WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Climate data sources (Global, Regional and National)

Ernest Afiesimama
WMO Regional Office for Africa

WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

Method and data sets

All data sets and their use are subject to licence or permission even if from an open source. Please consult the appropriate data download pages for appropriate support.

TEMPERATURE

- ***Gridded data***

Six data sets were used in the calculation of regional temperature. Regional mean temperature anomalies were calculated relative to 1961–1990 and 1991–2020 baselines using the following steps:

- ***In situ data***

Temperature in situ data are provided by National Meteorological and Hydrological Services.

The following six data sets were used:

BERKELEY EARTH

Rohde, R. A.; Hausfather, Z. The Berkeley Earth Land/Ocean Temperature Record. *Earth System Science Data* **2020**, *12*, 3469–3479. https://doi.org/10.5194/essd-12-3469-2020.

ERA5

Hersbach, H.; Bell, B.; Berrisford, P. et al. The ERA5 Global Reanalysis. *Quarterly Journal of the Royal Meteorological Society* **2020**, *146* (730), 1999–2049. https://doi.org/10.1002/qj.3803.

Bell, B., Hersbach, H., Simmons, A., Berrisford, P., Dahlgren, P., Horányi, A., et al. (2021) The ERA5 global reanalysis: Preliminary extension to 1950. Q J R Meteorol Soc, 147 741, 4186-4227. https://doi.org/10.1002/qj.4174.

GISTEMP V4

GISTEMP Team, 2022: *GISS Surface Temperature Analysis (GISTEMP), version 4*. NASA Goddard Institute for Space Studies, https://data.giss.nasa.gov/gistemp/. Lenssen, N.; Schmidt, G.; Hansen, J. et al. Improvements in the GISTEMP Uncertainty Model. *Journal of Geophysical Research: Atmospheres* **2019**, *124* (12), 6307–6326. https://doi.org/10.1029/2018JD029522.

HADCRUT5 ANALYSIS

Morice, C. P.; Kennedy, J. J.; Rayner, N. A. et al. An Updated Assessment of Near-Surface Temperature Change From 1850: The HadCRUT5 Data Set. *Journal of Geophysical Research: Atmospheres* **2021**, *126* (3), e2019JD032361. https://doi.org/10.1029/2019JD032361.

JRA-55

Kobayashi, S.; Ota, Y.; Harada, Y. et al. The JRA-55 Reanalysis: General Specifications and Basic Characteristics. *Journal of the Meteorological Society of Japan*. Ser. II **2015**, *93* (1), 5–48. https://doi.org/10.2151/jmsj.2015-001, https://www.jstage.jst.go.jp/article/jmsj/93/1/93_2015-001/_article.

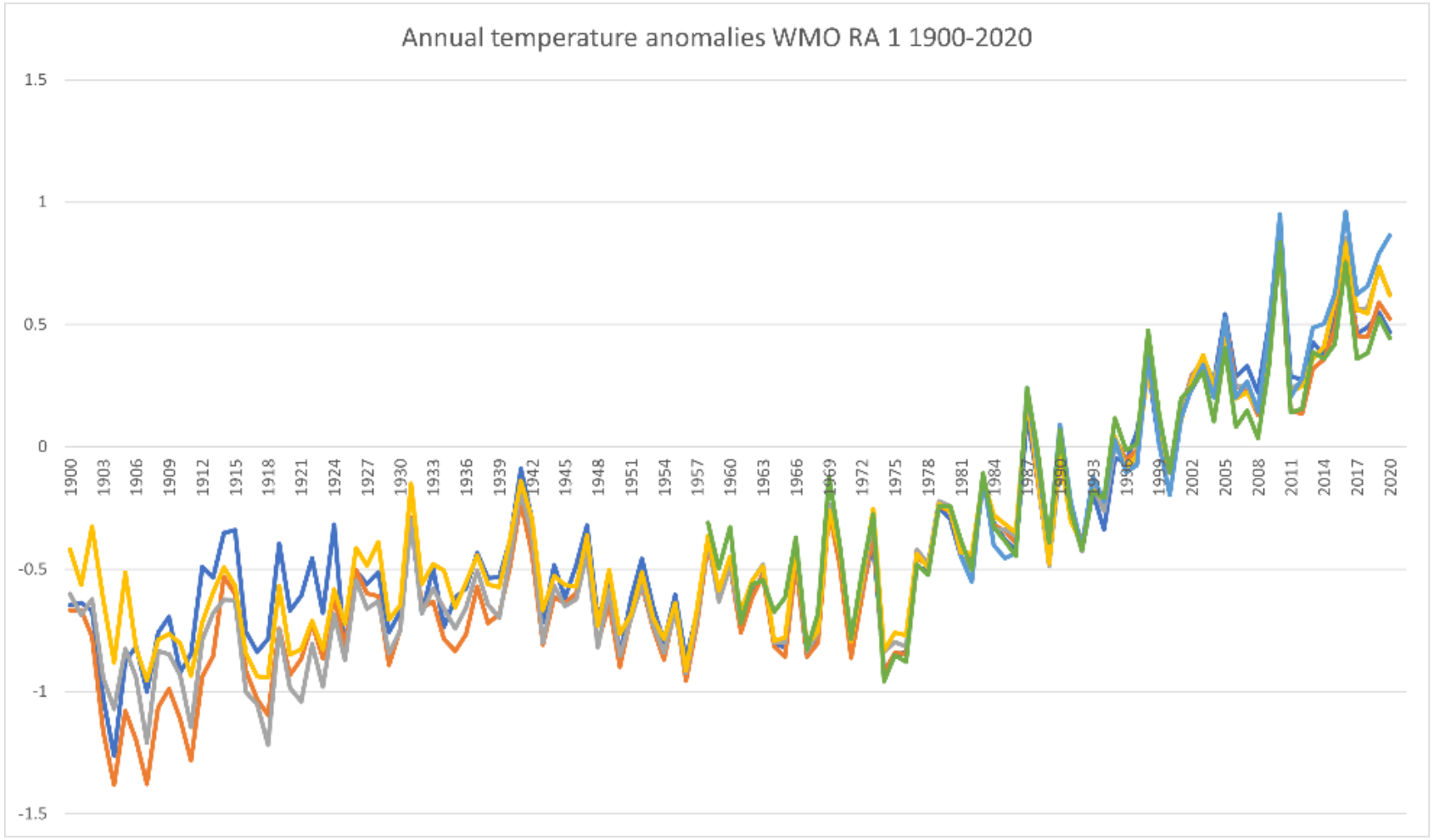
NOAAGLOBALTEMP

Huang, B.; Menne, M. J.; Boyer, T. et al. Uncertainty Estimates for Sea Surface Temperature and Land Surface Air Temperature in NOAAGlobalTemp Version 5. *Journal of Climate* **2020**, *33* (4), 1351–1379. https://doi.org/10.1175/JCLI-D-19-0395.1.

Zhang, Huai-Min, Jay H. Lawrimore, Boyin Huang, Matthew J. Menne, Xungang Yin, Ahira Sánchez-Lugo, Byron E. Gleason, Russell Vose, Derek Arndt, J. Jared Rennie, and Claude N. Williams. (2019) Updated Temperature Data Give a Sharper View of Climate Trends. Eos, 100, https://doi.org/10.1029/2019EO128229.

Interpretation

- Combine with other estimates calculated the same way
- Agreement between different data sets
- Long-term change
- Year-to-year variability (e.g. associated with El Niño)
- Rankings and context



Method and data sets

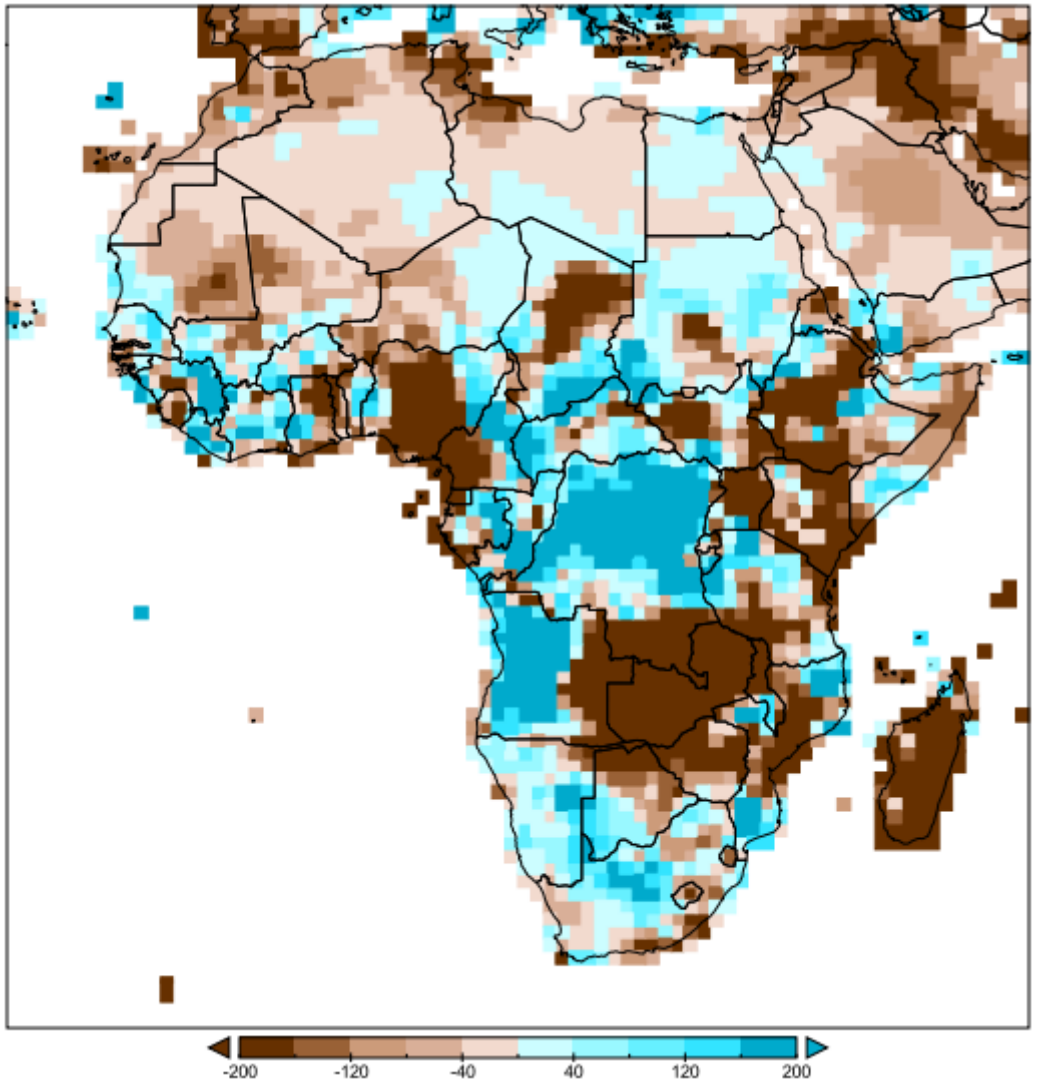
PRECIPITATION

- ***Gridded data***

Schneider, U.; Becker, A.; Finger, P. et al. 2020. GPCC Monitoring Product: Near Real-Time Monthly Land-Surface Precipitation from Rain-Gauges based on SYNOP and CLIMAT data. DOI: 10.5676/DWD_GPCC/MP_M_V2020_100. http://dx.doi.org/10.5676/DWD_GPCC/MP_M_V2020_100.

- ***In situ data***

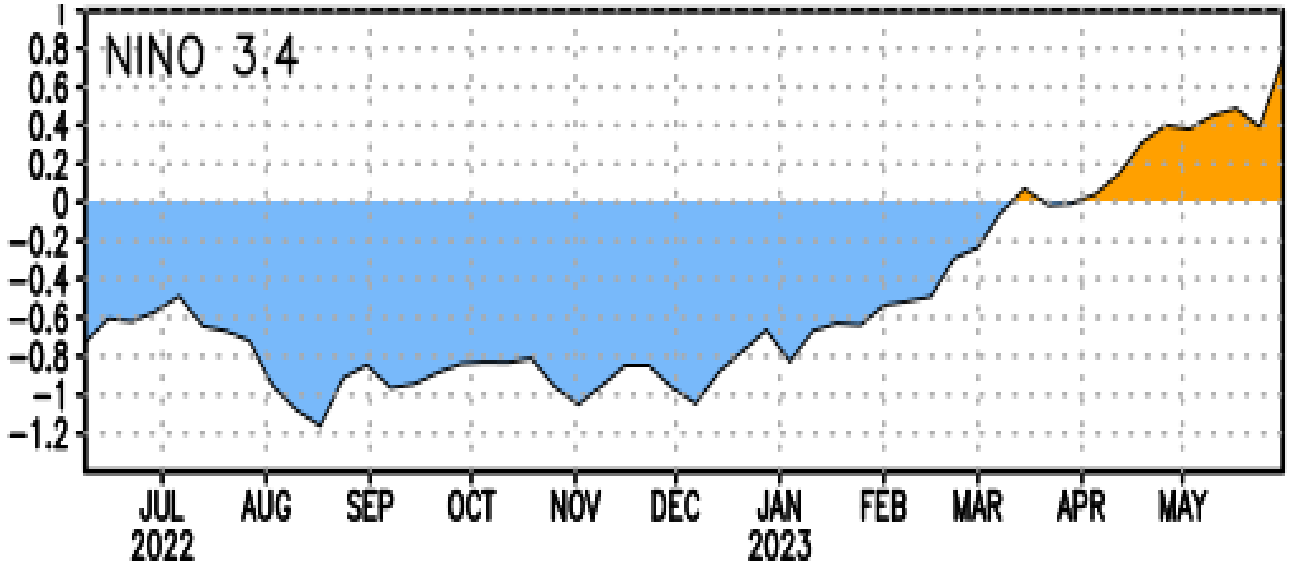
Precipitation in situ data are provided by National Meteorological and Hydrological Services.



Method and data sets

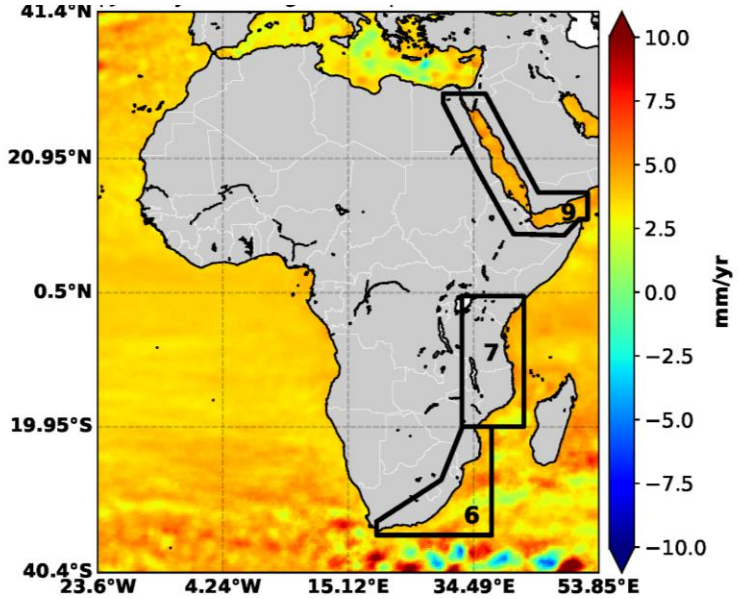
SEA-SURFACE TEMPERATURE

Reynolds, R. W.; Rayner, N. A.; Smith, T. M. et al. An Improved In Situ and Satellite SST Analysis for Climate. *Journal of Climate* **2002**, *15*, 1609-1625. https://doi.org/10.1175/1520-0442(2002)015<1609:AIISAS>2.0.CO;2.
Data: NOAA NCEP EMC CMB GLOBAL Reyn_SmithOIv2 monthly sst (columbia.edu).



SEA LEVEL

Guérou, A., Meyssignac, B., Prandi, P., Ablain, M., Ribes, A., and Bignalet-Cazalet, F.: Current observed global mean sea level rise and acceleration estimated from satellite altimetry and the associated uncertainty, Ocean Sciences, https://doi.org/10.5194/egusphere-2022-330, 2022.



Method and data sets

EM-DAT data

EM-DAT data were used for historical climate impact calculations: www.emdat.be.

EM-DAT is a global database on natural and technological disasters, containing essential core data on the occurrence and effects of more than 21 000 disasters in the world, from 1900 to the present.

EM-DAT is maintained by the Centre for Research on the Epidemiology of Disasters (CRED) at the School of Public Health of the Université catholique de Louvain located in Brussels, Belgium.

The indicators used for mortality, number of people affected, and economic damage are total deaths, number affected and total damages ('000 USD), respectively.

Calculating the regional average temperature

- Aim: to calculate the average temperature anomaly for WMO RA I from a global temperature data set

- The baseline will be 1991-2020
- Using the HadCRUT5 data set as an example
- The process is the same for other data sets and for other baselines
- Using the Python programming language to do the calculation
- To run the code you will need to install Python and a number of packages

Download and store the data and code

- We will be using HadCRUT5 as an example.
- The files needed are in this zip file, which you will need to unzip:
  - https://www.metoffice.gov.uk/hadobs/monitoring/regional/workshop.zip
- Copy the following files into a single directory:
  - `landmask_1x1.nc`
  - `WMO_RAs.shp`
  - `WMO_RAs.dbf`
  - `WMO_RAs.prj`
  - `WMO_RAs.qpj`
  - `WMO_RAs.shp.xml`
  - `WMO_RAs.shx`
  - `pycontinent.py`
  - `HadCRUT.5.0.1.0.analysis.anomalies.ensemble_mean.nc`
- To run the code type `python pycontinent.py`

General tools for climate data analysis

For processing global temperature data sets

need something that can process NetCDF data

NetCDF is a standard data format

https://www.unidata.ucar.edu/software/netcdf/

Portable – data generated using NetCDF can be easily used

There are lots of tools to work with it

Calculation of indices

- See also CLIMPACT
- https://climpact-sci.org/
- Originally based on ETCCDI indices and software
- https://www.wcrp-climate.org/etccdi
- Calculates a set of “extremes” indices based on daily temperature and precipitation data

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Thank you

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