Design Project - SIE 2019

CANTON DU VALAIS
KANTON WALLIS

Analyse de Variantes pour l'Optimisation de Réseaux d'Irrigation
Variants Analysis for the Optimization of Irrigation Systems

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1. Background

Causes	Actions
Spring 2017 frost event in Rhône plain	Outdated irrigation system	Plan to unify and optimize the irrigation systems
Impact on arboriculture & viticulture	Spatially separated individual irrigation systems	Projects as sprinkler & pumping development
Several millions worth of damage	Resources management not optimized	Total investment estimated at 48'000'000 CHF

2. Objectives

1. Determine the main characteristics of the area
2. Identify the variables needing monitoring
3. Design a global optimization system for the study area

3. Meteorology & Climate

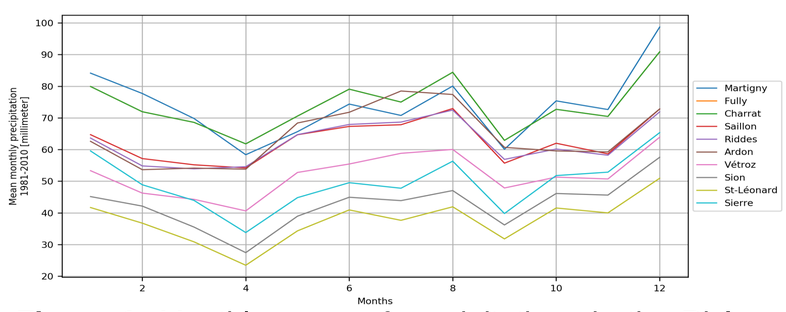


Figure 1: Monthly mean of precipitations in the Rhône valley from 1981 to 2010.

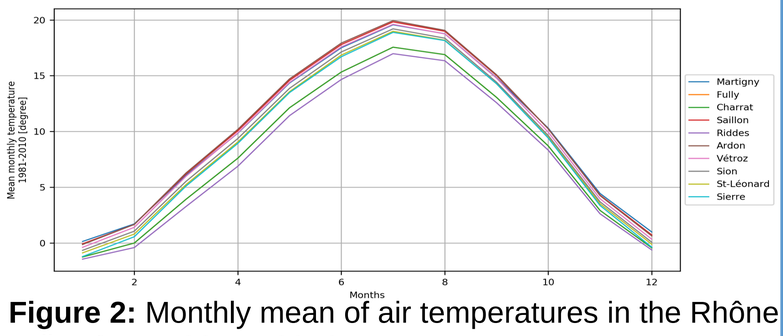


Figure 2: Monthly mean of air temperatures in the Rhône valley from 1981 to 2010.

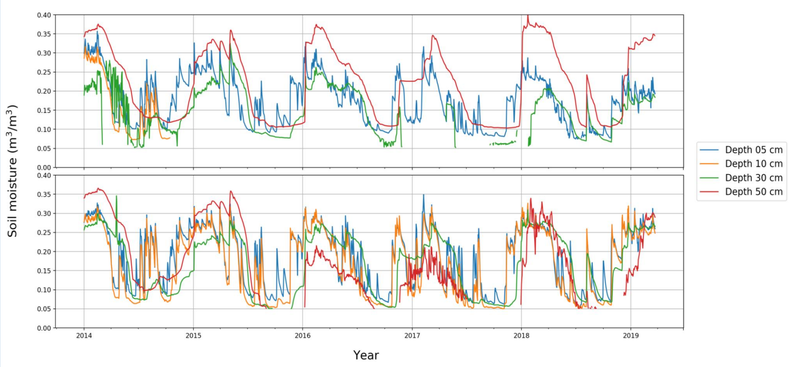


Figure 3: Daily means of soil moisture (different depths) at Sion, 2014-2019. Top: 10HS sensor, bottom: IMKO TDR PICO sensor.

4. Water Resources

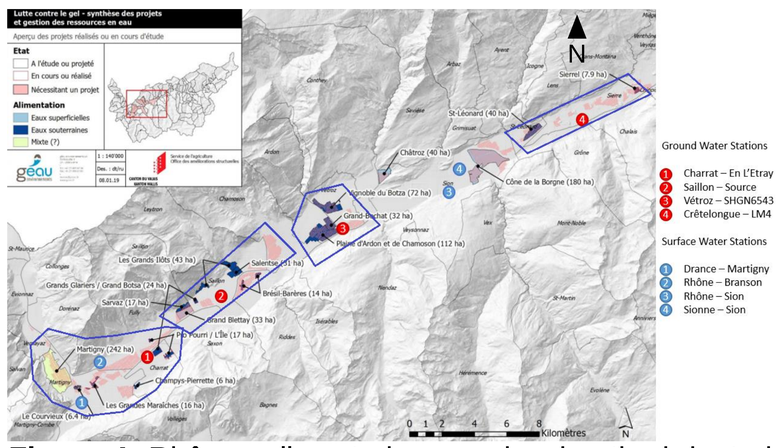


Figure 4: Rhône valley study area showing the irrigated fields and their clustering to water measurement units.

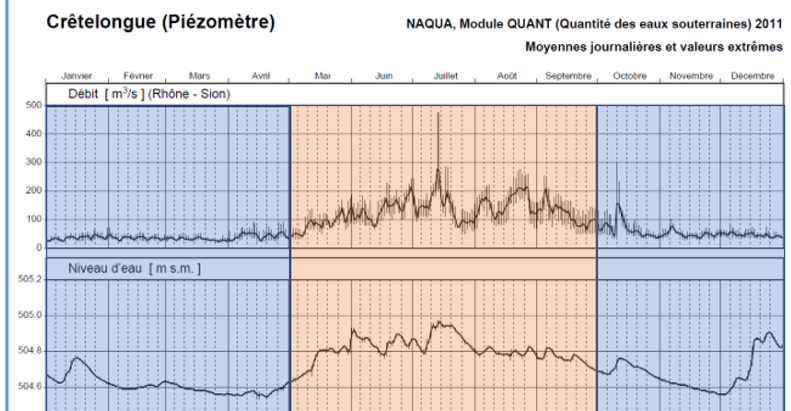


Figure 5: Example: Discharge and level variations at Crêtelongue station in 2011. All available stations were evaluated for 4 years (2011-2014 or 2015-2018).

The main fluctuations in surface & groundwater are related to water discharge & water level. Two phases occur: the Summer phase (orange zone) with high water level & discharge, and the Winter phase (blue zones) with low level & discharge.

5. Water Quality

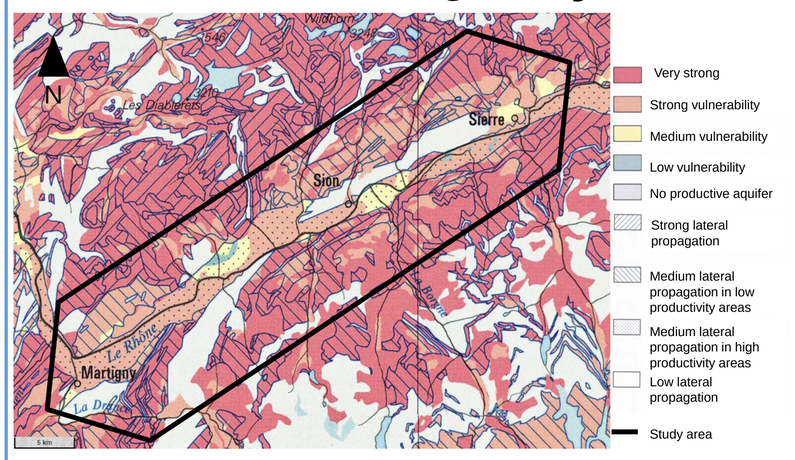


Figure 6: Physical and chemical vulnerability of aquifers and groundwater in the study area.

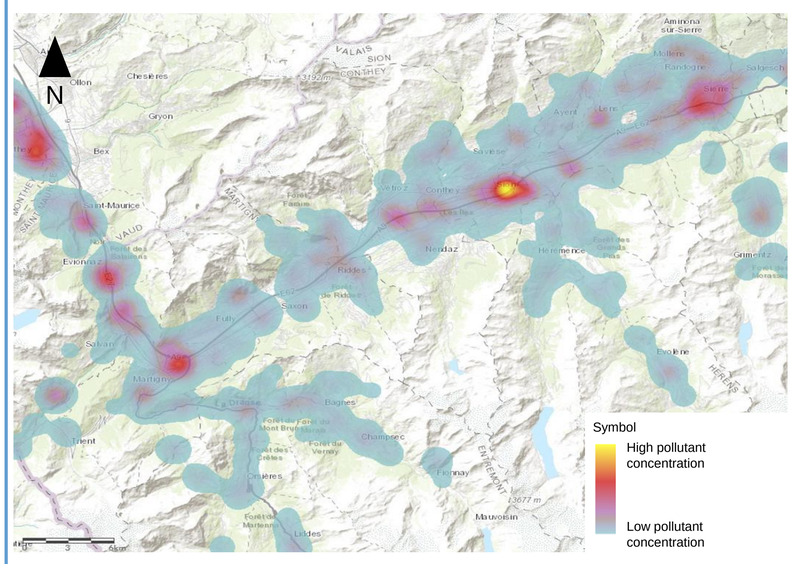


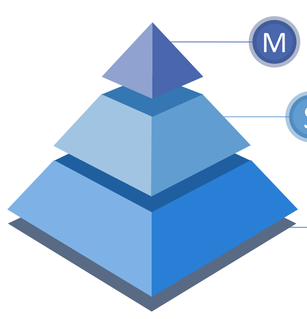
Figure 7: Heatmap of the pollution concentrations in the study area. Concentrations of all pollutants registered in the "Osites" database are aggregated and displayed.

6. Monitoring Needs

The monitoring needs have been assessed based on the seasonal and yearly fluctuations of selected variables and are indicated according to these fluctuations.

Table 1: Water monitoring needs in the different parcels of the study area.

Field	Town	Source	SWT	SWL	SWD	SWQ	GWT	GWL	GWD	GWQ
Grand-Bochat	Ardon	GW	N	N	N	N	Y	N	Y	Y
Plaine d'Ardon et de Chamoson	Ardon / Chamos	GW	N	N	N	N	Y	N	Y	Y
Les Grandes Maraiches	Martigny	GW	N	N	N	N	Y	N	Y	Y
Le Courvieux	Martigny	GW	N	N	N	N	Y	N	Y	Y
Ferme des Iles	Martigny	MIX	Y	Y	Y	Y	Y	N	Y	Y
Les Barères	Riddes	GW	N	N	N	N	Y	Y	Y	Y
Brésil	Riddes	GW	N	N	N	N	Y	Y	Y	Y
Pro Pourri / L'ile	Fully / Charrat	GW	N	N	N	N	Y	N	Y	Y
Sarvaz	Fully	GW	N	N	N	N	Y	Y	Y	Y
Grand Blettay	Fully	SW	Y	Y	Y	Y	N	N	N	N
Les Champys / La Pierrette	Charrat	GW	N	N	N	N	Y	N	Y	Y
Les Grands Ilots	Saillon	GW	N	N	N	N	Y	Y	Y	Y
Salentse	Saillon	GW	N	N	N	N	Y	Y	Y	Y
Grand Glariers / Grand Botsa	Charrat / Saillon	GW	N	N	N	N	Y	Y	Y	Y
Cone de la Borgne	Sion	SW	Y	Y	Y	Y	N	N	N	N
Chatroz	Sion	SW	Y	Y	Y	Y	N	N	N	N
St-Léonard	St-Léonard	GW	N	N	N	N	Y	Y	Y	Y
Sierre	Sierre	GW	N	N	N	N	Y	Y	Y	Y
Vignoble do Botza	Vétroz	GW	N	N	N	N	Y	N	Y	Y



7. Monitoring System Structure

- **Sensing:** Data acquisition from the field using specific sensors.
- **Transmission:** Data transfer from the sensing points to the application and visualization points using GPRS and other channels.
- **Application:** Real-time visualization, analysis, (automated & user-controlled) of the collected data on different hardware (PC, smartphone, tablet, etc.) for decision-making.

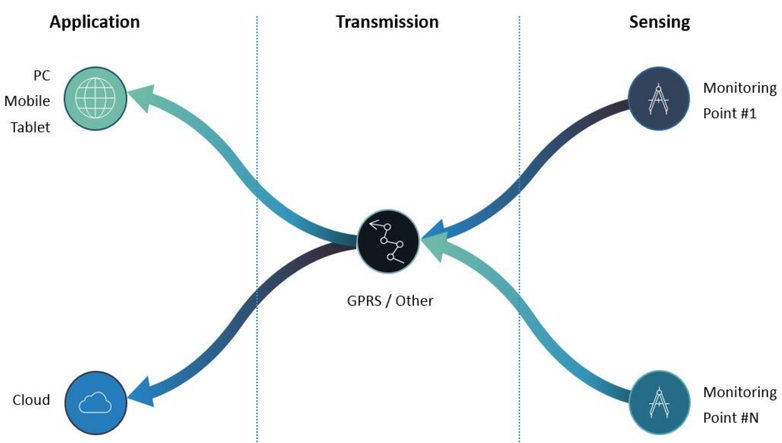


Figure 11: Schematic representation of the parts and components of the sensor-based wireless monitoring system for irrigation & anti-frost and their relationship.

8. Suggested Products

Meteorology

HOBOnet Field Sensor Network
- Real-time monitoring
- Enables alerts for frost events
- Irrigation optimization based on climate
- Modular addition of sensors (plug & play)
- Total investment: 55'000 CHF

Water Quantity

SatSCADA Real-time water monitoring
- Provides transmission (GPRS) & application (monitoring on PC, tablet or smartphone)
- Adapted to any 4-20ma water sensor
- Total investment: 150'000 CHF

Water Quality

Libelium Smart Water Real-time Water Quality Monitoring
- Controls the pH, DO, ORP, salinity, turbidity, ion concentration (NO_3^-, Ca^{2+}, etc.)
- Application-Programming-Interface (API) for real-time data visualization
- Total Investment: 120'000 CHF

Total Investment

325'000 CHF for 932.8 ha