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Process-based hydrological modelling framework MIKE SHE for flood forecasting on the Upper and Middle Odra

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New developments of grid-based hydrological modelling have been spurred by increasing access to meteorological modelling, radar and satellite remote sensing. However state of the art operational hydrological forecasting models are usually based on conceptual or empirical models, based to a greater or lesser degree on the physics of rainfall-runoff. By contrast state-of-the-art hydrological modelling is represented by fully distributed physically-based modelling that exhibit a much greater level of complexity. These are often regarded as too resource intensive for operational use however with the exponential growth of computer speeds such models may become operational in the not too distant future. In general operational hydrological forecast modeling requires a trade-off between model complexity and accuracy on the one hand and the need for rapid flood forecasts.

The approach adopted in the FLOODRELIEF project has been to develop a flexible, hydrological modelling framework based on the European Hydrological System (MIKE SHE) that permits changes in the model structure, including both conceptual and physic-based process descriptions, to be made within the same modelling tool. This framework had several advantages including the optimal use of grid-based precipitation fields from weather radar and numerical weather models, direct integration of satellite remote sensing and the unique ability to treat a range of new forecasting

problems such as groundwater flooding where the comprehensive nature of MIKE SHE can be exploited. This tool has been applied recently in the US under semi-arid conditions using NEXRAD data in the US National Weather Service study catchment, the Blue River. It is now being applied to one of the FLOODRELIEF study basins, the Upper and Middle Odra River. The Odra basin was selected as a highly flood-prone catchment representing highly developed European catchments where comprehensive modelling of the river system, flood plains, polder subsystems, and structures as well as rainfall-runoff and snowmelt processes in the tributary catchments are required. Flood forecasting in the Odra requires both fast and reliable simulations for this complicated river basin and therefore a careful balance between accurate representation of the catchment flood processes, the flood wave movement and inundation extent and the need for rapid forecasts. This paper will present this new framework and application to flood forecasting in the Upper and Middle Odra.