

Preface

The topic of “Weather Radar and Hydrology” brings together important science and technology challenges concerning the monitoring and forecasting of rainfall over space and time and how the pattern of rainfall is transformed by a varied landscape into surface water runoff and river flow across a city, region or country. It has significant practical application across a range of water resource functions, including flood forecasting and warning, flood design, urban drainage management, water supply and environmental services. The subject concerns developments in weather radar technology in combination with advances in hydrological application, and thus is of relevance to researchers in these fields, practitioners in the water industry and suppliers of weather radar systems.

These Proceedings bring together over 100 peer-reviewed papers presented at the International Symposium on “Weather Radar and Hydrology” (WRaH 2011), convened from 18 to 21 April 2011 at the University of Exeter, UK: see www.WRaH2011.org for details. The symposium was the 8th in a series that began in 1989 at the University of Salford (UK) under the title “Hydrological Applications of Weather Radar”. Subsequent symposia have been convened in Germany, Brazil, USA, Japan, Australia and France. WRaH 2011 marked a return to the UK after 20 years of successful symposia across the world. More than 250 people attended from a range of organisations – governments, academia, research bodies, national hydrometeorological services and consultancies – and travelled from countries spanning four continents. WRaH 2011 provided a forum for the exchange of experiences and ideas on the use of weather radar in hydrology with a particular emphasis on user applications for flood forecasting and water management. These Proceedings serve as a valuable record of this activity.

The set of papers are arranged in the Proceedings under seven themes as follows.

- (1) **Weather radar theory, technology and systems** including the topics: radar network compositing; correcting for attenuation, clutter, bright band and vertical profile of reflectivity (VPR) effects; radar reflectivity *versus* rain-rate (Z-R) relations; polarimetric radars at X-, C- and S-band; dual frequency, microwave and adaptive phase array radar technology; rain microphysics; and long-term diagnostic monitoring.
- (2) **Rainfall estimation and quality control** including the topics: multi-sensor precipitation estimation; polarimetric precipitation estimation; VPR and orographic corrected precipitation estimation; data quality-control; blended radar and raingauge rainfall estimation; performance evaluation of precipitation estimations; and space–time variability of rainfall estimates.
- (3) **Rainfall forecasting (nowcasting and numerical weather prediction)** including the topics: precipitation field advection estimation; blended radar rainfall advection and numerical weather prediction (NWP) model forecasts; nowcasting of orographic rain; probabilistic forecasting using ensembles; radar data assimilation for NWP; radar quality monitoring using NWP; and convective cell identification.
- (4) **Uncertainty estimation** including the topics: precipitation estimation error models; bias in radar calibration; quality indices for radar data; probabilistic rainfall warning; and impact of rainfall uncertainty on flow forecasts.
- (5) **Hydrological impact and design studies** including assessing the impact of summer thunderstorms and hailstorms, and a multifractal study of storm dynamics, using weather radar.
- (6) **Hydrological modelling and flood forecasting** including the topics: operational perspectives on flood forecasting; rainfall estimation for flood forecasting including use of

X-band and polarimetric radars, and raingauge and radar data in combination; use of rainfall forecasts in deterministic and ensemble form for flood forecasting; influence of rainfall spatial variability and storm motion on modelled flood response; distributed hydrological models using gridded rainfall estimates for catchment, region and countrywide flood warning; data-based flood forecasting; and hydrological modelling using radar rainfall for hydropower generation, water quality and environmental management.

- (7) **Urban hydrology and water management applications** including the topics: review of radar for urban hydrology; radar resolution requirements for urban applications; precipitation forecasting for urban surface runoff and flow prediction; rainfall depth-duration-frequency analysis and use with radar for monitoring urban drainage compliance; Z-R relations developed for urban and water management applications; and use of radar in predicting bathing water quality.

These seven themes serve to provide structure to the contents of the Proceedings, although in practice it is common for papers to overlap more than one theme.

The “Inter-Agency Committee on the Hydrological use of Weather Radar” (www.iac.rl.ac.uk) initiated and coordinated the WRaH 2011 Symposium, with the Royal Meteorological Society and the British Hydrological Society serving as joint convenors. The committee and the society convenors are thanked for their significant support. Members of the WRaH 2011 scientific committee served as reviewers of the papers published here: many thanks are due for their hard work and constructive suggestions that commonly led to a paper of improved quality. The editors of these proceedings served on behalf of the Inter-Agency Committee and as members of it.

Publication of these Proceedings by IAHS Press was managed by Cate Gardner with Penny Perrins responsible for its production: many thanks are due to their help and encouragement.

Some papers from these Proceedings have been developed further for publication in a Special Issue of the *Hydrological Sciences Journal* on “Weather Radar and Hydrology”.

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