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Climate of the Past
Discussions

Interactive comment on "Atmospheric circulation patterns associated to the variability of River Ammer floods: evidence from observed and proxy data" *by* N. Rimbu et al.

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Response to reviewer comments #2

We thank to the reviewer for his constructive comments. These comments help us to improve our manuscript. Bellow is the point to point response to the reviewer comments.

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General comments: Greetings to the authors of the manuscript submitted to Climate of

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the Past. The paper is written in a comprehensible style, easy to follow and addresses significant hydroclimatic questions. The authors use well-known statistical methodologies for data analysis and rely on widely used data sources. It is a discussed fact that floods occur in clusters which are separated by breaks of several decades. Based on observational Ammer discharge data and flood layer time series from varved sediments of Lake Ammersee (southern Germany) from 1766 to the present, the authors study the connections between flood frequency and atmospheric circulation variability. The analysis reveals that the floods in the river Ammer are associated with enhanced moisture transport from the Atlantic Ocean and the Mediterranean towards the Ammer region, a pronounced trough over Western Europe as well as enhanced potential vorticity at upper levels. However, a number of critical issues require some attention.

Specific comments: 1) Page 4485, line 24: The acronym of the Summer North Atlantic Oscillation is exactly SNAO. It is quite wrong to use NAO for this atmospheric variability pattern. Folland et al. (2009) review the temporal evolution and surface impacts of the SNAO, despite the fact that the SNAO-like patterns have previously been identified by e.g. Barnston and Livezey (1987). Lack of analysis has led to disagreement in the scientific literature about the pattern. An important part of this confusion arises from the more northerly position and smaller spatial extent of the SNAO compared to its winter counterpart, with the southern node over northwest Europe, rather than the Azores–Spain region, and a smaller-scale Arctic node. In spite of the fact that the SNAO has different characteristics than the winter NAO, it provides a similar paradigm for understanding the variability of summer climate. Bladé et al. (2011) describe the positive phase as a decreased pressure over Greenland and an increased pressure in north-western Europe. If it is compared to the winter NAO, the SNAO teleconnection is displaced northeastward, it is more zonally and meridionally restricted and the centers of action show a more southwest-to-northeast orientation, with more meridional advection over Northern Europe.

Response

We agree with this comment. Therefore we modify the abbreviation of the North Atlantic Oscillation (NAO) with Summer North Atlantic Oscillation (SNAO). 2) Page 4498. Line 20. It is correct to use the 250 hPa geopotential level to identify areas of convergence and divergence: but these variables have not been defined in the Data and Methods section. I suppose the data of 250 hPa geopotential level is downloaded of the 20CR website, but, the data of convergence and divergence, are they downloaded of the same website?

Response

The divergence field was calculated from 250 hPa wind using the function hdivg() of GRADS software (http://www.iges.org/grads/), used to prepare most of the figures presented in this manuscript.

Moreover, one doubt has emerged of the analysis of the Figure 3: The connection shown in Figure 3a between the Atlantic and African jets, cannot be an artifact not real due to the construction of the composite?

Response

Certainly the composite map of 250 hPa circulation does not represent a real atmospheric circulation pattern associated with a certain flood event , like that of 19-20 July 1981 (Fig. 4). However, it captures the common features of atmospheric circulations associated to all flood events during 1926-2006 period. One common characteristic is the structure of the jet represented in Figure 3.

3) Respect to the sections 3.2 and 3.3 and the composites of the figures 5, 6, 7: The authors written in Page 4490, lines 22-28: “For example, the circulation associated to the River Ammer flood on 14 June 1959 (not shown) is a typical omega blocking circulation with heavy precipitation produced on the eastern side of the block. However, most of the River Ammer floods >125m3 s−1 are related to synoptic patterns that are similar to those that characterize the 19 to 20 July 1981 flood, which is consistent with

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the composite analysis shown in Fig. 2." My doubt is: the configuration presented in the figures 5, 6 and 7 that explains the atmospheric circulation for the pre-instrumental and historic floods in the river Ammer, is it similar to the atmospheric configuration that caused the flooding of 14 June 1959? This configuration in Omega is presented by Peña et al., 2015 for the Swiss summer floods for the north flank of the Alps (Atlantic influence) and they differ from the floods in the southern Alps slope (Mediterranean influence).

Response

The circulation associated with 14 June 1959 flood is a typical omega blocking structure (Fig. s1a). Indeed the main source of the moisture is not Mediterranean basin, but the Atlantic, in agreement with Peňa et al. 2015 (Fig. s1b). However the Ammer catchment region is located on eastern side of the block (Fig. s1a) as it is mentioned in the paper. This pattern shows little resemblance with the canonical pattern represented in Fig. 2a. It is presented as an example to emphasize the variability of synoptic scale patterns associated to flood events. However, most of the flood related circulations resembles the pattern represented in Figure 2a.

We corrected all language errors. We fix also all references.

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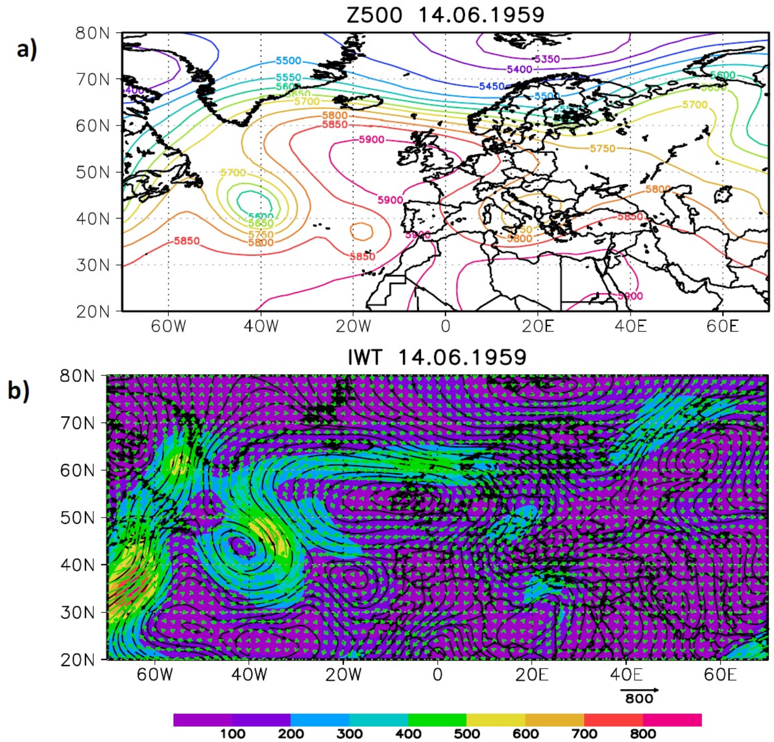

Figure s1. a) 500 hPa geopotential hheight (Z500) and b) vertically integrated water vapor transport (IWT) (vectors) and its magnitude (color) from 14.06.1959. Units m, and $Kgm^{-2}s^{-1}$. Data 20CR V2.

Fig. 1.