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Hydrology and Earth System Sciences Discussions



# *Interactive comment on* "A space-time generator for rainfall nowcasting: the PRAISEST model" *by* P. Versace et al.

**P. Versace et al.**

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We thank the referee 1 for his comments on our paper. We consider the comments as very useful and below we provide the answers to the questions raised. Reply on the specific comments:

1. The differences among the approaches are clearly highlighted in the introduction of the old paper, in which we have reported that: a)The "discrete time series" models are not intermittent and can be applied for "within storm" rainfall, "point processes" are continuous models, intermittent and can simulate interstorm period also; b) Multivariate models consider several rain gauges simultaneously and are intended to preserve the covariance structure of the historical rainfall data existing in the network points, while Multidimensional ones attempt to characterize the rainfall phenomenon at every

point over the area of interest; c) Meteorological models solve in numerical way partial differential equations of atmosphere thermodynamics; d) Moreover, meteorological models are useful qualitative-quantitative rainfall forecasting tools on 24-72 hours interval and on large spatial scale, but in order to perform short term real-time rainfall forecasts for small basins stochastic models appear to be competitive. Nevertheless, stochastic models input is only constituted by antecedent rainfalls, so they provide the same prevision, whether meteorological models forecast a wet period or a dry one. For these reasons, coupling stochastic and meteorological models appears a very interesting topic for rainfall forecasting in the small time space scale (Di Tria et al., 1999; Sirangelo et al., 2006). In the introduction of the revised paper we solely discuss nowcasting models without a detailed general review of stochastic models (and especially those that are not easily formulated for nowcasting), considering 2 or 3 reference at most for each model.

2. As regards the threshold value for estimating the correlation length, it is evaluated by generation of time series using autoregressive models of order equal to the correlation length, and considering the 95 % confidence interval of the sample maximum absolute scattering. Nevertheless, using autoregressive models appears unsuitable for the rainfall feature, and it cannot be used as statistical test. The coefficients alfa can be estimated by maximization of the coefficient of linear correlation. If ni is large the number of parameters may be too high, then a technique of linear filtering results convenient, like gamma-power function, as the coefficients alfa depend on a reduce number of parameters.

3. Al Saadi and Youngs trivariate exponential distribution with exponential marginals are adopted, because it is defined for variables strictly positive, like rainfall, and consequently, by using a power transformation, we make the model more flexible, allowing either amodal either modal marginal density functions. In the revised paper we have reorganized this part.

4. If we consider the whole year as a stationary period, referred to the rainfall fields,



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then the ratio d/p, for 10 years, is approximatively equal to 2050, and remains high enough (about 150) also if positive rainfall data are only considered. As the rainfall process is not homogeneous on the whole year, we have determined the stationary period (rainy season) October 1st - May 31st; consequently from 1990 to 2004 the d/p ratio is equal to about 2050 and about 150 considering only rainy intervals. PRAISEST Model is suitable for a lattice domain. In this case, because there are not available lattice data (for example radar dataset), we have evaluated the model parameters for each raingauge, and then interpolated them on the regular discretized domain.

5. 6 hours of forecasting is not a limit. The model can be used considering any width for temporal interval of forecasting. It is clear that, for values higher than 8 hours, predicted rainfalls are unconditioned by recorded data. We consider 6 hours as a good compromise, for which the prediction is dependent on the recorded rainfalls. As regards the figures 7-12, they are clearly commented on page 765, from line 14, of the old paper: "On the abscissa, the cells are sorted from left to right, and from North to South. In the figures, besides the rain histograms effectively occurred, for every cell, percentiles 90% and 95% of the simulated fields are reported. Following the axis of the abscissas, the chief towns of Cosenza (CS), Crotone (KR), Catanzaro (CZ), Vibo Valentia (VV) and Reggio Calabria (RC) are met in this order. One tail significance test, at 5% and 10% significance level, has been performed. The diagrams show that observed rainfall for all, but one, cells are inferior to percentiles 95% of forecasted values."

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