High-resolution, large-scale hydrological modelling tools for Europe

CHANTAL DONNELLY, JOEL DAHNE, JÖRGEN ROSBERG, JOHAN STRÖMQVIST, WEI YANG & BERIT ARHEIMER
Swedish Meteorological and Hydrological Institute, SE-601 76 Norrköping, Sweden
chantal.donnelly@smhi.se

Abstract Widespread availability of regional and global databases, as well as increases in computer processing speeds, enable the set-up and use of traditional high-resolution hydrological models over large regions. In this study, large-scale, high-resolution hydrological model applications were set up for the Baltic Sea runoff basin and the European continent using the HYPE model, a new, daily time-stepping hydrological model developed at the Swedish Meteorological and Hydrological Institute (SMHI, Lindström et al., 2010). The model applications were set up using readily-available regional and global databases for model input and model evaluation as a substitute for, and complement to, local data. Daily discharge data from the Global Runoff Data Centre (GRDC, 2009b), the European Water Archive (GRDC, 2009a), and the Baltex Hydrological Database Centre (BHDC, 2009) were used to calibrate and validate the BALT-HYPE application using a uniform calibration approach. Additionally, the large-scale modelling approach is demonstrated for the pan-European application, E-HYPE using the BALT-HYPE calibration parameters. The results indicate that BALT-HYPE is a useful tool for evaluating hydrology in unregulated basins for northern Europe and that the extended E-HYPE application has the potential to deliver the same data on a pan-European scale.

Key words Europe; Baltic Sea; large-scale; hydrological modelling; rainfall–runoff modelling