Internship AWI

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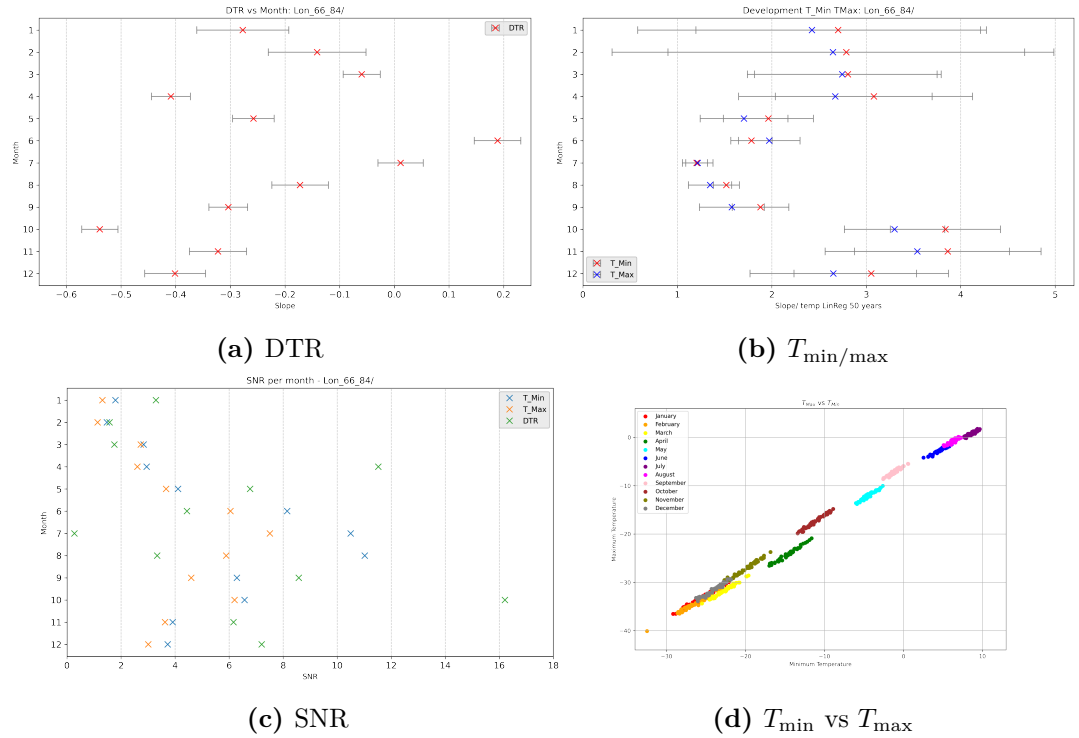
3.1 Diurnal temperature range

In the following section, the diurnal temperature range (DTR) is investigated. The CRU TS data is analyzed by month and latitude to determine trends.



(a) DTR **(b)** $T_{\text{min/max}}$

(c) SNR **(d)** T_{min} vs T_{max}

Figure 3.1: Diurnal temperature range change **(a)** over 50 years for the entire polar region (66-90°). **(b)** shows, for comparison, the maximum and minimum temperature trends. The variance for these temperatures is much larger compared to **(a)**. **(c)** presents the signal-to-noise ratio for the two previous plots.

After taking the over all average of the weighted data[1], we investigate the temporal development of DTR monthly average using linear regression. To examine the significance of the trend, the empirical variance in relation to the fit is calculated.

[1]The data are weighted by area. This leads to a stronger emphasis on the "lower" latitudes. The effect of the weighting is decreasingly small at the intervals of 5° chosen later on.

As show in Fig. 3.1, the changes in DTR are significant. But this is also true for the changes in the minimum temperature $T_{\min}$ as for the maximum temperature $T_{\max}$. Compared to the changes in mean min./max. temperature he DRT trend does have a bigger SNR, as shown in Fig. 3.1c. This can be explained through the strong correlation between maximum and minimum temperature (see Fig. 3.1d). Due to this higher SNR, the changes in DTR could be an advantageous indicator for climatic changes in regions with high climate variability. Therefore, the robustness of this parameter and trends are investigated in Section 3.2.

3.2 Robustness of the DTR for subgroups of data

The mathematical derivation of uncertainty is to complex for this internship. To gain a sense of how reliable the effect of DTR change is, we compare the results of the left and right hemisphere – the hemisphere from -180 to 0 and 0 to 180 degrees.

As depicted in Figure 3.2, the Diurnal Temperature Range (DTR) exhibits significant variations, particularly at higher latitudes. This variability may be attributed to the data selection process. The dataset encompasses the geographic region illustrated in Figure 3.3. When segregating the data into left and right hemispheres, it becomes apparent that the distribution of landmass is uneven. The left half of the Earth predominantly comprises mainland, whereas the right hemisphere consists mainly of islands. Consequently, temperature variations are influenced by the geographical circumstances, with islands experiencing unique factors such as ice formation, which influence their climate differently.

As shown in Figs. A.1 and A.2, the temperatures and their trends differ significantly for the two areas. The mainland experiences lower temperatures than the island dominated areas, especially for the areas of higher latitude. To check wether the data is robust, we have to compare two equivalent areas. Therefore, Greenland is divided into two halfs and the process is repeated.

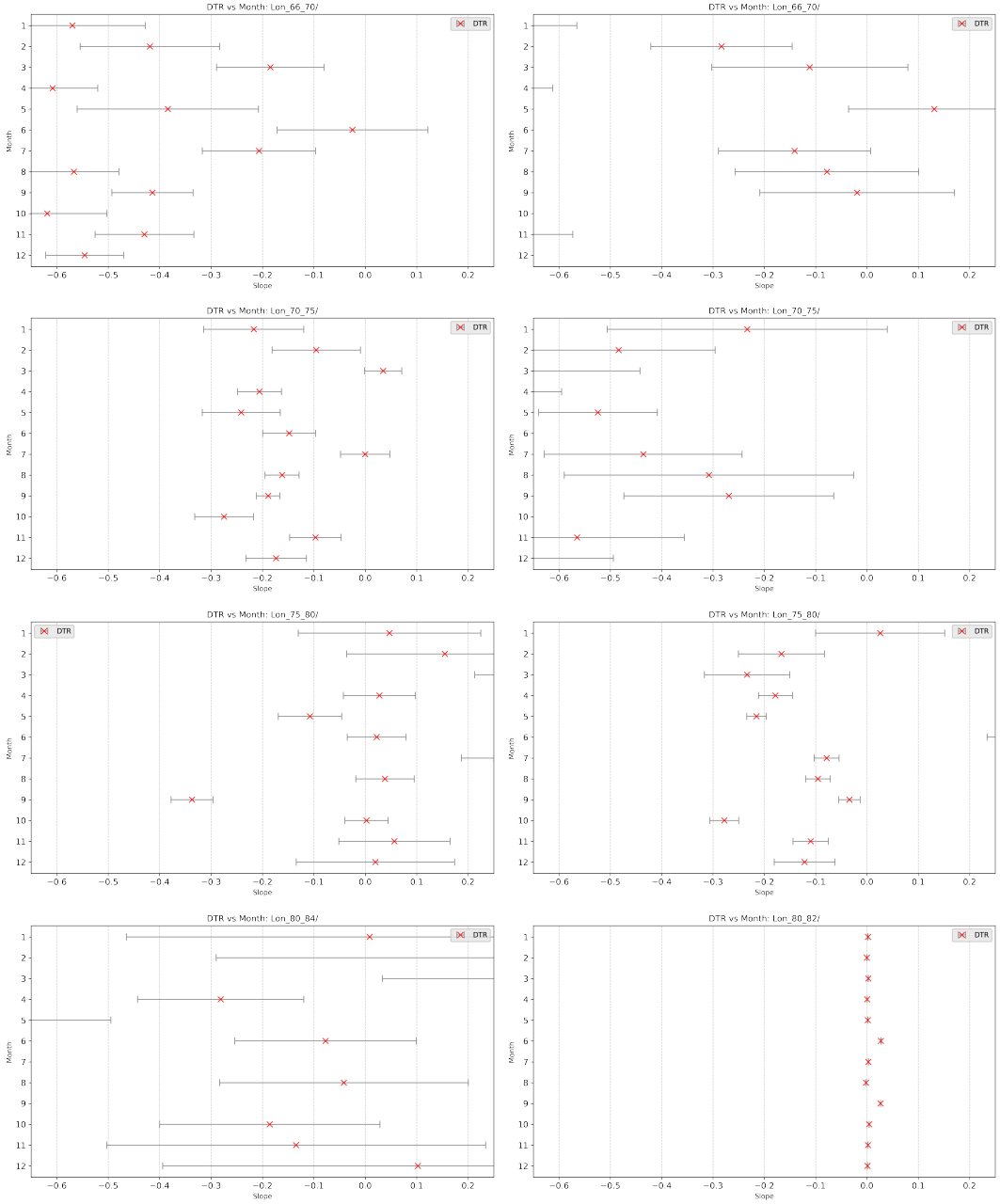


Figure 3.2: Subfigure with Two Columns

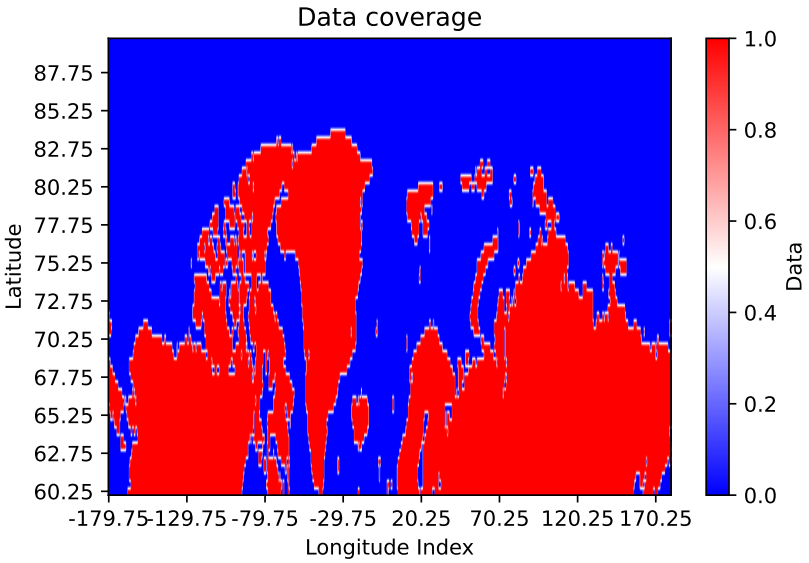
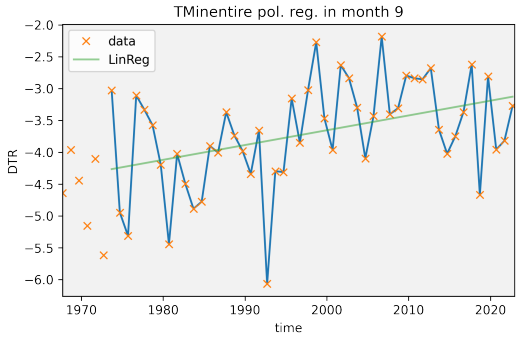


Figure 3.3: Data coverage of the CRU data.

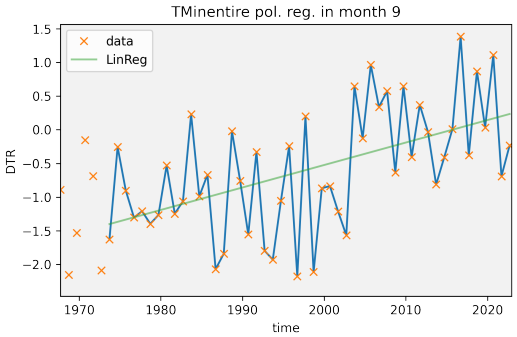
4 Summary

A Append

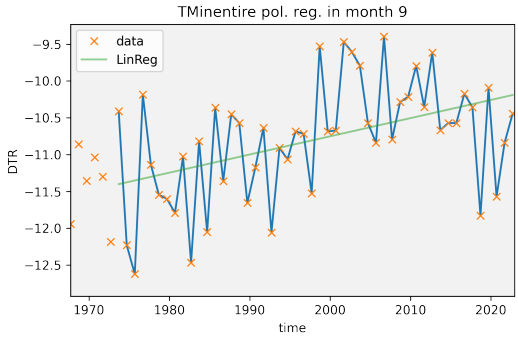
A.1 Robustness



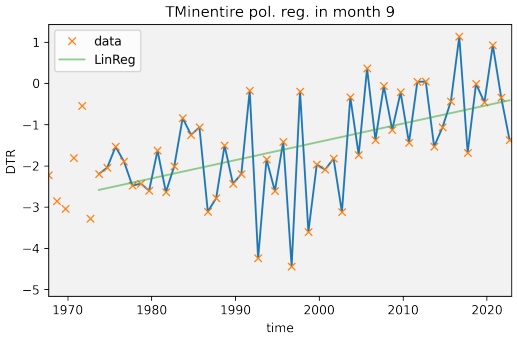
(a) T_{min} for the left hemisphere between 66 and 70°



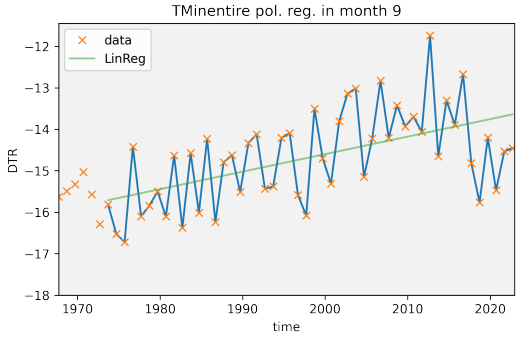
(b) T_{min} for the right hemisphere between 66 and 70°



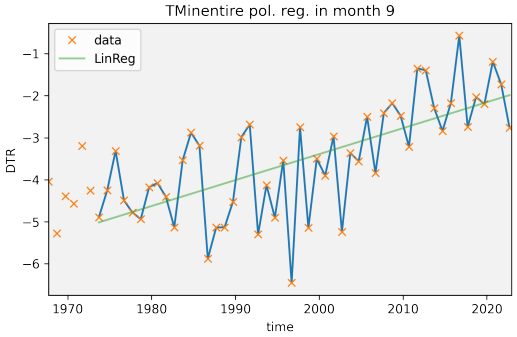
(c) T_{min} between 70 and 75°



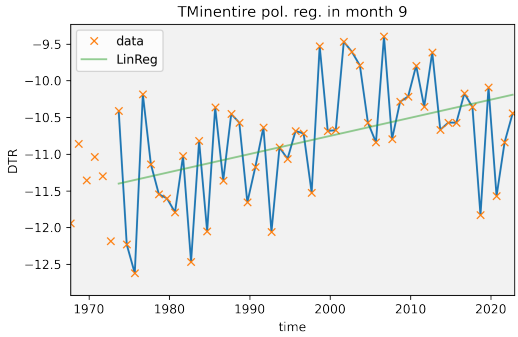
(d) T_{min} between 70 and 75°



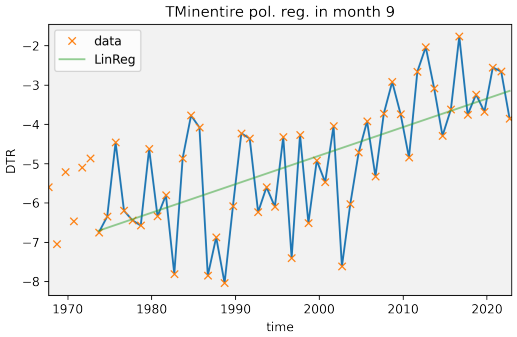
(e) T_{min} between 75 and 80°



(f) T_{min} between 75 and 80°

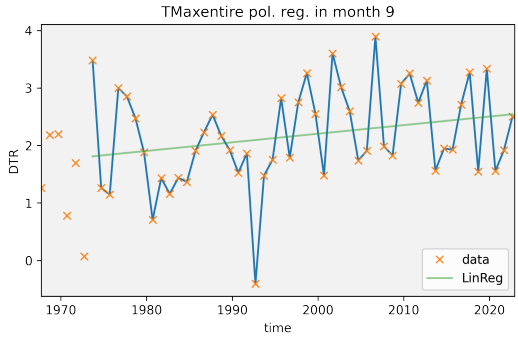


(g) T_{min} between 80 and 82°

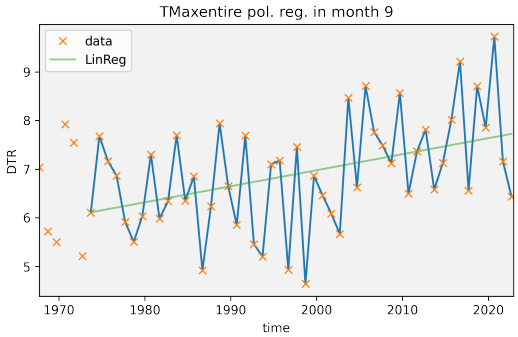


(h) T_{min} between 80 and 82°

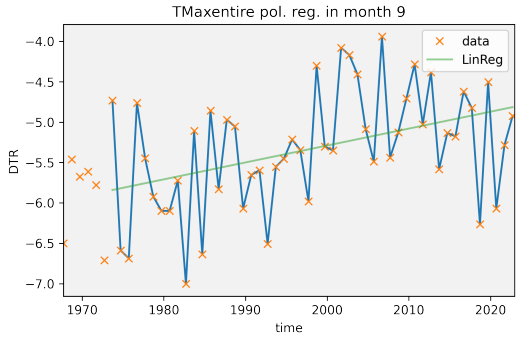
Figure A.1: Temperature for left and right hemisphere



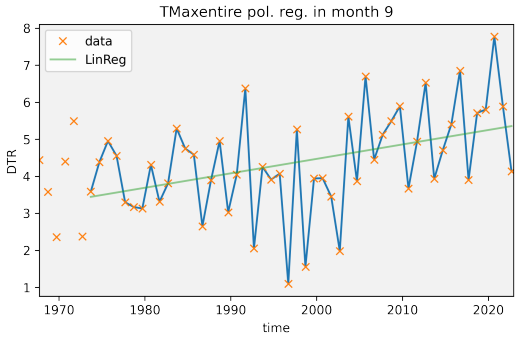
(a) T_{max} for the left hemisphere between 66 and 70°



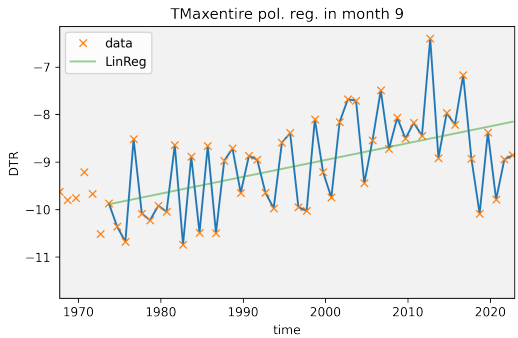
(b) T_{max} for the right hemisphere between 66 and 70°



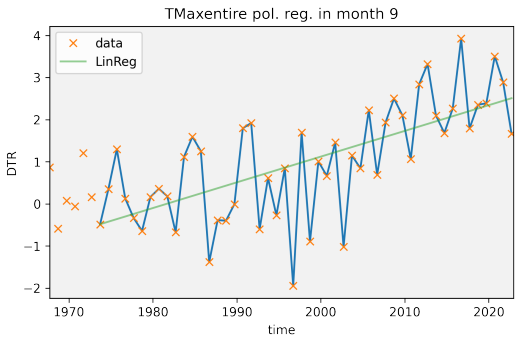
(c) T_{max} between 70 and 75°



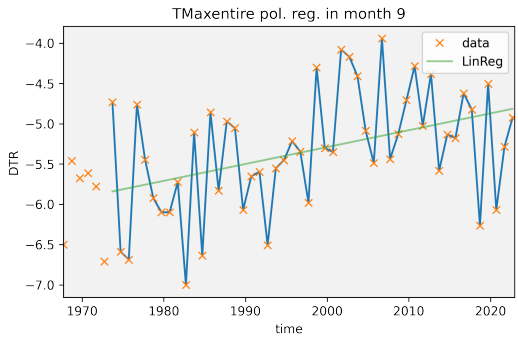
(d) T_{max} between 70 and 75°



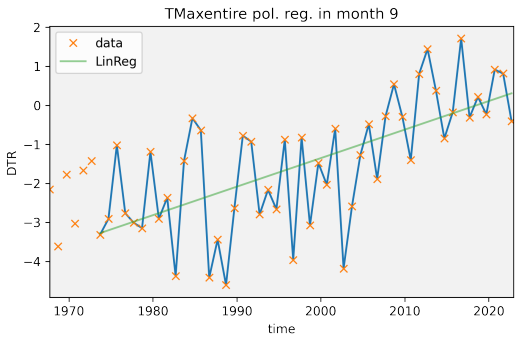
(e) T_{max} between 75 and 80°



(f) T_{max} between 75 and 80°



(g) T_{max} between 80 and 82°



(h) T_{max} between 80 and 82°

Figure A.2: Temperature for left and right hemisphere

Bibliography

[1] H. Chen et al. Gold nanorods and their plasmonic properties. *Chemical Society Reviews*, 42:2679–2724, 2013.

[2] Experimentalphysik III. Versuch Nanoplasmonik: Dunkelfeldspektroskopie von plasmonischen Nanorods.

[3] S. Link, M. B. Mohamed, and M. A. El-Sayed. Simulation of the Optical Absorption Spectra of Gold Nanorods as a Function of Their Aspect Ratio and the Effect of the Medium Dielectric Constant. *The Journal of Physical Chemistry B*, 103(16):3073–3077, 1999.