

## ***Interactive comment on “Early ship-based upper-air data and comparison with the Twentieth Century Reanalysis” by S. Brönnimann et al.***

**Anonymous Referee #4**

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This manuscript is a quite interesting example of upper air data availability and quality in the early twentieth century. It is certainly worth being published in "Climate of the Past". The two ship cruises give a valuable impression of what can be expected from the best available upper air measurement technology at that time. The relatively high correlation of temperature and geopotential with the 20th century reanalysis (20CR) data at least at lower levels at rather remote locations is encouraging. It allows to draw conclusions on data quality issues in both observations and reanalyses. The authors could reproduce weaknesses in the 20CR data, such as too weak or absent trade inversions as well as upper tropospheric cool biases, through comparison with the early ship based data. These weaknesses are well known from comparisons with much better data in the second half of the 20th century.

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Inferring data quality issues in the observations from comparison with 20CR data proves more tricky. A suspect period in the data of MS Schwabenland could be found but the adjustment of the observed data appears rather uncertain. The authors argue that the height levels during 12 ascents were not correct. However their suggested correction makes the temperatures of these ascents near the surface much (~3K) too warm compared to the 20CR and the rest of the profiles. Apparently not all issues are resolved there.

Minor comments: p2427: line 11: which procedure is meant here? measurement procedures line 12: Conversion of mm to SI units should be given already there instead at p 2428 line 21 p2432: Estimation of the observation errors of MS Schwabenland is based on several speculations. First it is not entirely clear that the radiosonde type on the ship is the same as the radiosonde type used for comparison with mountain station data. Second the estimate of the observation error is highly dependent on the estimate of the representation error. The representation error is simply estimated from the difference series between stations Jungfrauoch and Sântis. It is estimated almost as high (1.96K compared to 2.0-2.4K for the residuals). The representation error is probably less since the altitude difference between stations Sântis and Jungfrauoch (~1000m) is larger than the altitude difference between stations and the respective pressure levels. Thus the observation error, which is estimated as a residual, could easily be larger than 1.2 K.

Fig. 2: This figure is nice to look at but does not add value to the paper. It could be omitted. Figs 3 and 7: the right panels would be better comparable with the right panels if observations-20CR were plotted instead of 20CR-obs. Fig. 4: It would be interesting to have the observed GPH plotted in the lower panel.

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