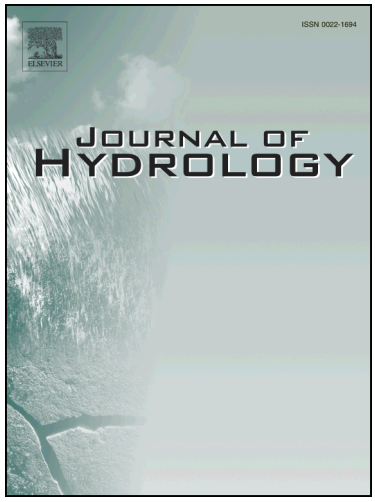


# Spatial interpolation of precipitation from multiple rain gauge networks and weather radar data for operational applications in Alpine catchments

Alain Foehn, Javier García Hernández, Bettina Schaefli, Giovanni De Cesare

PII: S0022-1694(18)30354-8
DOI: https://doi.org/10.1016/j.jhydrol.2018.05.027
Reference: HYDROL 22804

To appear in: *Journal of Hydrology*

Received Date: 13 November 2017
Revised Date: 4 May 2018
Accepted Date: 10 May 2018

Please cite this article as: Foehn, A., Hernández, J.G., Schaefli, B., Cesare, G.D., Spatial interpolation of precipitation from multiple rain gauge networks and weather radar data for operational applications in Alpine catchments, *Journal of Hydrology* (2018), doi: https://doi.org/10.1016/j.jhydrol.2018.05.027

# Spatial interpolation of precipitation from multiple rain gauge networks and weather radar data for operational applications in Alpine catchments

Alain Foehn[a], Javier García Hernández[b], Bettina Schaefli[c], Giovanni De Cesare[a]

[a]*Laboratoire de Constructions Hydrauliques (LCH), School of Architecture, Civil and Environmental Engineering (ENAC), Ecole Polytechnique Federale de Lausanne (EPFL)*
[b]*Centre de recherche sur l'environnement alpin (CREALP)*
[c]*Institute of Earth Surface Dynamics (IDYST), University of Lausanne (UNIL)*

**Abstract**

Increasing meteorological data availability and quality implies an adaptation of the interpolation methods for data combination. In this paper, we propose a new method to efficiently combine weather radar data with data from two heated rain gauge networks of different quality. The two networks being non-collocated (no common location between the two networks), pseudo cross-variograms are used to compute the linear model of coregionalization for kriging computation. This allows considering the two networks independently in a co-kriging approach. The methodology is applied to the Upper Rhône River basin, an Alpine catchment in Switzerland with a complex topography and an area of about 5300 km$^2$. The analysis explores the newly proposed Regression co-kriging approach, in which two independent rain gauge networks are considered as primary and secondary kriging variables. Regression co-kriging is compared to four other methods, including the commonly applied Inverse distance weighting method used as baseline scenario. Incorporation of additional networks located within and around the target region in the interpolation computation is also explored. The results firstly demonstrate the added value of the radar information as compared to using only ground stations. As compared to Regression kriging using only the network of highest quality, the Regression co-kriging method using both networks increases slightly the performance. A key outcome of the study is that Regression co-kriging performs better than Inverse distance weighting even for the data availability scenario when the radar network was providing lower quality radar data over the studied basin. The results and discussion underline that combining meteorological information from different rain gauge networks with different equipments remains challenging for operational purposes. Future research in this field should in particular focus on additional pre-processing of the radar data to account for example for areas of low visibility of the weather radars due to the topography.

## 1. Introduction

In Switzerland, severe flooding events in recent decades have increased the need for reliable forecasting systems to mitigate flood effects. In 1999, the research project MINERVE