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Interactive comment on "Seasonal mean pressure reconstruction for the North Atlantic (1750–1850) based on early marine data" *by* D. Gallego et al.

D. Gallego et al.

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We would like to thanks the referee for the constructive comments. The specifics comments raise a number of interesting issues to be discussed:

Specific comment 1:

The effect of the amount of available data for the CLIWOC period can not be assessed in the figures displaying the geographical distribution of the model performance (Figures 6 and 7) neither in that showing the spatial correlation (Figure 8). As the referee points out, figures 6 and 7 show that the quality is expected to be lower toward the south and the west. Nevertheless, both calibration and verification periods are based solely on ICOADS data and the result does not depend on the CLIWOC data. In consequence, these results can not be interpreted as a function of the CLIWOC coverage displayed in Figure 1. The same comment can be done for the spatial correlation (Figure 8) which can be only computed for the ICOADS period, when we have simulta-

neously SLP and wind measures (1851-2002 in our application).

Figure 8 (spatial correlation) has been presented as a concise way to display the relative stability of the equations prior to the calibration or verification periods. A look to this figure shows a steady decrease in the spatial performance as we go back in time. It must be emphasized that, despite this tendency to lower values, the relation is fairly stable, with positive correlation values even 80 years before the calibration period. This adds confidence to the value of the equations. However, the interpretation of the spatial correlation is not a trivial issue, especially for a coarse grid formed by a small number of squares. As commented in the paper, in this kind of grids a few squares with reconstructed SLP values slightly different than the measured SLP can produce large effects over the spatial correlation. In an area of relatively homogeneous pressure, as the center on the Azores High, this effect can be especially important.

The prudence necessary when interpreting spatial correlations of incomplete SLP fields can be evidenced with an example we evaluated during the work. We found that strongly positive and stable spatial correlations were not necessarily related to good reconstructions of the temporal SLP series. For example, when the calibration period is set to 1851-1925 (first half of the ICOADS data used in the paper), the evolution of the spatial correlation is quite stable along the entire ICOADS period used (1851-2002), with positive values well over the significance level and no evident trends, even after 1925, the last calibration year. The most notable exception occurs during the World War II period, whose extremely reduced coverage is evidenced by a sudden (but limited in time) drop in the spatial correlations between 1940 and 1945. However, when looking at the geographical distribution of the temporal correlation r2 at each point in this example (i.e. the information equivalent to that displayed in figures 5 and 6 of the paper), we obtained very low values, around 0.50, even during the calibration period and over the best reconstructed areas of the northern North Atlantic in winter. These r2 are significantly lower that those of the model finally selected (around 0.90 in winter, see figures 5 and 6 in the paper) and indicates a poor response of the reconstructed

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time series (i.e. while the SLP pattern was relatively well represented, the temporal evolution at each point was poorly reproduced). In fact, during the design phase of the methodology to select the best model, it resulted not possible to optimize simultaneously spatial and temporal correlations and we choose to optimize the temporal correlations at expense of the spatial ones, in order to obtain the best possible temporal response of the reconstructed SLP. In addition, the models with better temporal correlations resulted to be those calibrated for the second half of the ICOADS database (after 1930). This is relevant, because we preferred to perform the calibration of our model with data as modern as possible to minimize the effect of the relatively low data coverage of ICOADS for the 1900's. Since currently there is no way of improving the CLIWOC coverage, the equations were calibrated with the best possible ICOADS data.

We think that the model performance mainly depends on the data coverage. Years with most of their squares poorly represented presumable produced reconstructions with greater uncertainty but not due to the regression equations but to the uncertainty of the input winds. It is expected that the use of principal components minimizes this effect, because even though a few squares have no data or these data are uncertain, if the remaining squares are well represented, the overall pattern should be well reconstructed because the model looks at the general patterns (PCs) instead at single points. A secondary and independent uncertainty factor, which has been controlled by limiting the study domain, is the region of the Atlantic, with poorer responses for the southern half of the North Atlantic, independently of the coverage.

These considerations suggest that with the present methodology, the main factor affecting the quality of the reconstructions is the coverage. Other possible limitation to be considered could be the possibility of a variable relation among the SLP and wind patterns along the decades, which will make difficult to reconstruct the SLP based on regressing principal components. The current OSR methodologies do not allow to account for this possibility. However the relative stability of the spatial regression seems to discard a great influence of this scenario in favor of the coverage problems.

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Specific comment 2:

We concur with the referee. A new sentence will be added in the paper remarking the effect of larger relative errors in the SLP for subtropical latitudes.

Specific comment 3:

One of the main objectives of the paper is to present the CLIWOC database as a source of gridded data for climatic reconstruction apart of the obvious wind patterns (along with presenting guidelines to produce better reconstructions). The relatively low values of the common variance with the L02 data (20%) is, notwithstanding, a typical value when comparing two independent climate reconstructions for non instrumental proxies (See for example the references of Jones and Salmon 2005 or Jones et al. 1999 included in the reference section of the paper). During the last decade this fact has lead to climate reconstructions based on a mixing of independent proxies (multiproxy approaches), trying to isolate the common (and usually not too large) climatic signal. Of course, improving these multiproxies requires new databases, as it is that presented in the paper. In this regard, work is currently underway to construct a SLP reconstruction over the Atlantic by mixing this new data with that presented in Luterbacher et al. 2002 (reference included in the paper).

Specific comment 4:

We agree with the referee and a new sentence will be added to emphasize the dependence of the reconstruction on the region and season.

Minor points:

These points are related to labeling of geographical coordinates, typos and a new figure instead of table 3. We think that the inclusion of these suggestions will clarify the presentation and in consequence they will be included in the revised text.

Interactive comment on Climate of the Past Discussions, 1, 57, 2005.