MONITORING OF WATER IS STRATEGIC TO HYDRO-QUEBEC
River Systems

Water = 95% of power production
NEEDS

How much water will be available to feed each power plants (currently, in the next 24 hours, ... in the next years)? How much water out of precipitations and from the snow cover?

• Insure supply of water to meet production objectives and demands
• Maximum falling height
• Security of neighbouring communities
• Protection of natural habitats
• Minimum quantities of non-productive water
NEEDS

Historical trends in water levels: planning the current hydro-electric network and new installations
Monitoring of snow and precipitations
In-situ monitoring of SWE

± monthly measurements
DIFFICULT TO ESTIMATE THE SWE

233 samples of snow over a 15 km long and 300 meters wide corridor on 17-18 of March 2002
NEEDS

Needs vary

- Large and slow responding reservoirs
- Small and fast responding reservoirs
- Time of year (spring or fall runoff, rain over snow,…)
- Soil moisture conditions
- Data in support to hydrological forecasting tools/models

900 km
NEEDS

✓ Snow = ± 40 % of power produced

✓ Hydrological regimes are driven mostly by melting of snow cover as we go North

✓ Information on snow cover evolution during the winter and specially in spring time.
SOME INITIATIVES TO MEET NEEDS

Satellite remote sensing

✓ EQEAU: RADARSAT

✓ SSM/I: passive microwaves
AIRBORNE GAMMA SENSORS

Analyse application of technique over northern regions (moss and bogs)
SNOWPOWER

International three years project (Germany, Switzerland, Austria, Sweden, Canada)

Development of in-situ monitoring of SWE and snow cover density in real time

Based on measurements of the dielectric characteristics of the snow pack.
IN-SITU COSMIC RAYS SENSORS

Gamma ajustées vs données terrain

- gamma corrigée pour biais
- Chapais - site 1
- Chapais - site 2
- Chapais - près station

EEN en cm

Date

OTHERS AVENUES WERE ASSESSED

Laser sensors

Coupling of models

Rainsat

Weather RADARs

G P R

N R C (EDF)
H.Q. Current initiatives
Hydrometeorological Data

Discharge measurements – Doppler
Velocity Index: successful field tests
Margin of error ~ 5%
River models Q2D
Application to open flow and flow under ice.
H.Q. Current initiatives
Hydrometeorological Data

GMON (Gamma MONitoring)

SWE from GMON at SHA compared to manual sampling
(estimated margin of error in red)

Relative contribution of the soil to the signal detected as a function of its location relative to the base of the GMON, at 3 meters above ground (case with a SWE of 10 cm)

Soil moisture (additional work required)
H.Q. Current initiatives
Hydrometeorological Data

- SSM/I: SWE over northern regions using linear regression and multiple linear regressions.
- Information derived automatically: distribution map of SWE and the error distribution.
H.Q. Current initiatives

Hydrometeorological Data

- Passive micro-waves data
- Linear Regressions LR and MLR
- Réseaux de neurones RNA
- Physical Approach HUT model AP

- SWE < 150 mm: Error ~ 15 -20 %
- SWE 100 – 150 mm: Error ~ 10 –15 %
- SWE > 10 mm: Error ~ 10 %
H.Q. Current initiatives
Hydrometeorological Data

- Merging data over a grid

SSM/I derived data

In-situ data

Margin of error

Margin of error
Thank you