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Recent Experiences in Real-Time Flood Forecasting and Information System for the State of Iowa

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The Iowa Flood Center (IFC), established following the 2008 record floods, has developed a real-time flood forecasting and information dissemination system for use by all Iowans. The system complements the operational forecasting issued by the National Weather Service, is based on sound scientific principles of flood genesis and spatial organization, and includes many technological advances. At its core is a continuous rainfall–runoff model based on landscape decomposition into hillslopes and channel links. Rainfall conversion to runoff is modeled through soil moisture accounting at hillslopes. Channel routing is based on a nonlinear representation of water velocity that considers the discharge amount as well as the upstream drainage area. Mathematically, the model represents a large system of ordinary differential equations organized to follow river network topology. The IFC also developed an efficient numerical solver suitable for high-performance computing architecture. The solver allows the IFC to update forecasts every 15 min for over 1,000 Iowa communities. The input to the system comes from a radar-rainfall algorithm, developed in-house, that maps rainfall every 5 min with high spatial resolution. The algorithm uses Level II radar reflectivity and other polarimetric data from the Weather Surveillance Radar-1988 Dual-Polarimetric (WSR-88DP) radar network. A large library of flood inundation maps and real-time river stage data from over 200 IFC “stream-stage sensors” complement the IFC information system. The system communicates all this information to the general public through a comprehensive browser-based and interactive platform. Streamflow forecasts and observations from Iowa can provide support for a similar system being developed at the National Water Center through model inter-comparisons, diagnostic analyses, and product evaluations.