WMO Consultation on climate data homogenization

Use case from: *NMHS Madagascar*

Contact:

Luc Yannick Andréas RANDRIAMAROLAZA (PhD)
PR of Madagascar with the WMO
Director General of DGM
randriamarolaza.luc@gmail.com

WORLD METEOROLOGICAL ORGANIZATION

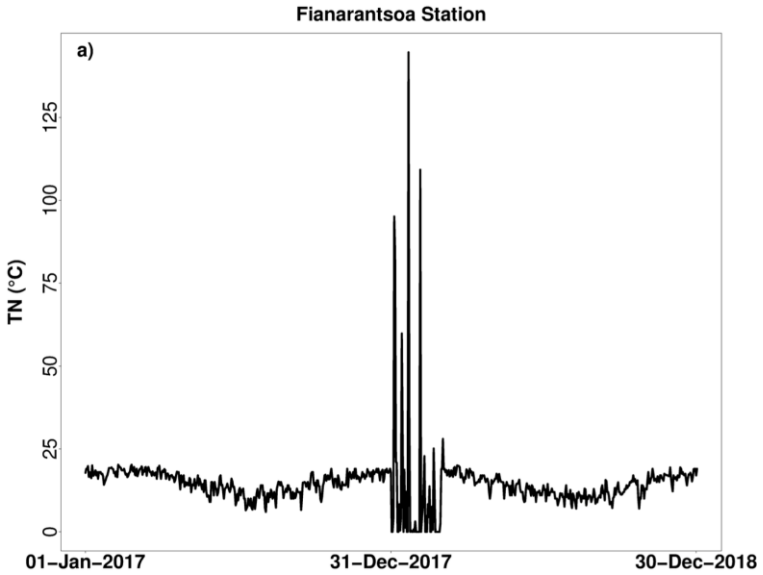
1950-2025 SCIENCE for ACTION

Date: *26/Sep/2025*

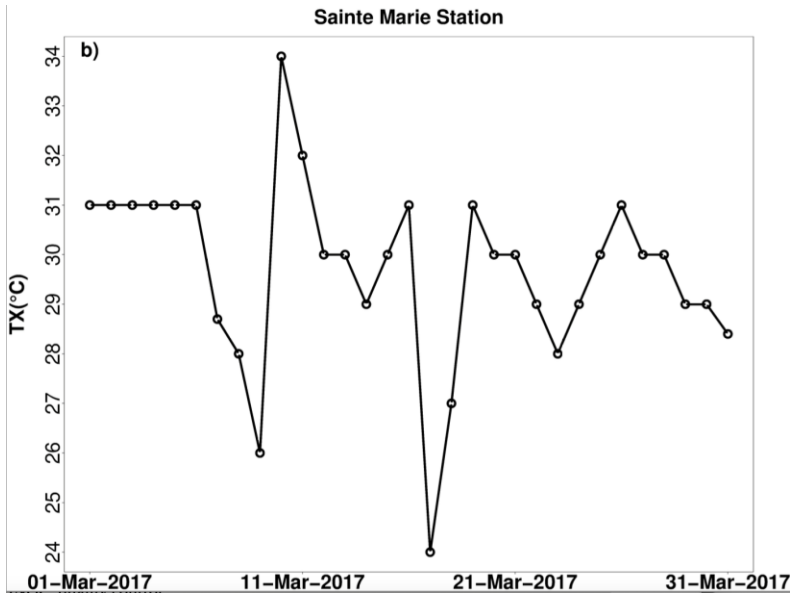
Homogenization: data processes, product, and services

1. Assess the quality control of observational datasets by using the INQC tool developed by the INDECIS project

Examples of error types in raw data (a) erroneous and (b) suspects and collectively suspects



Errors due to digitalization process



Suspect values due to sensor failure

	TX	TN	RR	Total
Checked values	892	205	85	1,182
Validated	35	11	4	50
Corrected	201	194	6	401
Set to missing	656	0	75	731
Total values passing QC	704,764	705,451	705,571	2,115,786
Total raw values	705,656	705,656	705,656	2,116,968

- 0.06% values are flags from 1 to 4
- More flag values are found in temperature, especially TX, than in precipitation
- Missing data percentage

Correction	TX	TN	RR
Before	15.70%	16.10%	10.20%
After	16.35% (+0.65%)	15.98% (-0.12%)	10.19% (-0.01%)

WORLD METEOROLOGICAL ORGANIZATION

SCIENCE for ACTION

Homogenization: data processes, products, and services

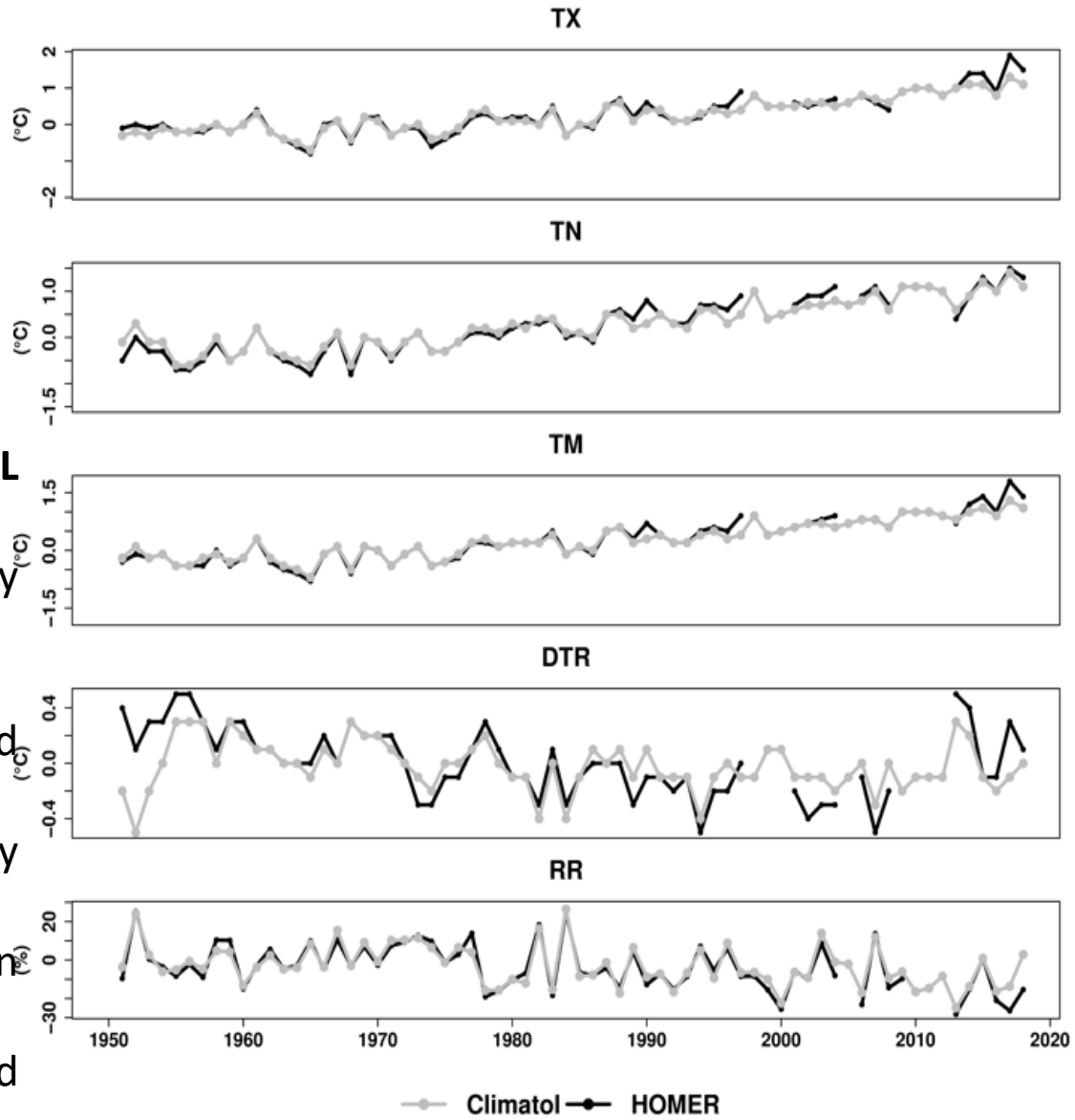
2. Homogenize the quality-controlled observational datasets by applying two different approaches;

Semi-automatic procedure with **HOMER** software:

- ❖ Breakpoint detection is done on a monthly scales
- ❖ 19 weather synoptic stations
- ❖ Subjective pairwise comparison technique and Joint-segmentation methods
- ❖ manual acceptance or rejection of breakpoints detected by using the metadata
- ❖ Daily adjustment by linear interpolation using monthly and annual factors
- ❖ No gaps fill in

Automatic procedure with **CLIMATOL** software:

- ❖ Breakpoint detection is done on a monthly scale
- ❖ 26 weather synoptic stations
- ❖ A modified version of the Standard Normal Homogeneity Test (SNHT)
- ❖ Any acceptance or rejection is done by using the metadata
- ❖ Daily adjustment by orthogonal regression or Reduced Major Axis
- ❖ iterative process to fill gaps in mean and standard deviation calculation



WORLD METEOROLOGICAL ORGANIZATION

1950-2025 SCIENCE for ACTION

Homogenization: projects, needs and issues

- **Data rescue** : Digitalization and Improvement of the archive of the recorded datasets
- **Capacity building** : Training on other methods of homogenization
- **Equipment and materials** : Operationalisation of the methods

References

Randriamarolaza, L.Y.A., Aguilar, E., Skrynyk, O., Vicente- Serrano, S.M. & Domínguez-Castro, F. (2021) **Indices for daily temperature and precipitation in Madagascar, based on quality-controlled and homogenized data, 1950–2018**. International Journal of Climatology, 42 (1), 265–288. Available from: https://doi.org/10.1002/joc.7243 [**JCR Q1, IF 3.651**]

Randriamarolaza, L.Y.A., Aguilar, E. & Skrynyk, O. (2023) **Extreme temperatures detection and attribution related to external forcing in Madagascar**. International Journal of Climatology, 43 (8), 3907-3924. Available from: https://doi.org/10.1002/joc.8065 [**JCR Q1, IF 3.651**]

Randriamarolaza, L.Y.A. & Aguilar, E. (2023) **Rainy season and crop calendars comparison between past (1950-2018) and future (2030-2100) in Madagascar**. Meteorological Applications, 30 (5), e2146. Available from https://doi.org/10.1002/met.2146
[**JCR Q3, IF 2.451**]