Modelled precipitation time series at snowdepth measurement stations as data source or spatialization of precipitation

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Introduction

Context
Spatialization of precipitation is often limited by insufficient reliable data. This project evaluates the performance of SNOWPACK which has the potential to provide additional reliable precipitation time series based on data measured at IMIS stations (SLF network).

Data source
Two networks of stations cover the meteorological monitoring of the Swiss Alps: IMIS and MeteoSwiss (MCH).

On map: IMIS ★ MCH

Precipitation is measured by both networks, but only MCH measures the solid precipitation, using heated rain gauges, while IMIS records meteorological data in addition to the rain rates.

Results

For all the five pairs of stations:
- Generally poor correlation in time series comparison (r = 0.04 – 0.53);
- Nearly perfect correlation in cumulative quantity and accumulation trend (r = 0.99, cumulated for a year);
- Similarity in frequency distribution of precipitation rates;
- Discrepancy always results from:
  1. SP often simulates higher rates (green ring)
  2. Rarely catches low intensity events (red ring)

Goals

The main goal of this project is to generate accurate solid and liquid precipitation time series at IMIS stations.

These values can be generated with SNOWPACK using the meteorological data collected at the IMIS station.

The quality of the simulated rain and snow rates is evaluated by comparison to the observed MCH precipitation data.

Methodology

Station pair selection (IMIS and MCH)

Creation of SNOWPACK files

SNOWPACK calibration then simulation

SP rain rates compared to IMIS

SP rain + snow rates compared to MCH

Interpretation

Poor time series comparison?
1. IMIS and its MCH counterpart are involved in different precipitation regimes (dependent on local topography);
2. Existing and varied lags;
3. Poor input data (difficult equipment maintenance, lack of energy, poor stability under extreme weather)

Improvement for evaluation?
1. Mapping the relevant topographic information;
2. Running SNOWPACK for a station where "real" data is measured;
3. Look further into SNOWPACK’s frequently encountered discrepancy

Conclusion

SNOWPACK performance?
1. Coherence with input (IMIS) in liquid precipitation rates
2. Bad correlation in time series comparison
3. The same types of inconsistencies occur frequently
4. Provide good estimation for patterns on yearly scale

Recommend or not?
More information on topographic influence is need; So far, we will not recommend the use of SNOWPACK for spatialization purpose.