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Interactive comment on "Integration of 2-D hydraulic model and high-resolution LiDAR-derived DEM for floodplain flow modeling" *by* D. Shen et al.

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The paper seeks to get more precise results of numerical 2D modeling of inundation areas at floodplains and polders taking into account results of high-precision laser scanning of the relief of the area. Up-to-date LiDAR technologies allow us to obtain elevation matrix with spatial resolution of 1 m x 1 m and vertical resolution up to 0.15 m. For the modeled area with a size of 50 km x 20 km considered in this paper such a matrix contains around 1 billion of elements. Nowadays 2D modeling on the grids of such a size is difficult even when using supercomputers. Therefore the authors propose calculating inundation zones for much coarser mesh followed by improving the results in a special way with the help of detailed digital topographic data. For me it is not obvious that the approach proposed in the paper would lead to an increased accuracy of the computer simulation results due to the following reasons: 1. The authors use a special method to identify confined depressions of the relief where the calculated water amount flows to. However, actually inundation of these depressions is impossible taking into account detailed analysis of the relief and the authors suggest excluding these areas and volumes of inundation from consideration. But if any volume of water doesn't reach a certain area, then due to the law of conservation of mass it should be redistributed over the remaining territory, which would lead to a change in areas, volumes, and depths of inundation at the other parts of the modeled area. This issue is not considered in modeling (to a lesser extent this may refer to stationary problems, but floods are never stationary). 2. Even more serious problems arise when flooded territories are crossed by roads elevated over the average relief of the area, as well as by rivers, which channels are below the average topography level (see, for example, Figure 6 of the paper). If these linear objects (and also bridgespan) are not approximated accurately enough in the applied 2D hydrodynamic model (they should be separated on the grid in a certain way), then the general character of flow, inundation zones and depths will not be described by the model. 3. Interpolation of high-resolution topography onto the 2D model computational mesh having much larger cells should be done by area averaging of all points of the elevation matrix that fall into a computational cell. Then inundation volumes at a certain water level calculated using the elevation matrix and computational mesh of the hydrodynamic model will coincide. 4. The authors get more precise values for only inundation extent and depth, but don't deal with the problem of specifying flow velocity. If the average velocity in a certain cell of the computational mesh is calculated for a certain bottom level averaged over this cell, then when applying a larger scale, the bottom elements within the cell would have different elevations, and therefore, local velocities would be different. To get the correct local flow velocities, we need to re-calculate 2D model for a denser mesh. 5. The method presented in the paper doesn't give more accurate results of numeric 2D simulation of

HESSD

12, C1166–C1168, 2015

hydrodynamic parameters of inundation of floodplain territories, if we're talking about specification of inundation levels (marks), flow velocities, distribution of discharges in different cross sections, etc. The method only gives more precise description of flood extent and depth, and moreover, with some assumptions. The results obtained using the suggested method show inundation boundaries and depth more clearly (which is definitely useful); however this approach should be rather considered as post-treatment of the simulation results. 6. For local interpolation of simulated water levels into nodes of the elevation matrix, the authors use Formulae 6, 7, 8. As the practice of numerical simulation of stream flow shows, this method gives poor results when used for interpolating the marks of bottom topography into nodes of computational mesh. This method doesn't satisfy the major requirements for methods of interpolation on arbitrary sets of points. Interpolation methods that have this ability are described in [1-4]. 1. Sibson R. A brief description of the natural neighbour interpolant. // Interpreting Multivariate Data. Chichester: Wiley, UK, 1981. P.21-36. 2. Belikov V.V., Semenov A.Yu. New Non-Sibson Interpolation on Arbitrary System of Points in Euclidean Space. //Proceedings of 15th World Congress on Scientific Computation Modeling and Applied Mathematics. Berlin August 1997, V.2 3. Belikov V., Semenov A. Non-Sibsonian interpolation on arbitrary system of points in Euclidean space and adaptive isolines generation.// Appl. Numer. Math. 32, âĎŰ 4, 2000. 4. Sukumar N., Moran B., Belikov V., Semenov A.Yu. Natural neighbour Galerkin methods // Int. Journal for Numerical Methods in Engineering. 2001; 50(1): 1-27.

I recommend re-submitting the manuscript for repeated review after taking into account the mentioned comments.

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