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0.1 A multiscale assimilation model for short-term forecasting of precipitation

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A multiscale recursive data assimilation model is developed for short forecasting of precipitation. The methodology uses local rainfall rates measurements/estimates, affected from measurement/estimation noise. The precipitation field is modelled using a lognormal random cascade (LN), well suited to properly represent the scaling properties of the rainfall field. Adopting a multi-scale recursive Kalman filter (derived from the RTS filter), the optimal estimation is carried out of the measured rainfall rates, providing unbiased estimates with the least estimation variance. Using a multi-scale recursive version of the maximum likelihood estimation (MLE), the random cascade parameters (process noise variances) are correctly assessed, properly accounting also for the noise in data. The methodology is then adopted to provide short-term forecasting of precipitation. Using the cascade framework, expected rainfall rates for different lead times are evaluated, including their confidence limits at the required confidence level. The multi-scale assimilation model is able to provide reliable short term forecast of precipitation, keeping into account its properties in scales and noise in measurements. A case study is then shown for a half-hourly rainfall rate series in Italy, showing the good fitting of the model to the observed rain rate series and the good matching of the short time forecasts to the observed values.