

¹ Laboratory of Hydraulic Constructions (LCH)



PREDICTING FLOODS...

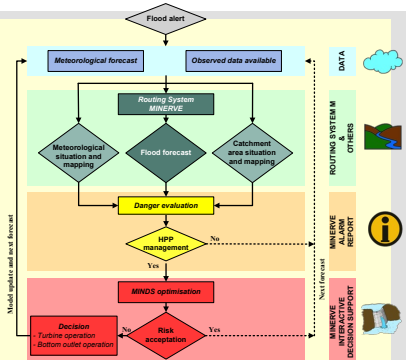
...warning authorities for population safety and...

...taking profit of the existing hydropower schemes for reducing flood damages



What after a "water alert" from MeteoSwiss?

- **Analysis of the meteorological and hydrological forecast**
- **Danger evaluation** at the control points (Brig, Sion, Visp, Dranses, Portes du Scex,...) and in the hydropower plants
- If a risk of overflowing exists, the Decision Support System MINDS proposes the **optimal hydropower plants management for flood peak reduction**



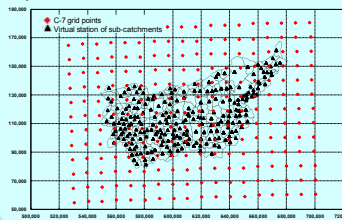
METEOROLOGICAL FORECASTS

Computation of three forecasts from MeteoSwiss

	COSMO-LEPS	COSMO-7	COSMO-2
Members	16	1	1
Boundary conditions	ECMWF	ECMWF	COSMO-7
Spatial resolution	7-7 km	6.6-6.6 km	2.2-2.2 km
Vertical levels	40	60	60
Lead time	132 h	72 h	24 h
Temporal resolution	3 h	1 h	1 h
Update	24 h	12 h	3 h

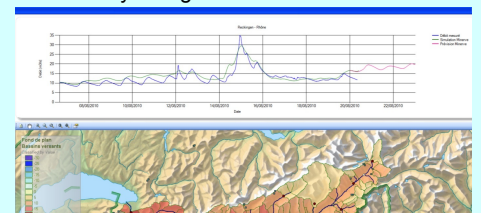
Requirements:

- ❖ Precipitation (P) at each grid point over the soil
- ❖ Temperature (T) at each grid point at different altitudes and hp levels



Visualisation of...

- ❖ P & T in every sub-catchment
- ❖ P & T in measurement stations
- ❖ Also: Hydrological variables



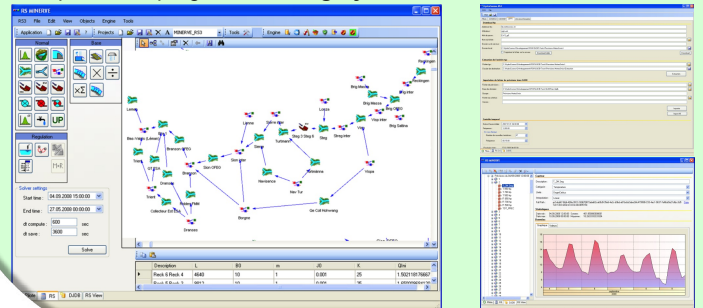
Run-off model Snow model
Infiltration model Glacier model

HYDROLOGICAL MODEL

Calculation requirements:

- **Semi-distributed hydrological model** of the catchment area with 239 sub-catchments and 1050 altitude bands, completed with: hydraulic works (reservoir, turbine, pump, spillway, intakes,...), rivers, derivations, junctions,...
- Database with observed data and meteorological forecasts

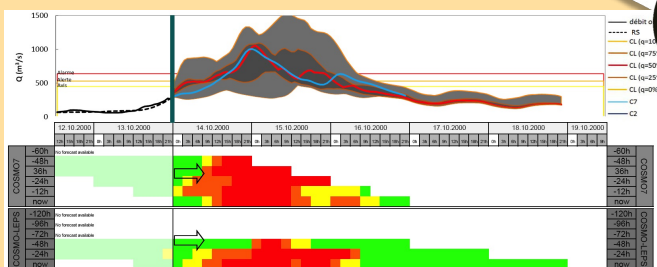
Computational program: Routing System MINERVE



Visualization of...

- **Continuous simulations** with hydrological forecasts from an automatic tool system
- Proposed **warning levels** depending on the exceeded thresholds (notice, alert or alarm) for each important control point located on the Rhone catchment area

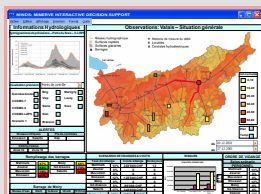
HYDROLOGICAL WARNING REPORT



▪ MINERVE is **operational** manually since September 2006 and automatically from July 2010

▪ The system has been used in September 2006 following an alert in the Wallis Canton

▪ News improvements and developments are being done currently



Requirements:

- ✓ Hydrographs in control points
- ✓ Inflows & levels in the reservoirs
- ✓ Characteristics of the hydropower plants

Objectives of the reservoirs optimization:

- ✓ **Maximizing water inflows** (water intakes and pumps) & **minimizing outflows** (turbines and water release structures)
- ✓ If insufficient available storage volume: start preventive turbine or bottom outlet operations

MINERVE Interactive Decision Support

MINDS



MINDS: DECISION SUPPORT SYSTEM

Outputs:

- ✓ Visualization of preventive operations & final hydrographs
 - ✓ Economical **risk assessment** of management scenarios (preventive operations costs & potential damages)
- Conclusion:
- ✓ Even with no-perfect forecasts, the decision making tool is **capable of reducing peak discharge during floods** thanks to the hydropower schemes management

