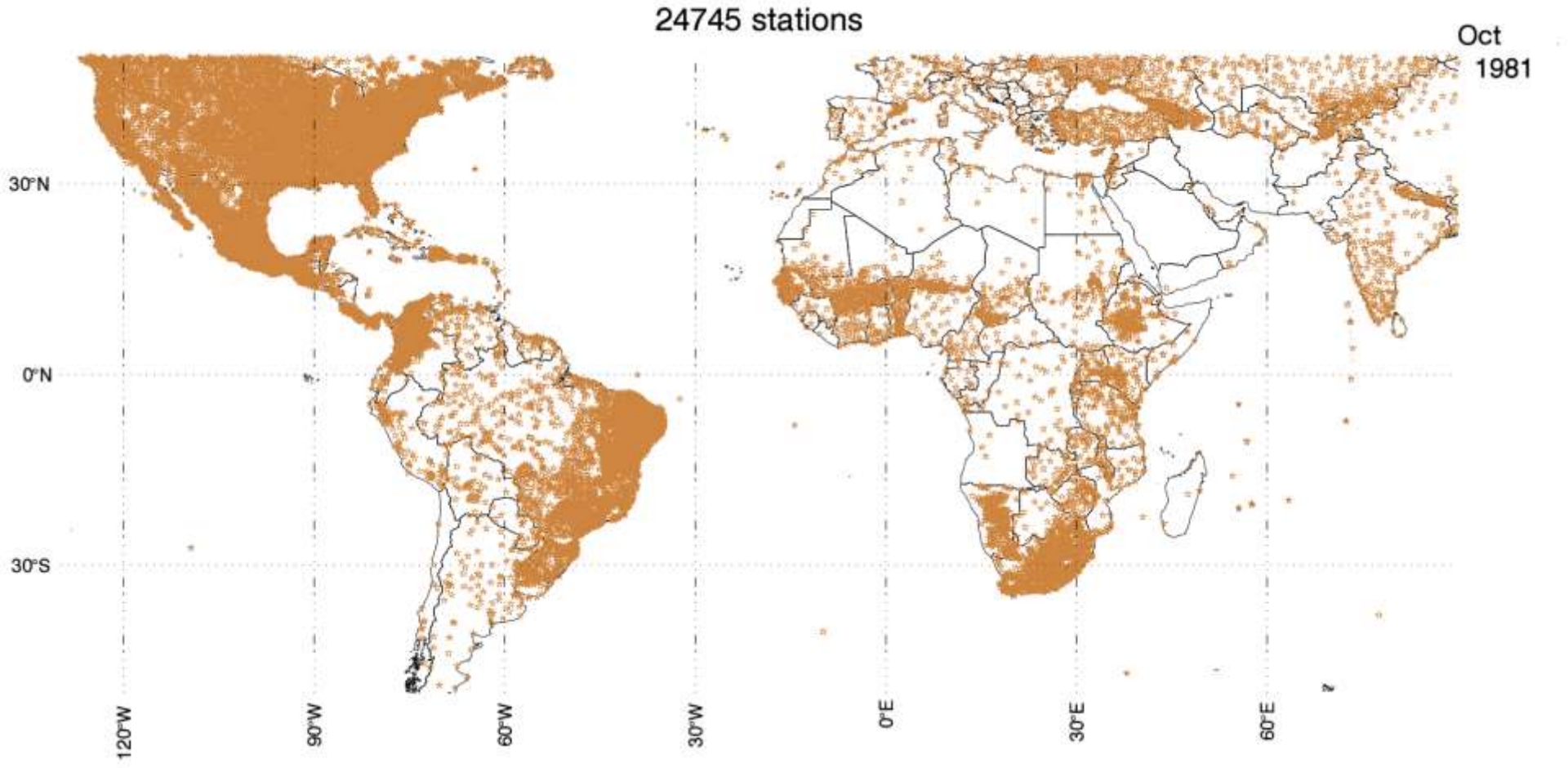
USAID
FROM THE AMERICAN PEOPLE

CHG | Climate Hazards Group

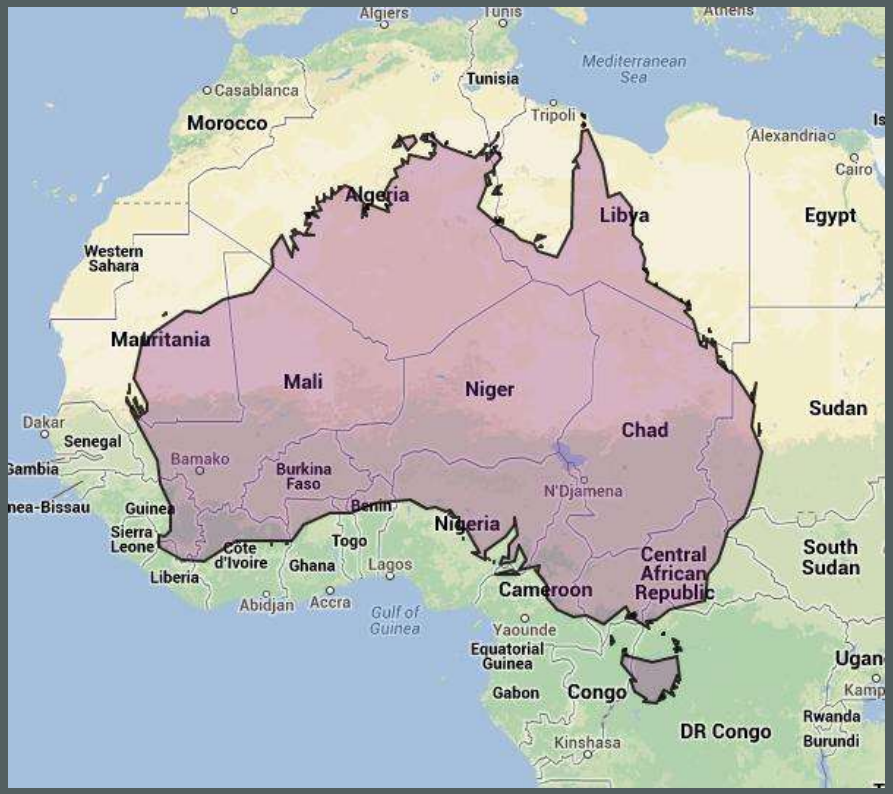
Background and caveats

- We work for the Famine Early Warning Systems Network
- We have a lot of experience with near real time monitoring
- We have some experience building (trying to build) African climate data sets, mostly rainfall, but …..
- Discussing all of Africa, on any topic, is challenging and there will be many differences between countries

CHIRPS Stations



Africa is huge ….



Africa : 30.22 million km²
Australia: 7.692 million km²

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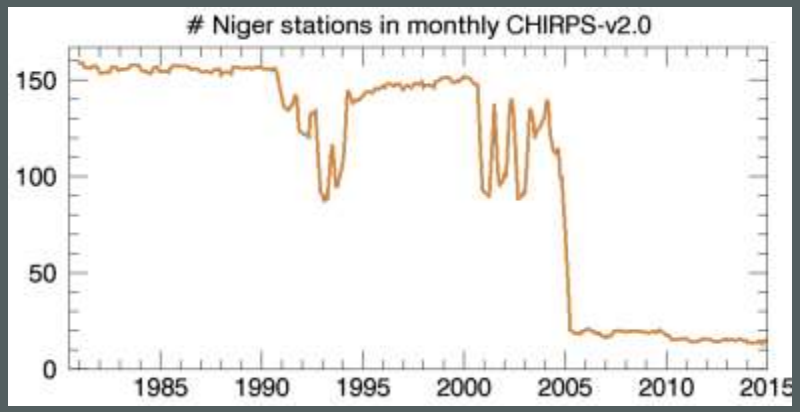
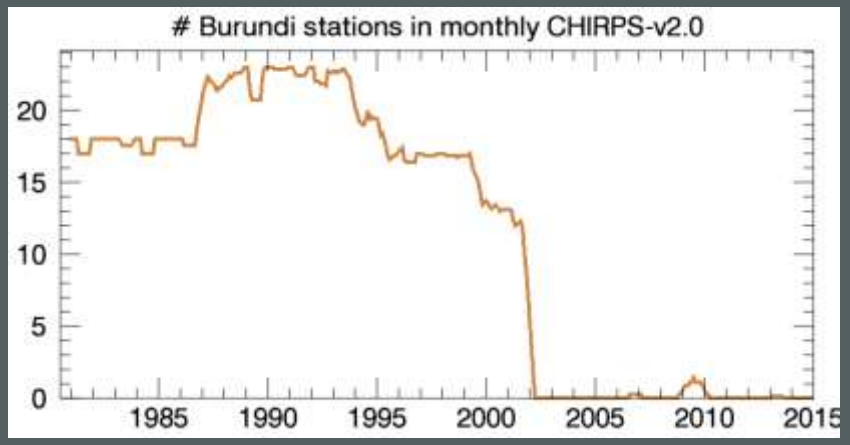
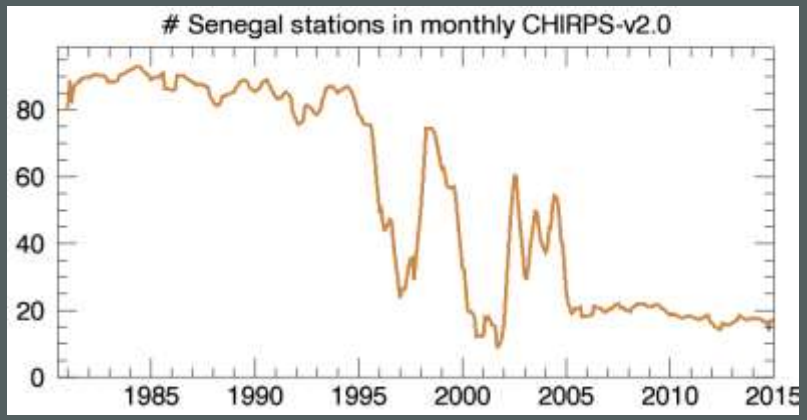
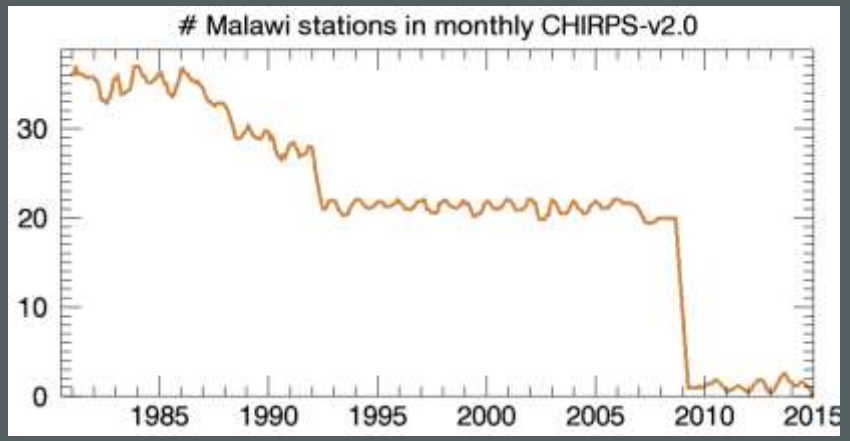
And recent reporting is very poor









http://chg.geog.ucsb.edu/data/chirps/stations/index.html

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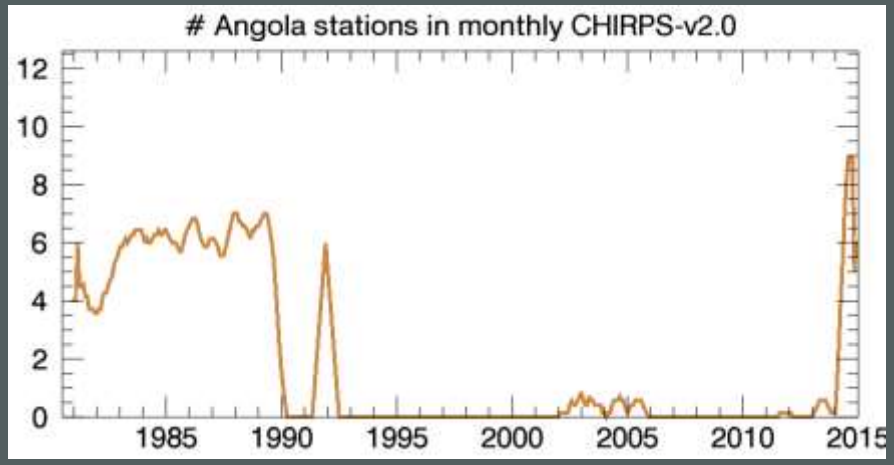
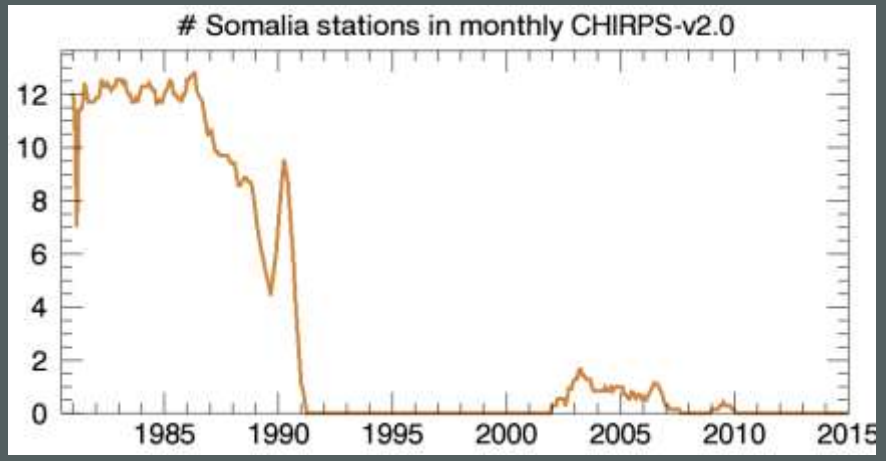
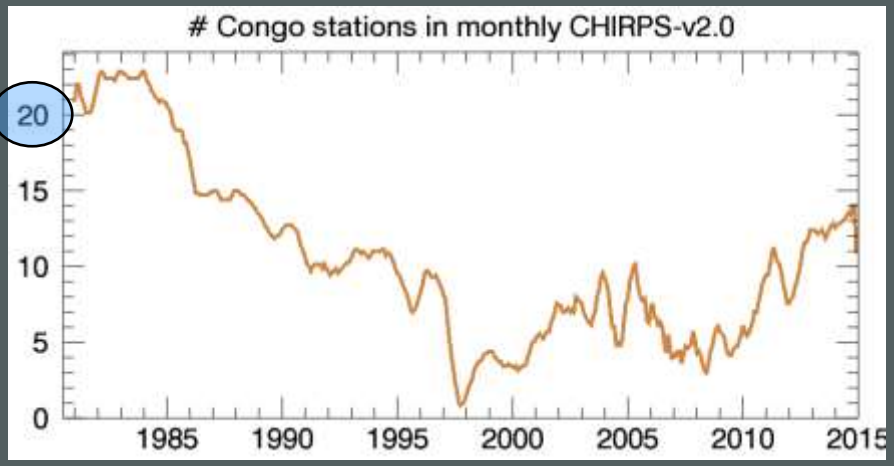
And for some countries there is essentially no data







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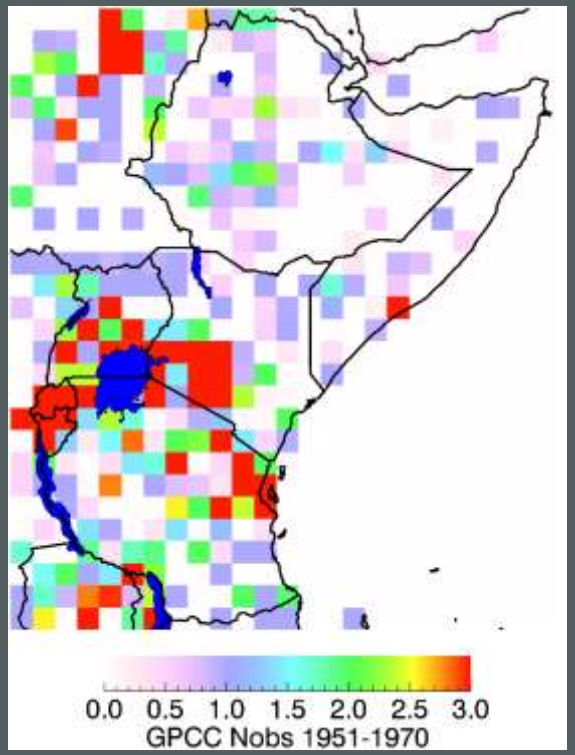
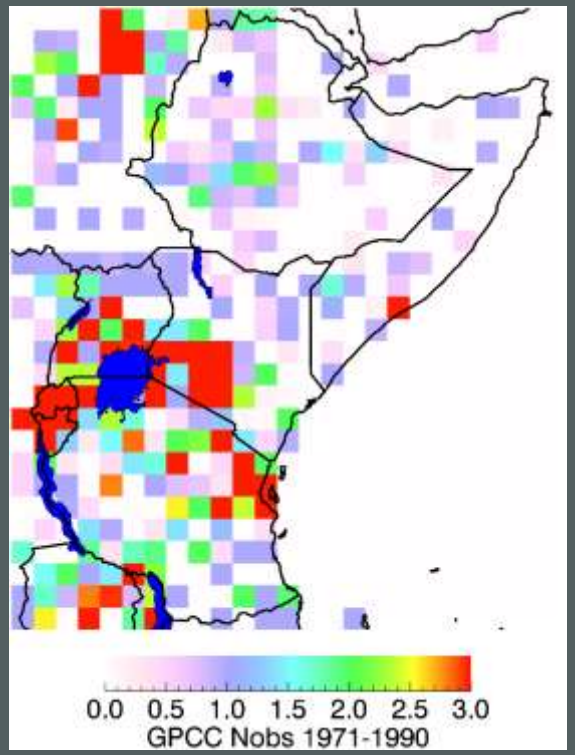
Some countries' data policies are becoming more 'intricate'

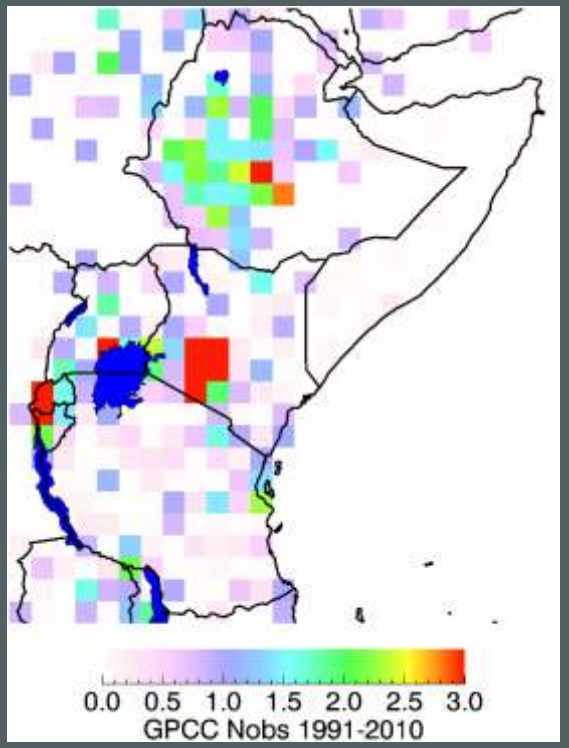
" … I recently learned an amazing story around rainfall data that took place here in [country X]. In country X the national early warning system (EWS) is attached to the Prime Minister's office. In order to get some analysis done EWS had the Prime Minister (the second highest position in the country) to write to the Met agency asking them to provide EWS with the data it needed. The met agency replied that its data are to be purchased but not to be released for free even to other Government institutions. Well, I'm telling you this anecdote just to illustrate how intricate the rainfall data issue has become….."

From an email I received this morning ….

The use of gridded data sets can obscure the lack of station data … 1







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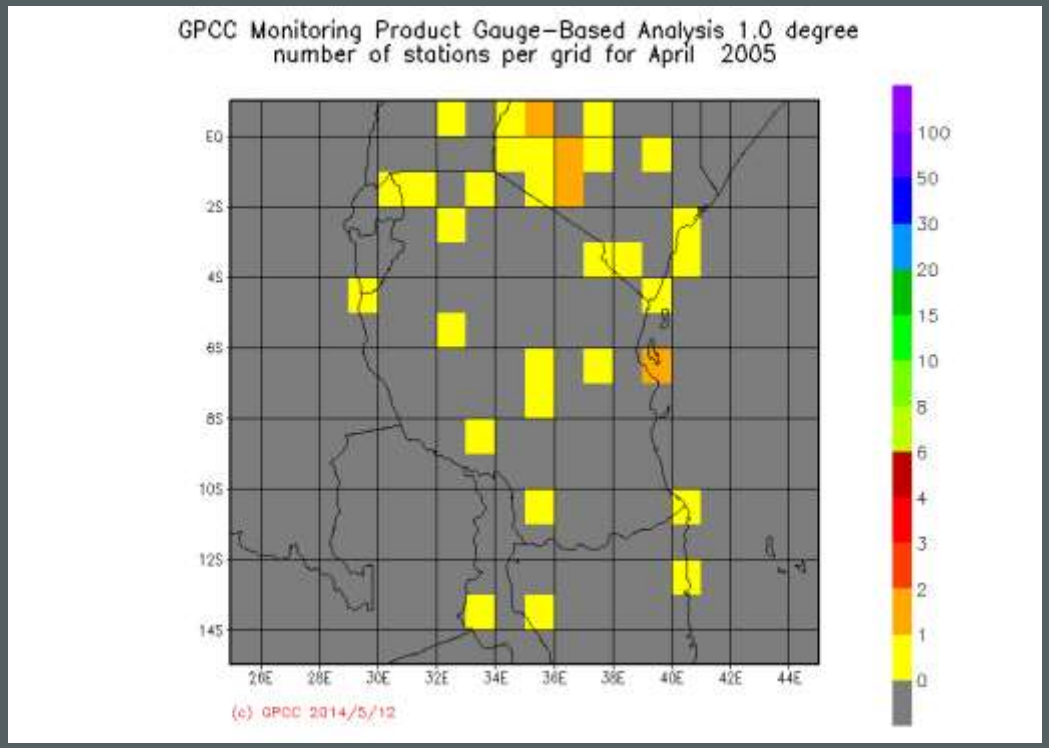
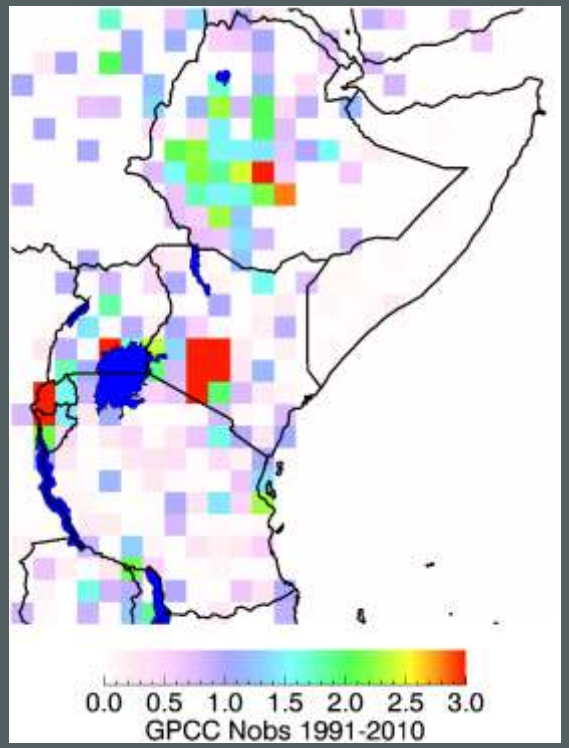
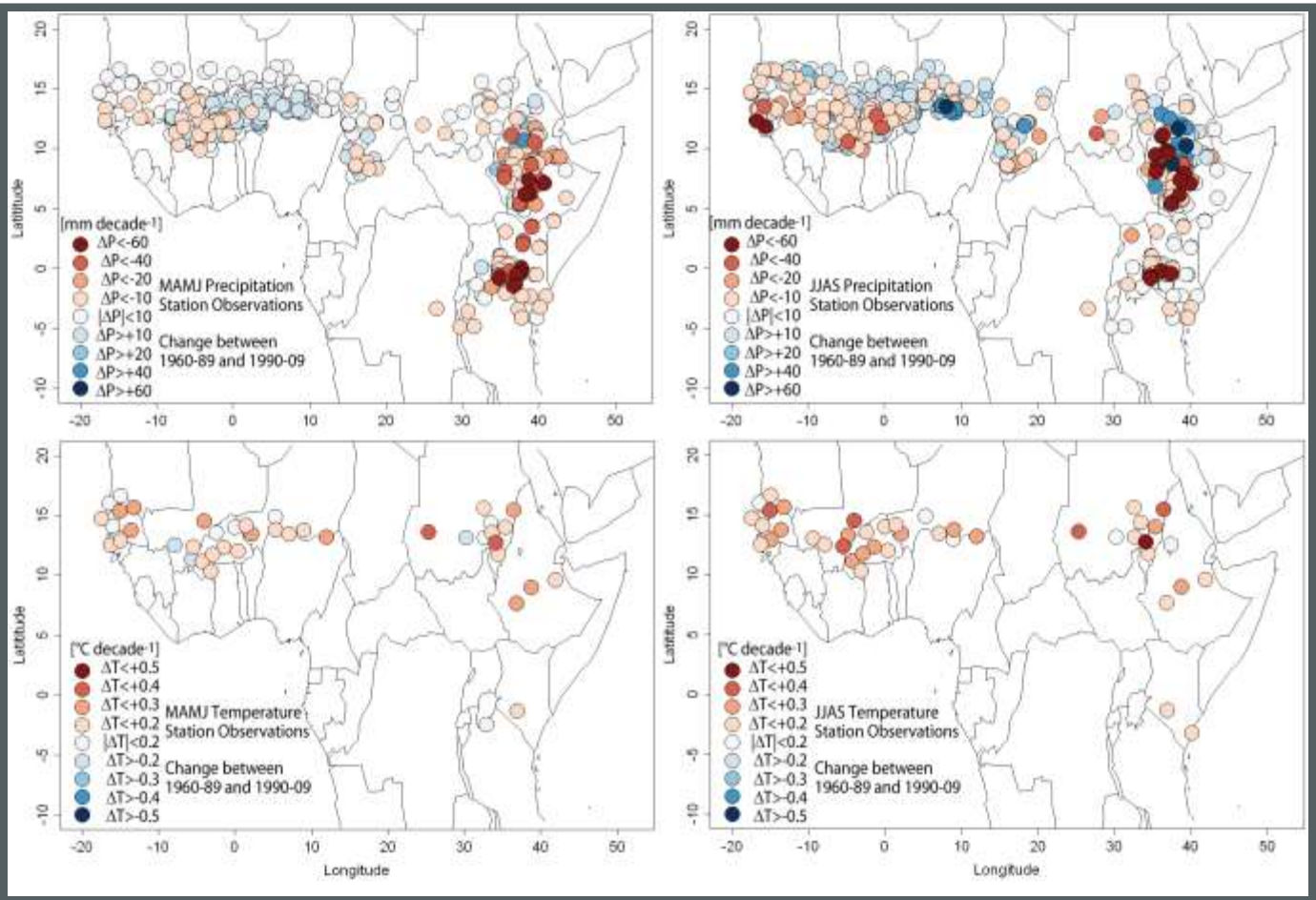
The use of gridded data sets can obscure the lack of station data …2





The situation for air temperature observations is even more dire



Funk et al. (2012) Mapping recent decadal climate variations …

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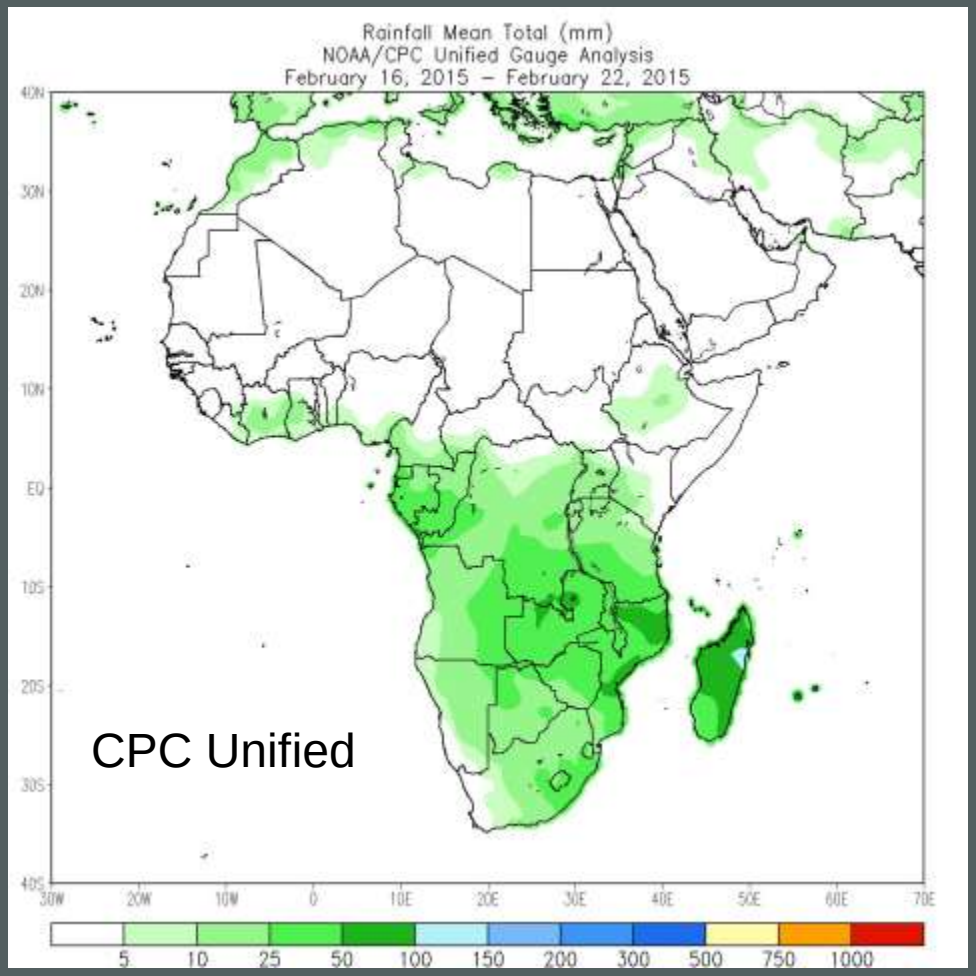
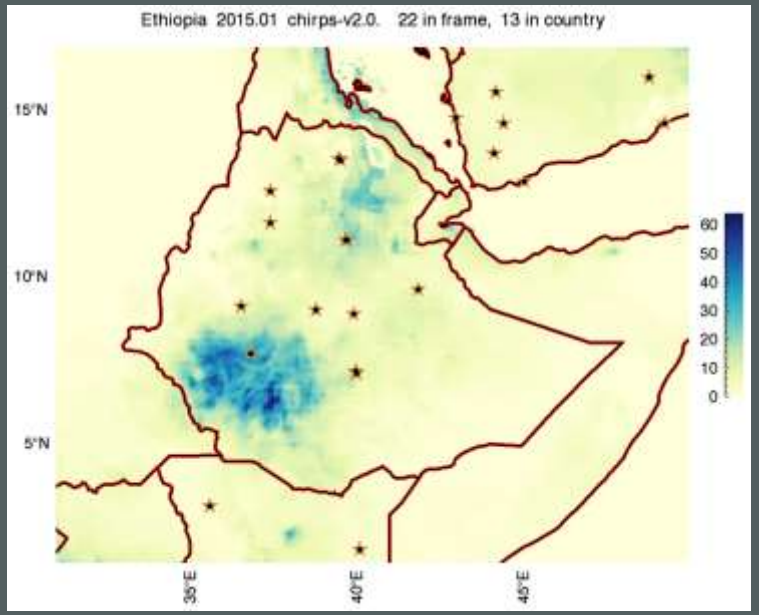
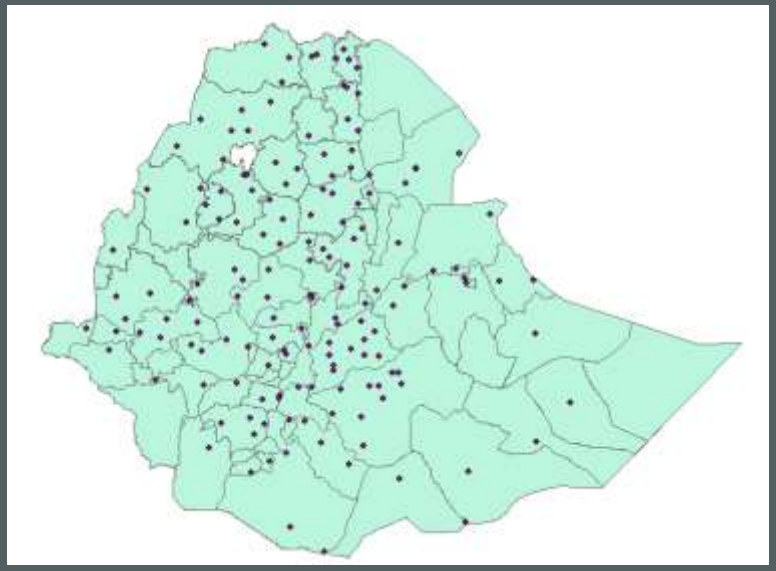
GTS Station density is very low

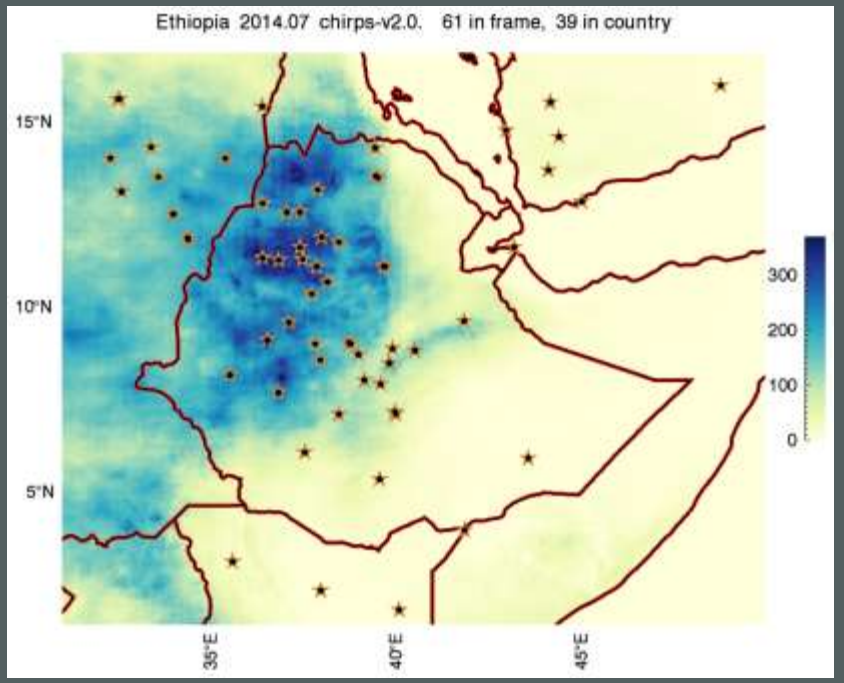




Typically many more stations are available at the country level



Number of Stations Available July 2014



GHCN/GTS Stations July 2014

Global data sources …

- **GHCN Monthly**
  - Often runs out in past ten years
- **GHCN Daily**
  - Often runs out in past ten years
- **GSOD**
  - Potential BIG PROBLEM with missing data coded as zero
- **GTS**
  - Potential BIG PROBLEM with missing data coded as zero

Comparison of GHCN and national station archive densities

	1900-1920	1921-1940	1941-1960	1961-1980	1981-1999	2000-2014
Tanzania CenTrend	13	76	125	209	162	64
GHCN	7	47	63	111	53	4
Kenya CenTrend	26	43	62	146	127	62
GHCN	11	19	24	85	43	3
Ethiopia CenTrend	4	6	9	112	176	164
GHCN	4	6	9	63	41	4
Uganda CenTrend	13	22	55	67	42	8
GHCN	8	13	49	50	17	0
Rwanda CenTrend	1	16	29	56	51	5
GHCN	0	1	2	1	1	0
Burundi CenTrend	0	7	10	18	23	3
GHCN	0	1	2	1	2	0
Eritrea CenTrend	2	4	8	6	2	0
GHCN	2	4	8	6	2	0
Somalia CenTrend	4	25	21	20	10	0
GCHN	2	19	16	14	6	0
Total CenTrend	63	199	319	634	593	306
GHCN	34	110	173	331	165	11

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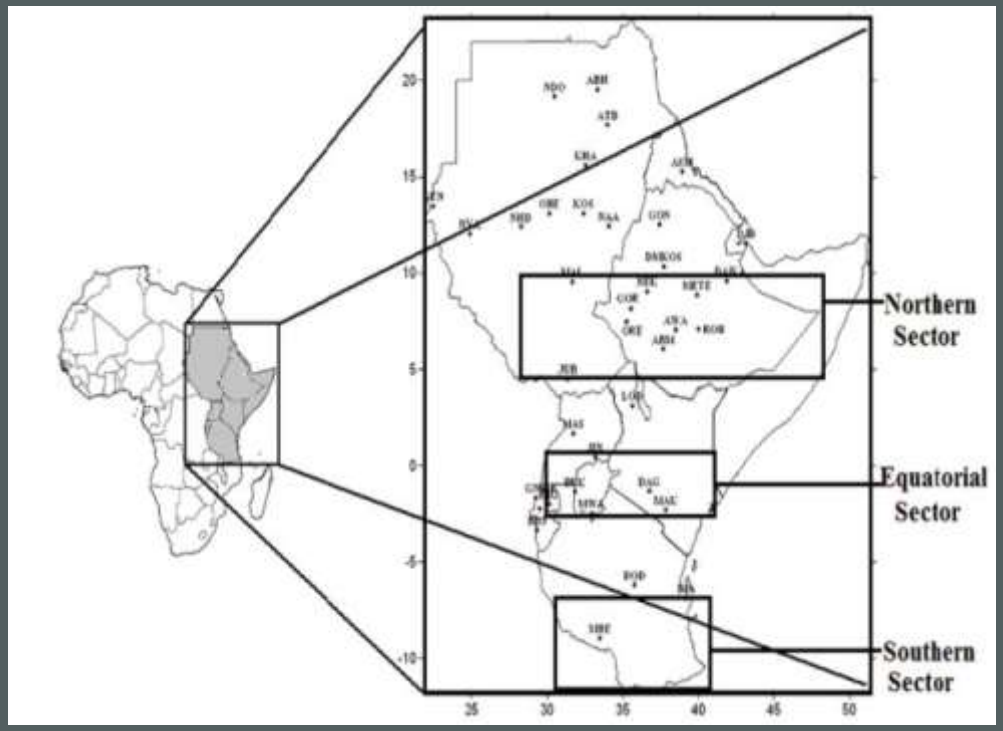
Example – Extremes study by Philip Omondi-I



Stations used in study

Omondi et al. (2013) Changes in temperature and precipitation extremes over the Greater Horn of Africa region from 1961 to 2010, IJOC.

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Example – Extremes study by Philip Omondi-II

Table II. List of the ETCCDI indices used in this study.

ID	Indicator name	Description	Units
FD*	Frost days	Count of days where TN (daily minimum temperature) < 0 °C	d
SU	Summer days	Count of days where TX (daily maximum temperature) > 25 °C	d
ID	Icing days	Count of days where TX < 0 °C	d
TR	Tropical nights	Count of days where TN > 20 °C	d
GSL*	Growing season length	Annual count of days between first span of at least six days where TG (daily mean temperature) > 5 °C and first span in second half of the year of at least six days where TG < 5 °C.	d
TXx		Monthly maximum value of daily maximum temperature	°C
TNx		Monthly maximum value of daily minimum temperature	°C
TXn		Monthly minimum value of daily maximum temperature	°C
TNn		Monthly minimum value of daily minimum temperature	°C
TN10p	Cold nights	Count of days where TN < 10th percentile	%
TX10p	Cold day-times	Count of days where TX < 10th percentile	%
TN90p*	Warm nights	Count of days where TN > 90th percentile	%
TX90p	Warm day-times	Count of days where TX > 90th percentile	%
WSDI*	Warm spell duration index	Count of days in a span of at least six days where TX > 90th percentile	%
CSDI	Cold spell duration index	Count of days in a span of at least six days where TN > 10th percentile	d
DTR	Diurnal temperature range	Mean difference between TX and TN (°C)	
RX1day	maximum 1-d Precipitation	Highest precipitation amount in 1-d period	mm
RX5day*	Maximum 5-d Precipitation	Highest precipitation amount in 5-d period	mm
SDII*	Simple daily intensity index	Mean precipitation amount on a wet day	mm
R10mm*	Heavy precipitation days	Count of days where RR (daily precipitation amount) ≥ 10 mm	d
R20mm	Very heavy precipitation days	Count of days where RR ≥ 20 mm	d
R_{nn}mm		Count of days where RR ≥ user-defined threshold in mm	d
CDD*	Consecutive dry days	Maximum length of dry spell (RR < 1 mm)	d
CWD	Consecutive wet days	Maximum length of wet spell (RR ≥ 1 mm)	d
R95p TOT*		Precipitation due to very wet days (>95th percentile)	mm
R99pTOT		Precipitation due to extremely wet days (>99th percentile)	mm
PRCPTOT		Total precipitation in wet days (>1 mm)	mm

Very hard to get daily to support the calculation of these indices.

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Example – Extremes study by Philip Omondi-III

Table III. Regional trends in temperature indices.[a]

Index	Guinea	Central Africa	Zimbabwe	Global	Kenya	Ethiopia	Units
Warmest day	**0.14**	**0.25**	0.15	**0.21**	**0.35**	0.11	°C/decade
Warmest night	**0.17**	**0.21**	0.10	**0.30**	0.17	**0.33**	°C/decade
Coldest day	**0.23**	**0.13**	0.00	0.37	0.02	0.10	°C/decade
Coldest night	0.04	**0.23**	0.02	**0.71**	**0.21**	**0.32**	°C/decade
DTR	0.12	0.00	0.11	−0.08	0.22	0.61	°C/decade
Cold Night frequency	−0.21	**−1.71**	**−1.24**	**−1.26**	**−1.10**	**−1.23**	% of days in a year/decade
Cold Day frequency	**−2.15**	**−1.22**	**−1.05**	**−0.62**	**−1.6**	**−1.0**	% of days in a year/decade
Warm night frequency	**1.19**	**3.24**	0.71	**1.58**	**1.44**	**2.14**	% of days in a year/decade
Warm day frequency	**1.56**	**2.87**	**1.86**	**0.89**	**1.07**	0.65	% of days in a year/decade

[a]The trends for the globe area from Alexander *et al*. (2006) and Caesar *et al*. (2010) based on the time period 1955–2003. A trend significant at the 5% level is marked with bold font.

Omondi et al. (2013) Changes in temperature and precipitation extremes over the Greater Horn of Africa region from 1961 to 2010, IJOC.

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Summary-I

- It is extremely difficult to apply standard extreme indices, based on daily data, at regional scales in Africa
- The paucity of temperature observations is extreme
- The flow of national met data into either standard WMO channels (GHCN, GSOD, GTS) or regional centers (AGRHYMET, ICPAC, SADC Climate Services Center) has slowed dramatically over the past decade

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Summary-II

- The technical infrastructure (internet, compute environment) in many weather and climate institutions is often insufficient.
- Data policies vary dramatically country by country. Charging for data is fairly standard, but the cost can vary greatly.
- The good news is that there is often quite a lot of data held by met agencies.
- Collectively, our community needs to develop better incentives for effective data sharing.

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