Comments to the paper: **Arctic marine climate of the early nineteenth century**
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The paper is a fascinating reconstruction of weather from Royal Navy expeditions in the early nineteenth century. The analysis of ship logs is particularly relevant because it includes remote Arctic areas deprived of any fixed weather station, or even amateur observers, diaries, chronicles or other proxies. After having compared the above pioneer observations with modern interpolation of grid data, the Authors draw some conclusions about the past climate, especially after the occurrence of the Tambora eruption. I enjoyed very much in reading this article that adds newly produced data and ideas.

The only limit I found is the lack of information about uncertainties in observations. Instruments, observational methodology, thermometer shields, sampling times etc remain almost totally unknown. It would be logic to expect that any ship had at least a description of the instrument and the name of the instrument maker. This might be the first step to know more about the instrument characteristics. With patience and some luck, the Authors might find something in one of the books, written for various aims, which include the description of early meteorological instruments and their performances. Some of these books are addressed to people involved in meteorology or history of science, others to conservators or even collectors, and the Royal Navy has been for centuries a major source of nice objects for private and public collections. Some books are concerned in meteorological instruments in general, including thermometers and barometers. For instance, Negretti and Zambra (1864) were famous instrument makers and wrote a comprehensive and detailed catalogue of weather instruments including drawings, critical comments and explanatory notes for the best use of them. The book can be considered a complete treatise including theory and physical principles, technical details about all instruments in use at that times and procedures for use, i.e. instructions for observers. Scott (1875) made a survey of weather instruments and methodologies in use in UK to train observers and to provide a technical-scientific support to the personnel of the UK Meteorological Service. In “modern” times, Middleton wrote three fundamental books, with purely scientific purposes, on the history of meteorological instruments, i.e. the barometer (1964), the thermometer (1966) and the early weather instruments in general (1969). Turner (1983) made a survey of beautiful old scientific instruments, including a chapter on meteorological instruments, dedicated to friends of scientific collections. Weather and rain are a popular support for conversation, and the barometer has historically been the chief instrument for any weather prediction. In addition, their magnificent decorations are particularly attractive in any distinguished drawing room. These are two good reasons for having a number of books dedicated to any kind of barometers (Banfield, 1976, 1985a,b,c, 1993) and their care and restoration (Collins, 1990).

This and other English or non-English literature may help finding images of instruments used by the Royal Navy and understanding strong and weak points of them. This effort might be useful for a first guess about instrument reliability as a first step towards a crude, but useful classification concerning Royal Navy weather observation quality.

The problem of observational procedure and sampling time is different. I suppose that the necessary information should be found in the ship logs, except in the case the Royal Navy had a standardized observational methodology, following the tradition established after the first weather log model produced in UK by Robert Hooke in 1663, on request of the Royal Society, London.

However, a positive factor is that at high latitudes the solar beams travel for a long optical path crossing the atmosphere, and the result is an attenuation of the direct and diffuse light intensity. Again, when the solar beams are grazing the horizon, their energy is distributed on a wide horizontal area, i.e. weak power density on the horizontal plane and no soil heating. In addition, the height of the sun above the horizon varies much less over the daytime. This reduces very much the bias for inaccurate shielding and irregular time sampling, except solar beams directly hit the thermometer. Finally, fresh wind improves heat exchanges and reduces thermometer overheating.

However, we don't know how the Royal Navy observer reacted to this potentially favourable situation. We can suppose that he has carefully followed all instructions he got during his professional training and sailing experience. As opposed, we can also suppose that he realised that observations in the Arctic needed less care that at mid or low latitudes, and for this reason he might have disregarded some precautions. Once again, the key may be found in the individual ship logs and in the observer's personality.

In conclusion, the nice work made by Broham et al. adds new light to our knowledge of climate in remote Arctic areas in the early nineteenth century. However, it would be even better if the Authors would dedicate some more time to investigate instrumental and observational uncertainties and classify any ship log series in terms of estimated accuracy. After this further effort, the Royal Navy data would be much more conclusive and attractive.

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