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A two-model hydrologic ensemble prediction of hydrograph: case study from the upper Nysa Klodzka river basin (SW Poland)

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The HydroProg system has been elaborated in frame of the research project no. 2011/01/D/ST10/04171 of the National Science Centre of Poland and is steadily producing multimodel ensemble predictions of hydrograph in real time. Although there are six ensemble members available at present, the longest record of predictions and their statistics is available for two data-based models (uni- and multivariate autoregressive models). Thus, we consider 3-hour predictions of water levels, with lead times ranging from 15 to 180 minutes, computed every 15 minutes since August 2013 for the Nysa Klodzka basin (SW Poland) using the two approaches and their two-model ensemble. Since the launch of the HydroProg system there have been 12 high flow episodes, and the objective of this work is to present the performance of the two-model ensemble in the process of forecasting these events. For a sake of brevity, we limit our investigation to a single gauge located at the Nysa Klodzka river in the town of Klodzko, which is centrally located in the studied basin. We identified certain regular scenarios of how the models perform in predicting the high flows in Klodzko. At the initial phase of the high flow, well before the rising limb of hydrograph, the two-model ensemble is found to provide the most skilful prognoses of water levels. However, while forecasting the rising limb of hydrograph, either the two-model solution or the vector autoregressive model offers the best predictive performance. In addition, it is hypothesized that along with the development of the rising limb phase, the vector autoregression becomes the most skilful approach amongst the scrutinized ones. Our simple two-model exercise confirms that multimodel hydrologic ensemble predictions cannot be treated as universal solutions suitable for forecasting the entire high flow event, but their superior performance may hold only for certain phases of a high flow.