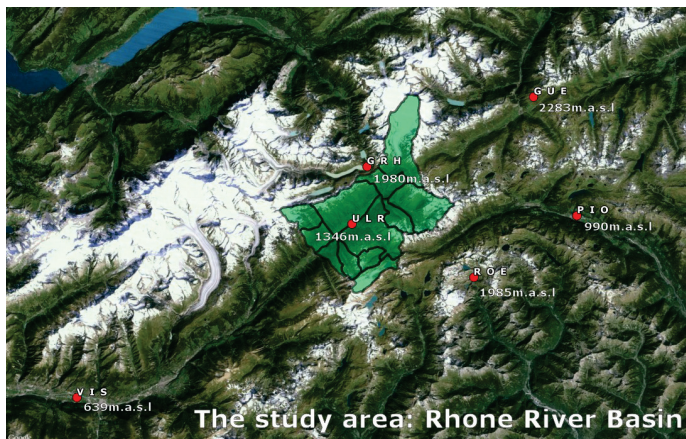


Precipitation spatialisation for the improvment of hydrological simulations in alpine environment

Introduction

The purpose of this project is to gain a better understanding of different spatial interpolation methods and to understand how they influence hydrological simulations in mountainous terrain. To achieve this goal, original precipitation data from the Rhone Glacier water basin will be interpolated using the Thiessen method, the Inverse Square Distance method and the Kriging method to generate new precipitation data sets.

These data sets will serve as inputs for a hydrological model and the outcoming data will be compared to actual river flow measurements in order to see how well each interpolation method estimates the resulting flow.



Programs

HydroPrepR

Software created by CREALP for data treatment consisting of four modules :

- Polygon Analysis: Calculates the center of gravity and surface area of polygons
- Elevation Bands Creator: Draws elevation bands based on basin shapefile and Elevation file
- Data Spatialization : Spatial interpolation and aggregation of time series
- CSV Import : Dataset conversion from csv to dsx/dst format

RSMINERVE

Software created by CREALP for hydrological Runoff simulations :

- Allows the importation of datasets
- Can create Hydrological models as shown left
- Simulates flow based on the given database and allows to compare it with real data
- Includes automatic calibration of the different parameters of each element of the model

Conclusion

- A Nash-Sutcliffe model efficiency coefficient of 1 indicates that the model fits the observations perfectly. An efficiency of 0 indicates that the model fits the observations as good as the mean of the observations. Efficiencies <0 indicate that the model does not fit the observations well.

- For the subbasins Gletsch and Oberwald the Nash-Sutcliffe model efficiency coefficients are very similar for the Thiessen, IDW and Kriging method. No significant performance difference between the different interpolation methods is evident. For Gletsch, $0 < \text{efficiency} < 1$, so the model is more accurate than the mean of the observations but could be more accurate. For Oberwald, $\text{efficiency} < 0$, indicating that the model is less accurate than the mean of the observation.

Acknowledgments

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Method

Use the CREALP software HydroPrepR to generate precipitation datasets using the following interpolation methods:

- Thiessen method with aggregation by altitude bands
- Inverse Distance Weighting with aggregation by altitude bands
- Kriging method with and without aggregation by altitude bands

Cross-validation of the interpolation methods using the generated precipitation datasets and original datasets

Simulation of river discharge with the CREALP software RS MINERVE to create a hydrological model for the Rhone Glacier basin and model calibration with the generated precipitation datasets as inputs.

Interpolation Methods

Thiessen interpolation

The interpolation value is equal to the value of the nearest measurement point.

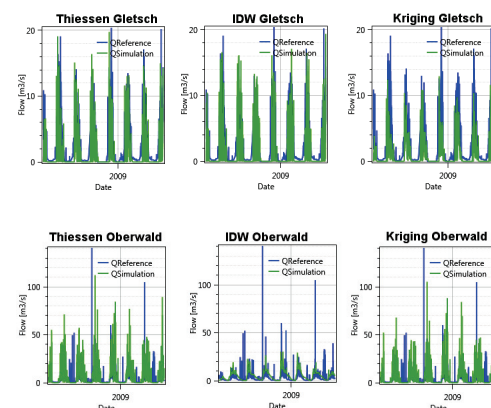
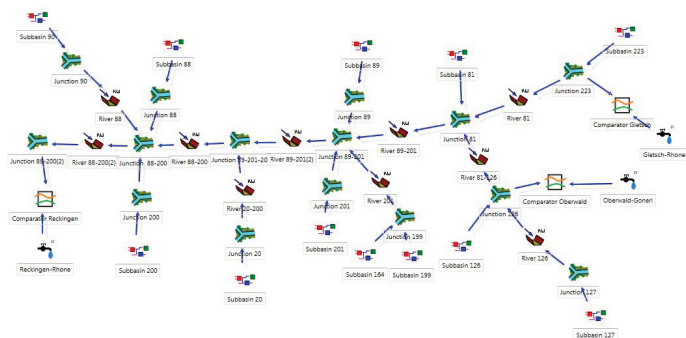
IDW interpolation

Linear combination of all measurement points weighted by the inverse of the distance to interpolation point squared.

Kriging interpolation

Linear combination of all measurements with weights based on two conditions: (1) unbiased estimation and (2) minimisation of error variance.

Hydrological Model



Nash-Sutcliffe model efficiency coefficient	Thiessen	IDW	Kriging
	Gletsch 0.36	0.3	0.32
	Oberwald -1.6	-1.9	-1.61