

Experiences in using INCA-CH precipitation nowcasting for Urban Flood Nowcasting

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1

OBJECTIVES OF THE RESEARCH

ASSESS THE ADDED-VALUE OF INCA-CH NOWCASTING PRODUCT FOR URBAN FLOOD FORECASTING

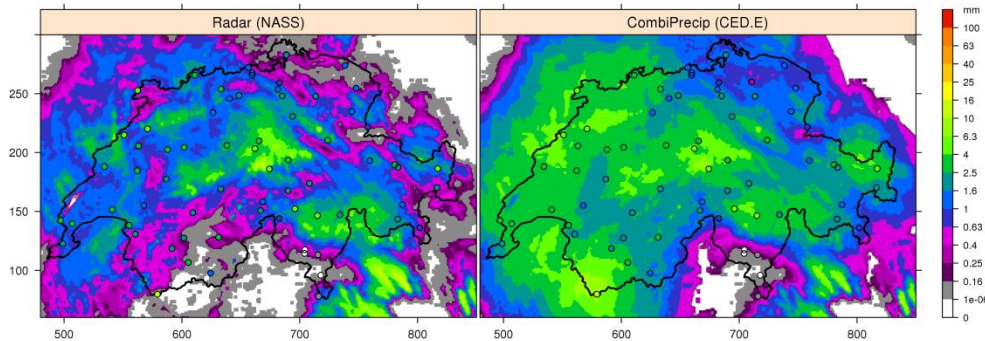
- What is the current performance of nowcasting in small river catchments ?
- Is the Inca-nowcasting product able to improve the forecasting skill of the system ?
- How to convert the new information into added-value for our customers ?

2

INCA-CH PRODUCT

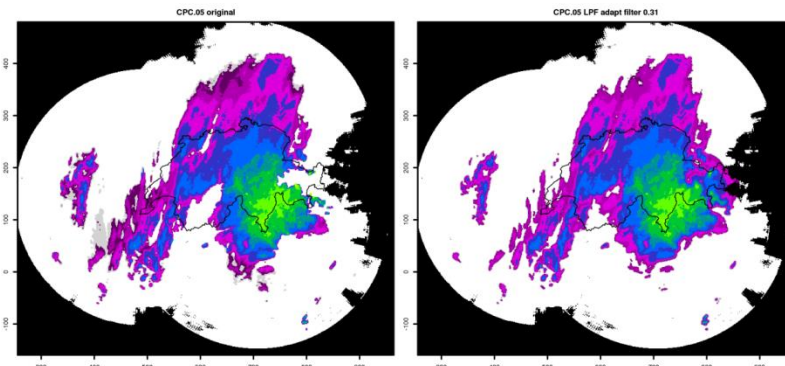
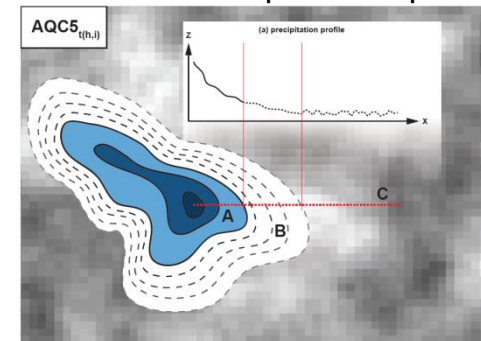
Geostatistical technique

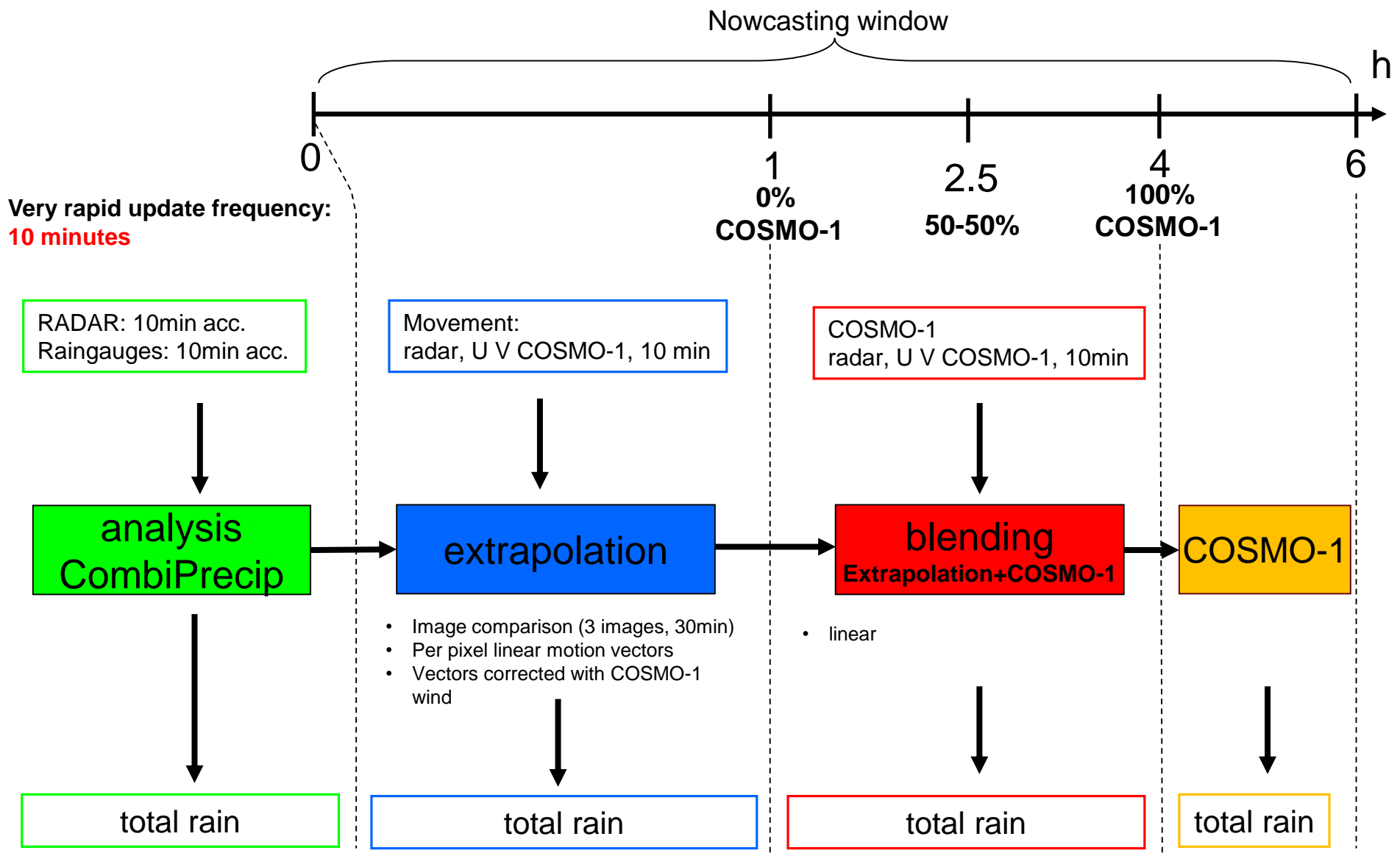
- Spatio-temporal co-kriging with external drift
- Correlations are computed using **semivariograms**.
- Convection control capabilities
- Use of semivariograms of past states (*Sideris et al., 2014*)
- **Hourly aggregation.**
- Produced every 10 minutes: 144 images per day.
- Processing takes 3-5 minutes.
- Equipped with a quality flag (0-9).



Disaggregation

- From 60 minutes accumulation to **5 minutes** accumulations using radar (12 pieces)
- Solution to zero accumulation problem (*Barton et al., 2018*)
 - Dilution by means of low-pass filtering
 - Use of spatio-temporally correlated noise



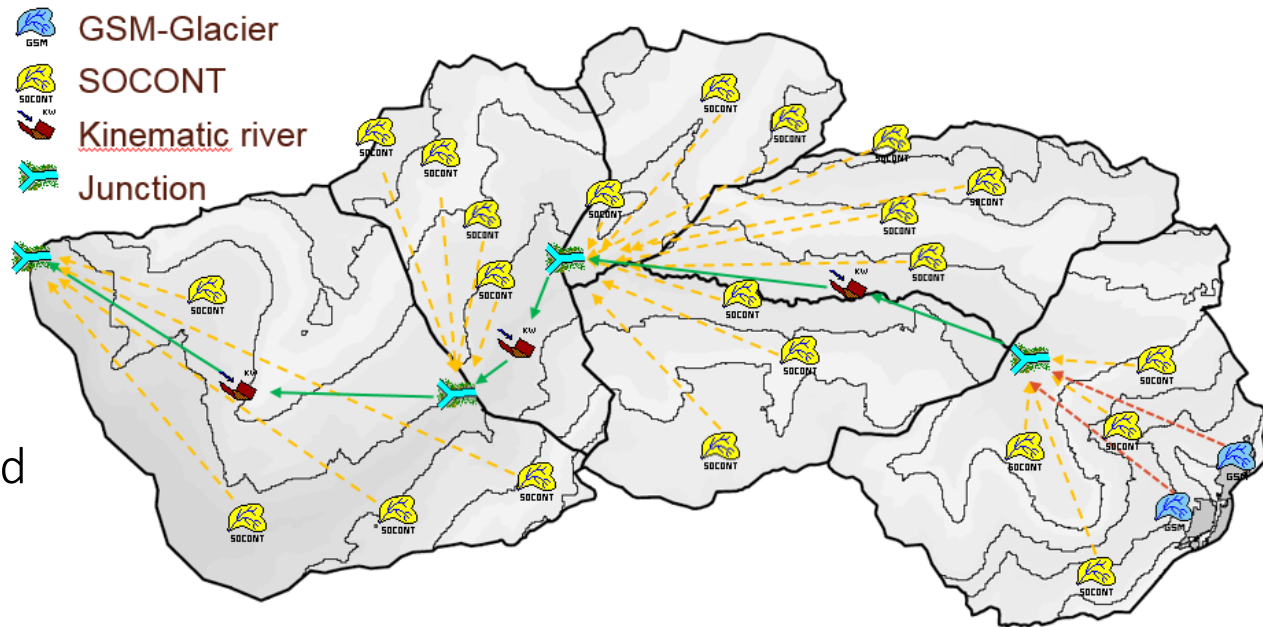


3

HYDROLOGICAL FORECASTING SYSTEM

Hydrological Model: Routing System

- Semi-distributed model
- Elevation bands (typically 300m)
- SOCONT-MODEL

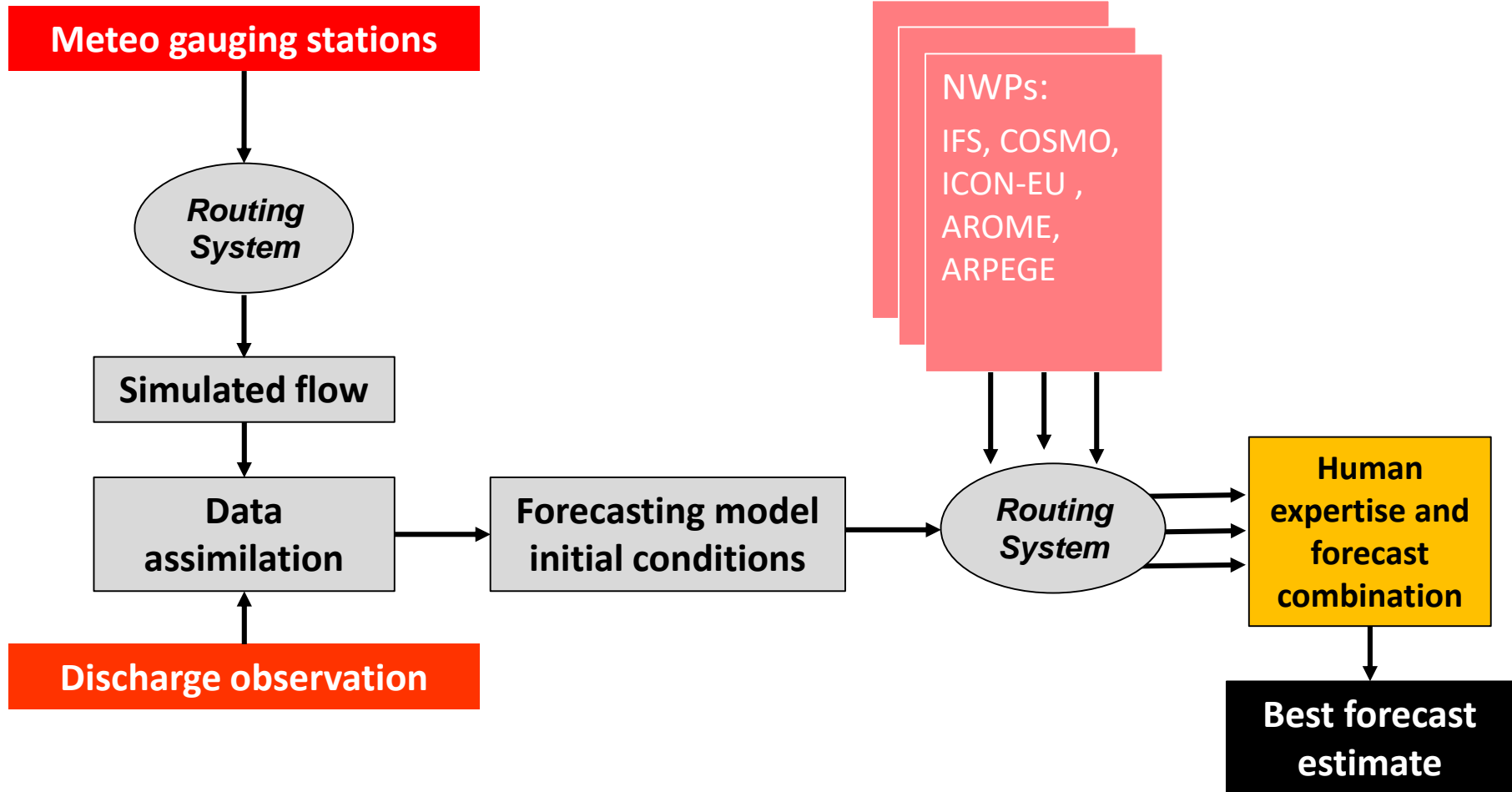


Processes modeled

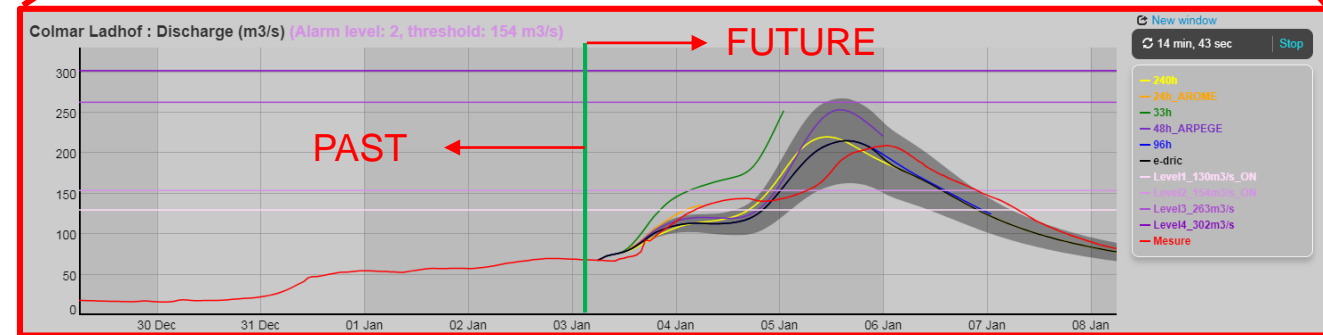
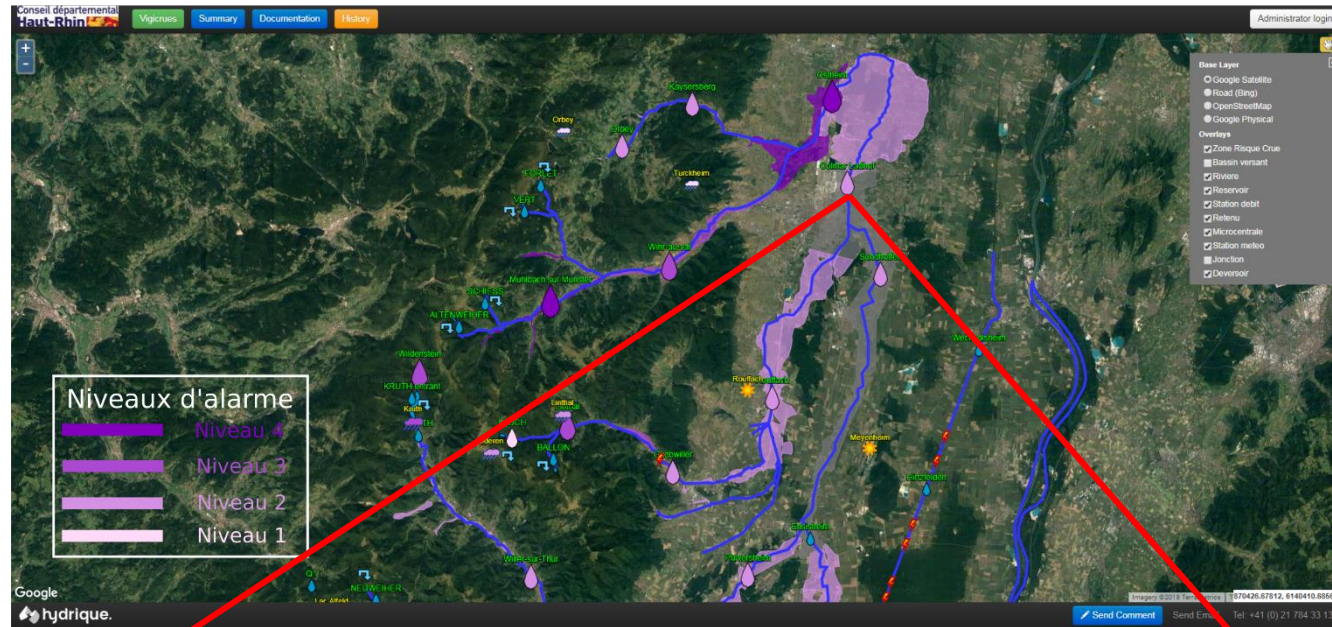
- Runoff
- Snow / glacier melt
- Evapotranspiration
- Soil moisture
- Flow routing
- ...
- Intake, lakes
- Pumps, turbines
- Reservoir management

(Schäfli et al., 2005 ; Jordan, 2007)

HYDROMETEOROLOGICAL CHAIN



- Forecast as a service, webgis application
- Forecast update with Inca : 10min
- Alerts (SMS, e-mail) : **future** precipitation, discharge, water level, runoff
- Archives of forecasts available online

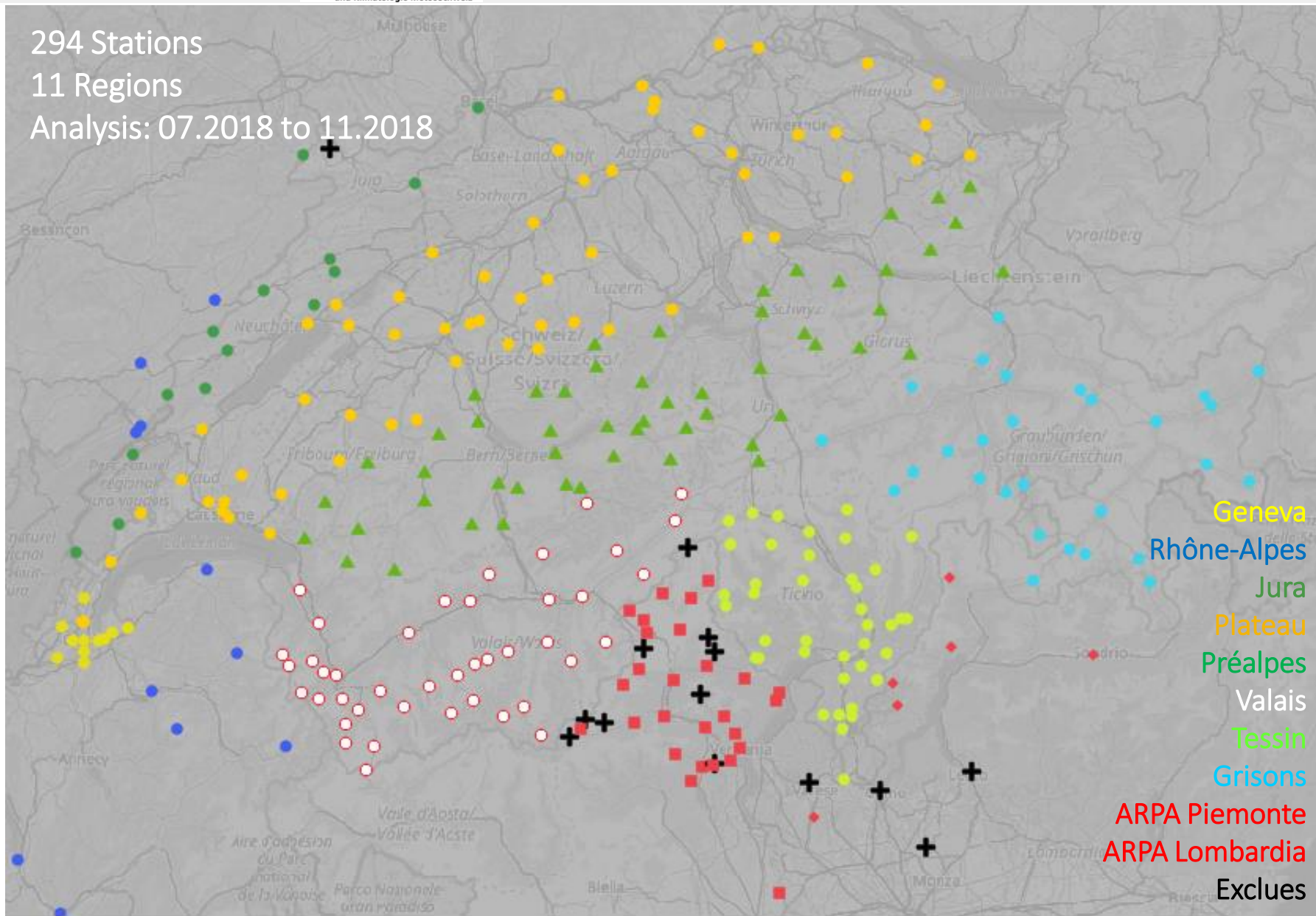


Example of the 3rd of January, 2018

4

INCA-CH ASSESSMENT

294 Stations
11 Regions
Analysis: 07.2018 to 11.2018

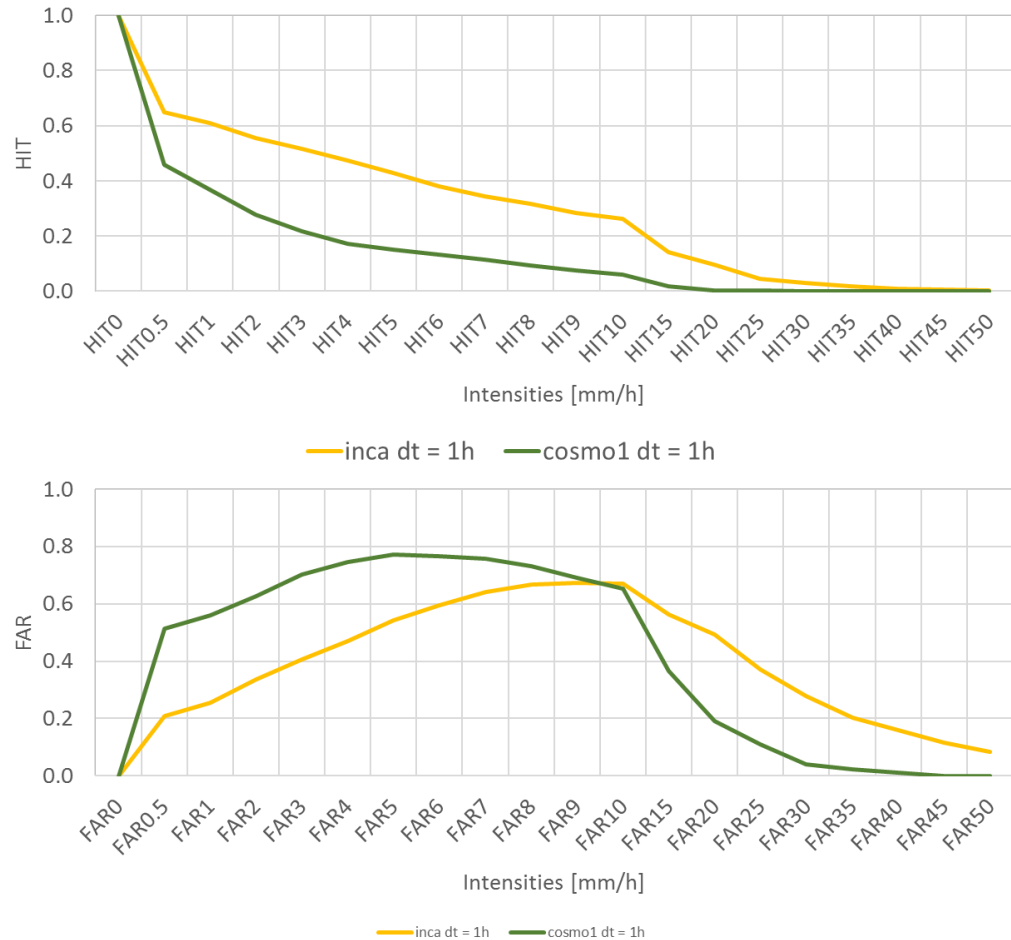


HIT / FAR analysis : COSMO-1 vs INCA-CH

Average of all 294 stations

1h lead time total precipitation

- Better results for INCA
- Poor skills of COSMO-1 :
HIT < 0.2 and FAR > 0.6 for
P > 1 mm/h
- Good skills of INCA-CH up
to ~5 mm/h





5

APPLICATION TO SMALL RIVER CATCHMENTS

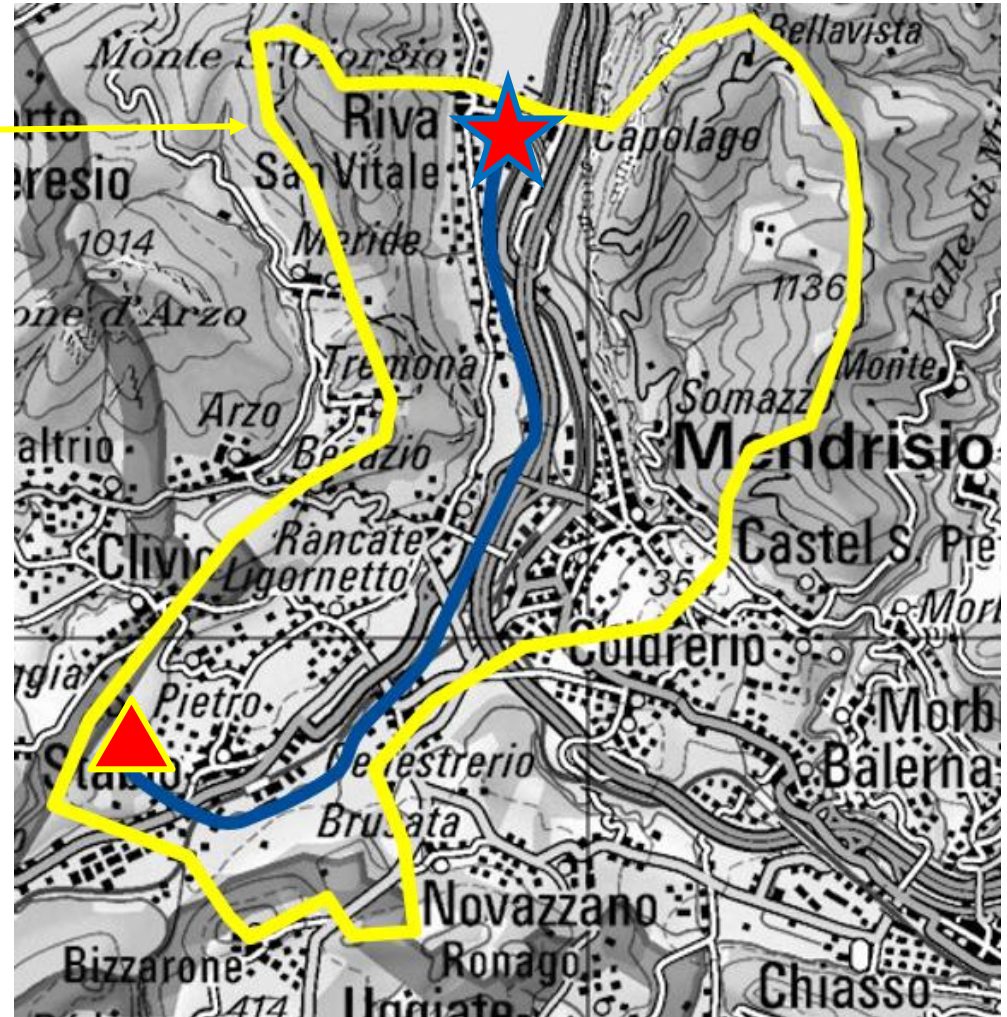
Laveggio in Riva san Vitale (Ticino, Switzerland)

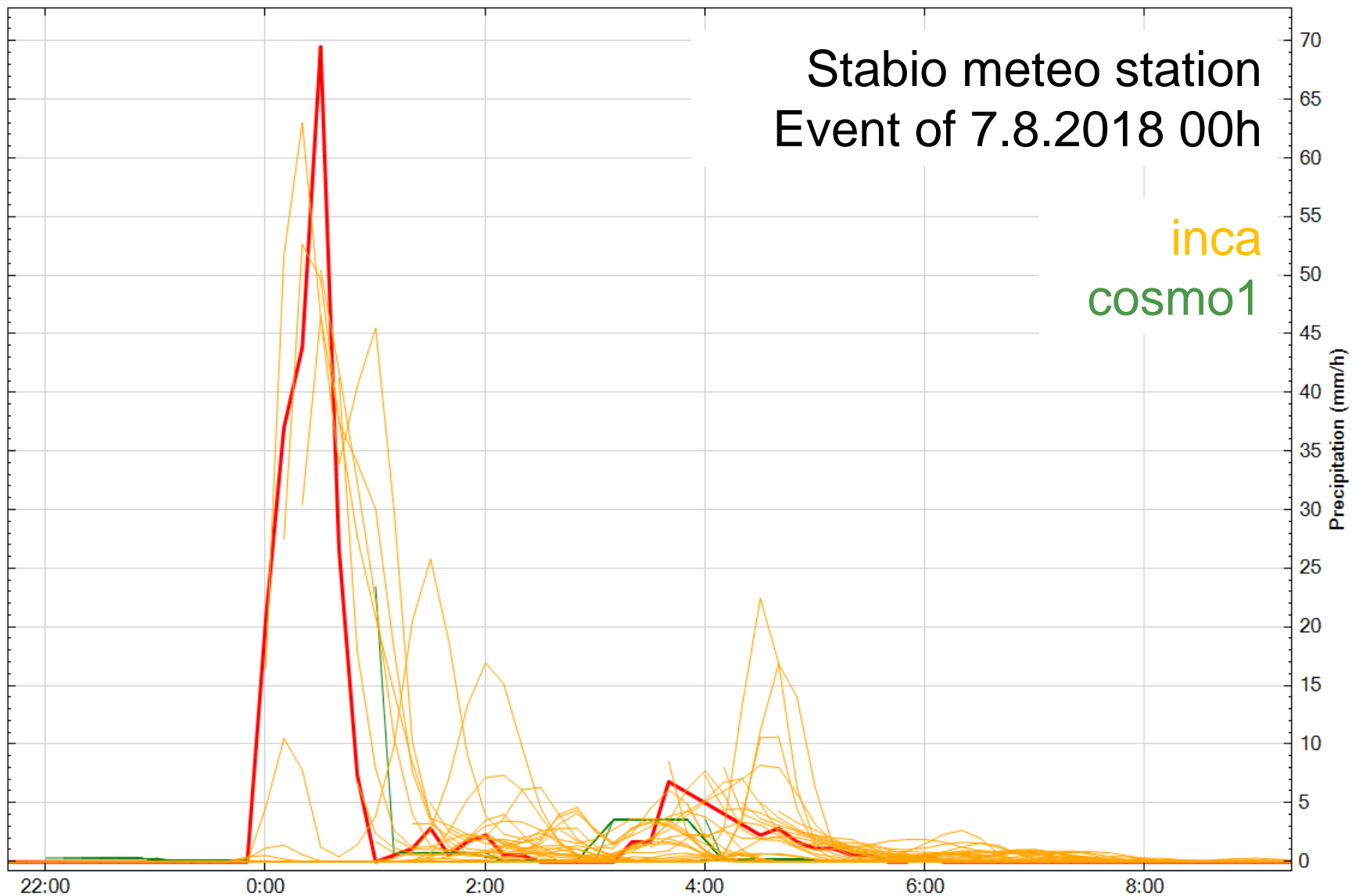


32.4 km² (catchment area)
4.5 km² (impervious area)

-  Stabio rainfall gauge
-  Riva discharge gauge

Response time: 40' to 1h

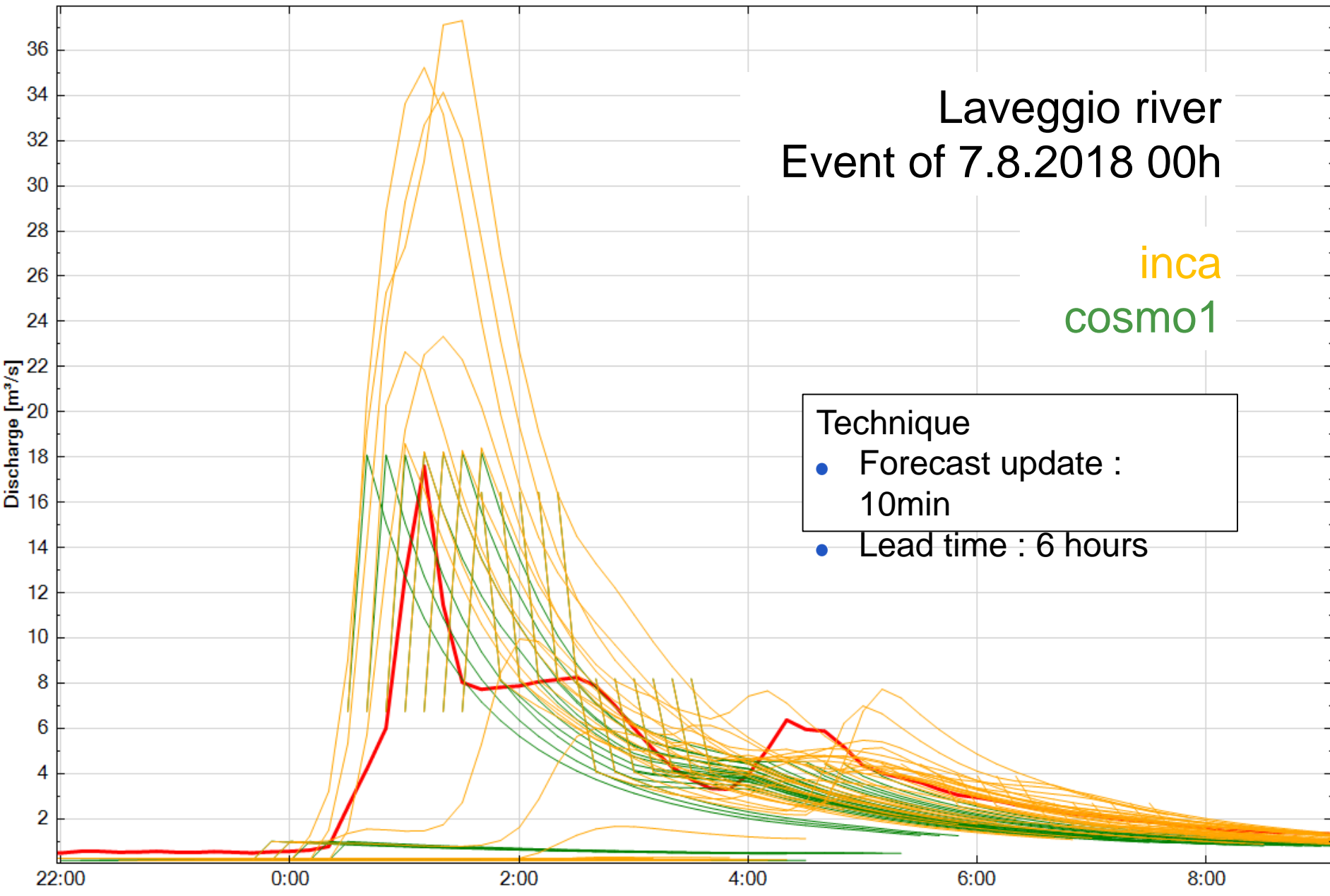




Laveggio river
Event of 7.8.2018 00h

inca
cosmo1

- Technique
- Forecast update : 10min
 - Lead time : 6 hours



Summary for forecasts in the Laveggio catchment:

No	Date	Duration of anticipation		comment
		Inca	cosmo1	
1	20.07.2018	90	no	Peak 30min too late
2	25.07.2018	no	no	
3	06.08.2018	90	no	
4	13.08.2018	30	no	Poor quality of cosmo1 forecast during event
5	31.08.2018	80	no	Poor quality of cosmo1 forecast during event
6	27.10.2018	no	no	
7	06.11.2018	180	180	Model too low, but good reaction from forecasts

7 storm events analyzed

cosmo1 – 1 event “predicted”

inca – 5 events “predicted” 30-90 min ahead

6

DISCUSSION

- What is the current performance of nowcasting in small river catchments ?

Some events can be «predicted», up to 1.5 times the response time of the catchment.


- Is the Inca-nowcasting product able to improve the forecasting skill of the system ?

Yes, especially when the numerical weather model doesn't predict any rainfall.


- How to convert the new information into added-value for our customers ?

Most important feature : update the precipitation information as fast as possible (5-10 min)

THANK YOU FOR YOUR ATTENTION

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HIT / FAR analysis
Average of all 294 stations
10 min volumes

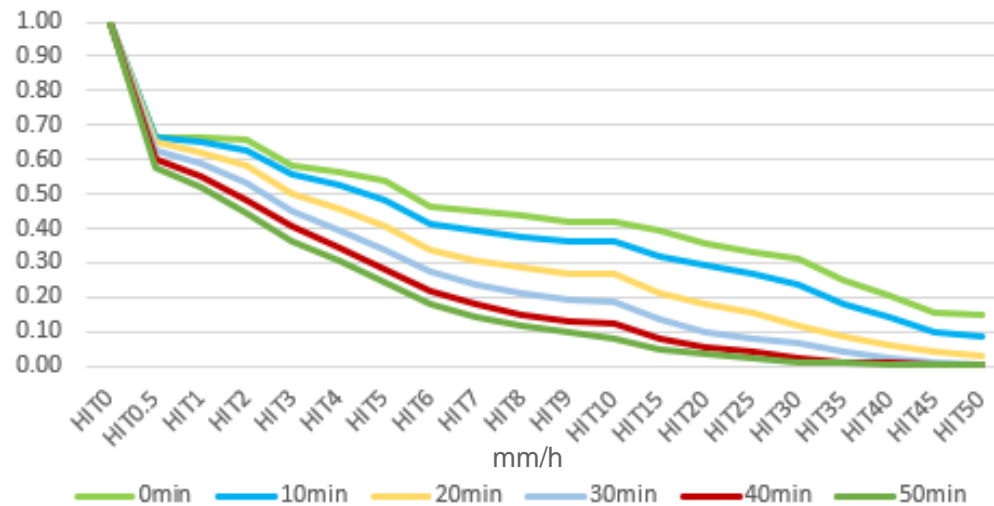
Example: 10 mm/h
during 10 min

- HIT drops from 0.4 to 0.08
- FAR goes from 0.5 to 0.9

Lead time

- Skill until 20-30 minutes ahead

10 min steps with offset



10 min steps with offset

