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Real-time radar-raingauge spatiotemporal combination in Switzerland.

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We investigate the problem of combining efficiently all available information associated with precipitation in the alpine terrain of Switzerland, and subsequently producing high-resolution and precision estimation maps. Such information typically incorporates measurements of rainfall intensity at a small number of raingauge locations on ground, and information from volumetric radar backscatter monitoring of meteorological targets above ground level. Additional information associated with topographic factors may be introduced to improve results. The combination of measurements collected from the aforementioned devices falls within the context of the project "CombiPrecip", originated in 2009 and expected to be completed in 2012 with the eventual employment of an on-line tool, able to produce real-time estimation maps over the whole region of Switzerland.

The practical aspects of such a project can be easily be brought to mind. Floods have been pronounced and unfortunately frequent natural disasters. An accurate scheme of quantitative precipitation estimation (QPE) is not simply of theoretical interest, but instead has important practical applications, since it plays a critical role in contributing to the protection of lives and property. Maps of QPE serve as inputs for complex flow functions in meteorological and hydrological forecasting, which makes a central issue the proper choice of uncertainty modeling as well as the accuracy of rainfall estimations and the determination of confidence intervals.

A number of researchers have investigated such combinations of raingauge and radar measurements, over the past few decades [1:10]. However, the alpine regime of Switzerland makes it a particularly challenging region to apply established techniques without careful investigation of the methodologies and their associated pathogenies. The main problem is that radar monitoring may occasionally be severely affected by topographic obstructions, but also by the peculiarities topography causes on meteorological systems. The complexity of the problem increases considerably due to the expectation of producing real-time estimation of precipitation fields, where the robustness of the data owes to be questioned. Of sensitive nature is the requirement for full-automatization, no-human-intervention for such tools, which stands as a challenge by itself, since such estimations have to be able to deal effectively with a highly variable range of storm systems, without much a severe expense on the corresponding accuracy.

Our approach centers on geostatistical modeling based on multi-gaussian transformation in order to incorporate spatially conditional information into the involved uncertainty model and to reduce the effect of problems such as homoscedasticity, or effects of deviations of transformed scores from the gaussian distribution at extreme values, often appearing in problems of estimation. The benefits of such an approach may increase further through incorporation of temporal information in the form of a secondary variable introduced through a cokriging coupling of present and past data, which are typically available in the precipitation context. Incorporation of spatiotemporal information in such fashion not only improves skill scores, but also stands as a solid and implementation-straightforward computational scheme. The complete design of this algorithm and its benefits will be discussed.

REFERENCES.

1. Koistinen, J., and T. Puhakka, An improved spatial gauge-radar adjustment technique, in Preprints of the 20th Conference on Radar Meteorology, Boston, MA, Amer. Meteor. Soc., 179-186, 1981.
2. Krajewski, W.F., Cokriging Radar-Rainfall and Rain Gage Data, Journal of Geophysical research, 92, 9571, 1987.
3. Creutin, J.D., Delrieu, G., and Lebel, T., Rain measurement by raingage-radar combination: a geostatistical approach, Journal of atmospheric and oceanic technology, 5, 102-114, 1987.
4. Seo, D., Krajewski, W.F., Bowles, D.S., Stochastic interpolation of rainfall data from rain gages and radar using cokriging. 1. Design of experiments, Water Resources Research, 26, 469-477, 1990.
5. Gabella M., Joss J., Perona G., Optimizing quantitative precipitation estimates using a non-coherent and a

coherent radar operating on the same area, J. of Geophys. Research, 105, 2237-2245, 2000.
6. Gabella, M., Notarpietro, R., Improving Operational Measurement of Precipitation Using Radar in Mountainous Terrain, IEEE Geoscience and Remote Sensing Letters, 1, 1545, 2004.
7. Germann U, Galli G, Boscacci M, and M. Bolliger, Radar precipitation measurement in a mountainous region, Q. J. Roy. Meteor. Soc., 132, 1669–1692, 2006.
8. Salek, M., Novak, P., Experience gained by five years of the utilization of the radar-based quantitative precipitation estimation at the Czech Hydrometeorological Institute, ERAD, 2008.
9. Velasco-Forero, C.A., Sempere-Torres, D., Cassiraga, E.F., Gomez-Hernandez, J.J., A non-parametric automatic blending methodology to estimate rainfall fields from rain gauge and radar data, Advances in Water Resources, 32, 986-1002, 2009.
10. Erdin, R., Master Thesis, ETH, Zurich, 2009.