



## **Concept of dealing with uncertainty in Polish weather radar-based meteorological and hydrological data**

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The methodology is based on a concept of: (1) quality index ( $QI$ ) field for all kinds of precipitation data, (2) probability density function (PDF) that is chosen to characterise the phenomenon, (3) ensemble of the PDF quantiles as input to rainfall-runoff models, (4) ensemble of runoff forecasts.

It will be applied to input data to System of Hydrology in Polish national weather service. In Poland precipitation data from weather radar network POLRAD are corrected and nowcasted by UK Met Office NIMROD system using data from other sources. The NIMROD precipitation estimates and forecasts constitute input to hydrological modelling.

In this presentation a concept of quality index ( $QI$ ) field scheme for both radar-based precipitation estimates (QPE) and forecasts (QPF) is proposed. It takes under consideration analysis of precipitation field rather than conditions and limitation of measurements. Different quality parameter fields can be chosen to characterise the two types of data together, e.g.: digital elevation map (for QPE), height of the lowest scan (for QPE), spatial variability (for QPE and QPF), temporal variability (for QPE and QPF), number of rain rate products incorporated in particular hourly accumulation (for QPE), lead-time of forecast (for QPF), quality of initial estimate of precipitation (for QPF).

Basing on the listed above quality parameters individual  $QI$ s are computed. It is assumed that the relationships between particular quality parameters and relevant individual quality indexes are linear. Having computed all individual  $QI$  fields they are summarised to an averaged  $QI$  field using appropriate weights.

In practice the uncertainty in estimates or forecasts of precipitation can be taken into

account using a specific PDF suitable for physical features of rainfall, e.g. a gamma distribution. It is assumed that the PDF parameters are functions of averaged  $QI$  and this relationship is experimentally determined for each pixel of the data field. It means that probabilistic precipitation field consists of three values for each pixel: two PDF parameters (or more in dependence on specific PDF) and QPE (or QPF).

However the rainfall-runoff models in Polish System of Hydrology are deterministic models that require deterministic precipitation as input, not probabilistic one. A solution is to produce an ensemble of a few deterministic inputs instead of only one. It may be done by selection of some characteristic maps. The members can be chosen as quantiles, e.g. 5, 25, 50, 75, and 95% basing on a cumulative distribution function. This ensemble will constitute a sequence of inputs to deterministic rainfall-runoff model.

In consequence the hydrological model needs to be activated 5 or more times according to a number of quantiles. As output from rainfall-runoff model the same number of discharge hydrographs will be obtained generating classes of runoff uncertainty. Classes of runoff probability will be determined basing on statistical investigation of a big number of rainfall flood events.