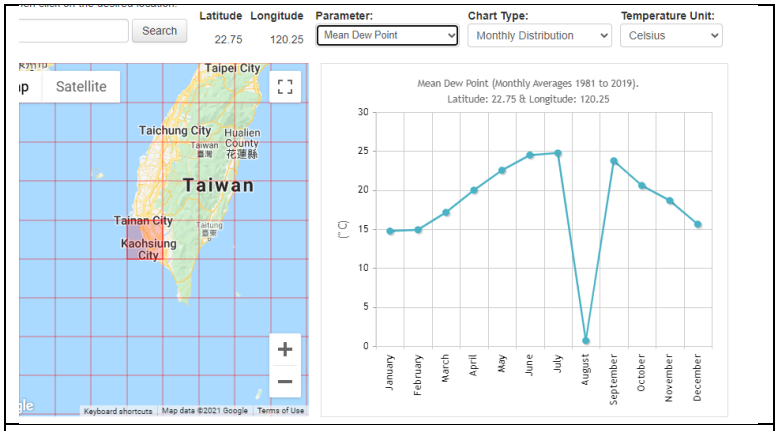
Technical note regarding a replacement version of the CRU 0.5° gridded climatology, CRU CL.

1. Summary

After discontinuities were found in the published climatology, CRU CL v1.0, the decision was taken to construct an improved replacement version from the higher-resolution CRU CL v2.0. This approach eliminated nearly all detected discontinuities, and did not introduce new ones. The result of this is that CRU TS variables[1,2] have, in some cases, changed: where the underlying climatology has changed, so has the variable. These changes are end-to-end and do not affect trends.

2. Identification of discontinuities

In September 2021, we (CRU) were contacted by Bruno Lemke (NMIT, NZ). Together with his colleagues Matthias Otto (NMIT) and Tord Kjellstrom (HEIT, NZ), he had identified several discontinuities in CRU TS v4.05. For example, a depression in mean dewpoint temperature (Tdew, calculated from CRU TS VAP) in SW Taiwan, in August:

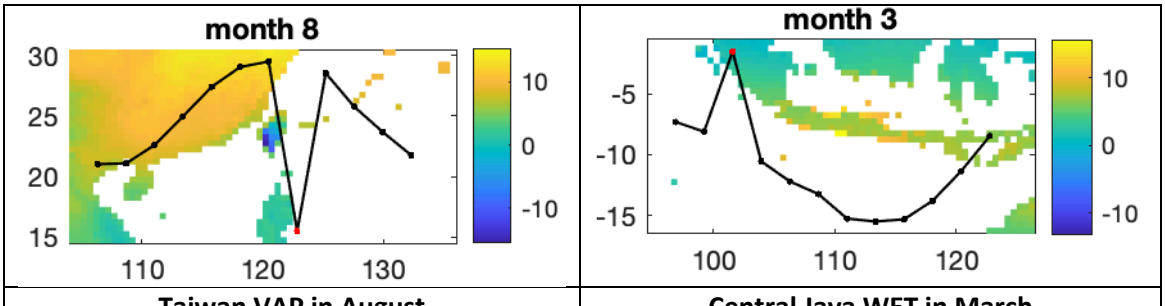


Kaohsiung (Taiwan) grid cell showing the dip for Tdew in August. Data from climatechip.org.

(graphic reproduced from Bruno Lemke's work, with permission)

3. Investigation

Preliminary investigations revealed that the discontinuities were, at least in part, due to the underlying climatologies (the patterns could not be seen in the gridded anomalies). CRU CL v1.0[3] was examined for temporal and spatial discontinuities, and several were discovered, in addition to those found by Bruno Lemke and colleagues (examples only):

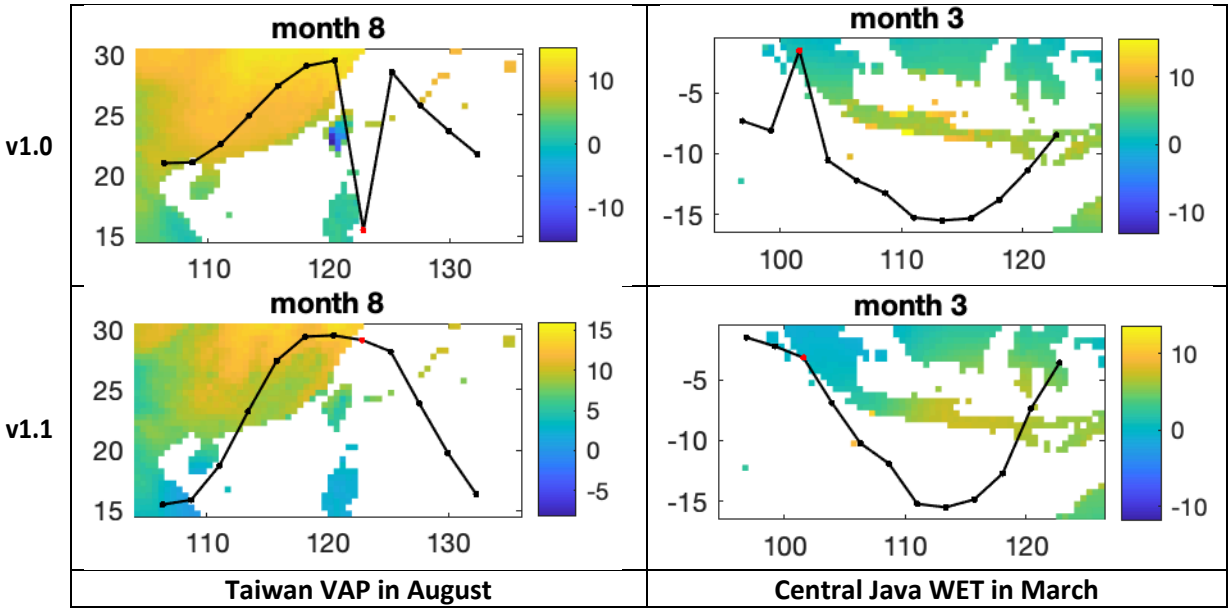


Taiwan VAP in August	Central Java WET in March

4. Strategy

The CRU CL v2.0 dataset[4], a global climatology at 10' resolution, was published several years after v1 and included some improvements in input data alongside the higher resolution. It was therefore chosen as a potential source to create an improved 0.5° climatology. A new 0.5° climatology, CRU CL v1.1, was derived from v2.0, by taking the straight average of groups of nine 10' cells enclosed by each destination 0.5° cell.

Examination of this revised dataset for spatial discontinuities revealed it to have eliminated those found in the original climatology (again, these are just examples):



5. Conclusions

It was felt that the importance of replacing the climatology with an improved version outweighed the inevitable changes that this would introduce to CRU TS and other datasets.

We always welcome opportunities to improve our datasets. Users who find unexpected features in (eg) CRU TS are encouraged to (and do!) get in touch with us.

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References & other information

[1] CRU TS Variables

Code	Name	Units
TMP	monthly average daily mean temperature	degrees Celsius
DTR	diurnal temperature range	degrees Celsius
PRE	precipitation	millimetres per month
VAP	vapour pressure	hectopascals (hPa)
WET	wet day frequency	days
CLD	cloud cover	percentage
TMN	monthly average daily minimum temperature	degrees Celsius
TMX	monthly average daily maximum temperature	degrees Celsius
FRS	frost day frequency	days
PET	potential evapotranspiration	millimetres per day

[2] CRU TS v4 paper

Harris I, Osborn TJ, Jones P and Lister D (2020) Version 4 of the CRU TS Monthly High-Resolution Gridded Multivariate Climate Dataset. *Sci Data* **7,**, 109 (2020). https://doi.org/10.1038/s41597-020-0453-3

[3] CRU CL v1.0 paper

New, M., Hulme, M. and Jones, P.D., 1999: Representing twentieth century space-time climate variability. Part 1: development of a 1961-90 mean monthly terrestrial climatology. *Journal of Climate* **12**, 829-856
doi:10.1175/1520-0442(1999)012<0829:RTCSTC>2.0.CO;2

[4] CRU CL v2.0 paper

New, M., Lister, D., Hulme, M. and Makin, I., 2002: A high-resolution data set of surface climate over global land areas. *Climate Research* **21**
doi:10.3354/cr021001