

Interactive comment on “Simulating historical flood events at the continental-scale: observational validation of a large-scale hydrodynamic model” by Oliver E. J. Wing et al.

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This study is a valuable contribution which improves the understanding of the quality of continental-scale flood models, while highlighting the complexity of validation exercises and the existing limitations of observed data. The manuscript is well written and structured. I especially appreciated the use of a large dataset of case studies, which allows a comprehensive validation, and the detailed discussions of the different results. I think this manuscript should be accepted for publication after addressing the following issues.

- Section 3 is quite long and I would suggest splitting into subsections to improve read-

C1

ability

- Section 3, lines 209-24: I'm not fully convinced about the use of interpolated linear water profiles to evaluate HWMs along the two rivers. While it is true that Altenau et al. found a roughly linear water surface slope in their study, in general the water surface is influenced by the magnitude and variations of the bed slope (see Dottori et al. 2009, apologies for the self-citation). In fact, the average bed slope in the Platte River (approx 1m/km) is likely to determine a quasi-kinematic behaviour of the flood wave, with the water surface being roughly parallel to the bed profile (as indeed suggested by the HWMs in figure 3d). Using a steady flow profile consistent with the peak flow would be more appropriate than the linear interpolation. However, I reckon that in this case simulating steady flow conditions using a 1D model would be complex in this case due to the widespread flooding, so maybe this issue could just be mentioned in the text to improve the discussion.

Minor remarks

- Line 24-25: Flood models are generally used to produce a range of flood maps, so I suggest: "The output of these models is typically one or more flood maps..."

-Line 37: "Researchers" is probably better than "geographers" here

- Section 2.1: My suggestion is to modify the title in "USGS Gauge input and event selection"

-Line 102: "Model domains of a 50x50km were constructed..." yet in Figure 1 some areas look much larger than 50x50km. Could you please explain this difference?

-Lines 172-180: I guess HWMs are referred to NED for the comparison, right?

-Lines 172-180: You could mention that the interpolated water surface map interpolated from HWMs might be affected by further errors due to the distance between HWMs

-Line 218: 90km reach

C2

- Lines 370-374: Here you don't mention the possibility of combining remote sensing data (for instance flood extent from satellite imagery) with dedicated field campaigns. Given the growing availability of remote sensing data, this could be an effective strategy to improve validation datasets.

References

Dottori, F., M. L. V. Martina, and E. Todini. "A dynamic rating curve approach to indirect discharge measurement." *Hydrology & Earth System Sciences* 13.6 (2009).

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