Dreaming of relative statistical homogenization of SST

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Over the last few years relative statistical homogenization methods have become much more powerful. Relative methods compare a candidate station with nearby reference stations. We have moved from single-breakpoint methods to multiple breakpoint methods. First attempts to detect breaks in all series simultaneously (joint detection) are made and joint correction methods are used more and more.

An important advantage of relative homogenization is that inhomogeneities are corrected whether their cause is known or not. It may thus be interesting to study whether statistical homogenization can be used to detect currently unknown inhomogeneities in sea surface temperature.

In current state-of-the-art datasets the secular sea surface temperature trend is small compared to the land surface temperature trend. The difference may be even larger, because recent results suggest that the global land temperature trend in the main collections show too little warming due to remaining inhomogeneities. The main indication is that well-homogenized national datasets on average show clearly more warming than global collections when averaged over the region of common coverage.

Relative homogenization efforts for marine data may be impossible because of the small amount of data. However, if we limit our aim to estimating the long-term trend, we only need to do it for a few dozen locations spread over the world. It is thus possible to focus on data dense regions, such as much used shipping routes. Even if we could only perform relative homogenization at a few locations, this would still be an important independent estimate to compare our current SST datasets to.

Detecting breaks with relative statistical homogenization requires difference time series with a low noise level. In addition, the platforms would need to have a stable ID over their observing time, so that multiple encounters can be used to compute a difference time series. For marine data the difference series will be sparse, but there are many difference series to perform joint detection, which would optimally halve the noise. It would be a strong simplification if break detection were not necessary and the problem could be reduced to computing one adjustment for every unique platform.

Next to ocean weather ships, ferries and liners using locations close to islands, light houses, moored buoys and coastal land stations could help in making more comparisons. For some inhomogeneities, climate may be less important (engine intake bias), which would allow the use of any encounter for a comparison between ships regardless of location. If the difference in biases within a group is not too large (buoys?), they may also be treated as a group making the number of comparisons larger. Detection of breaks may also be helped by comparing sea surface temperature to observed (night) marine air temperature.

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- **Data homogenization (benchmarking, bias adjustments, step change analysis, metadata)**