Hydro Québec Production

Une division d'Hydro-Québec

MONITORING OF WATER IS STRATEGIC TO HYDRO-QUEBEC

River Systems

Water = 95% of power production

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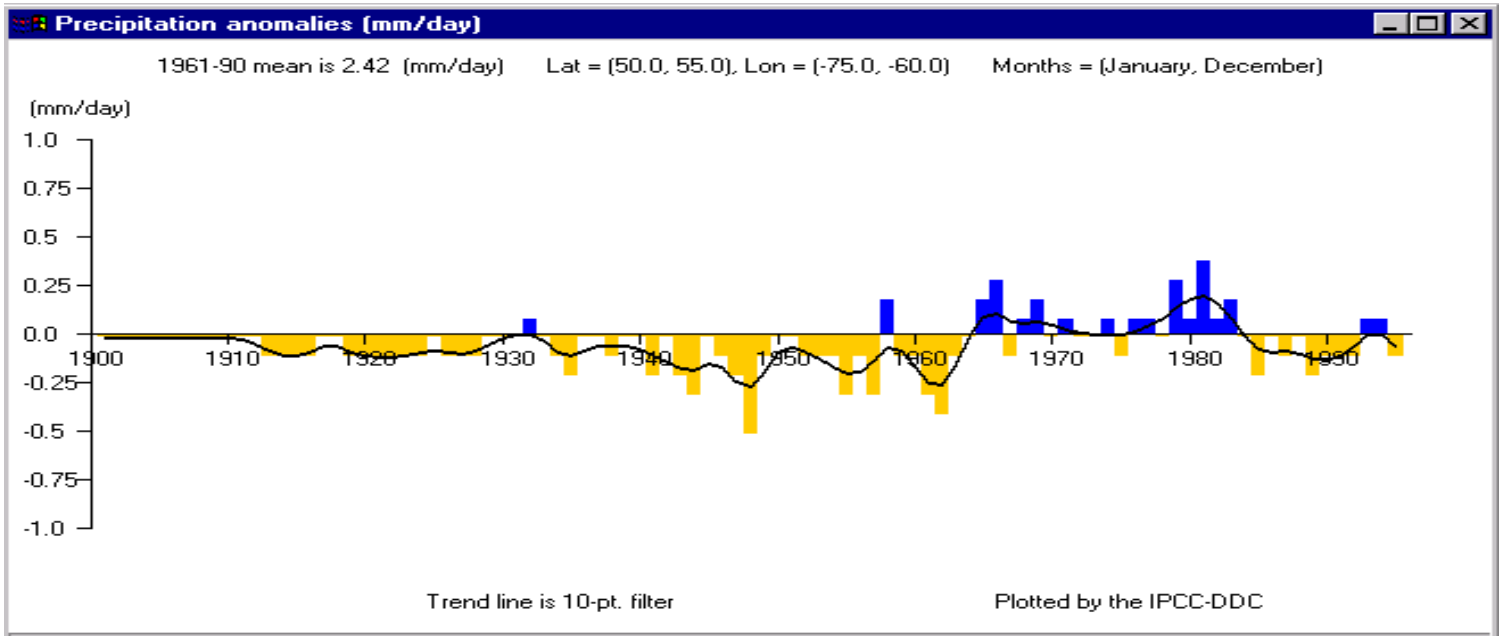
NEEDS

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

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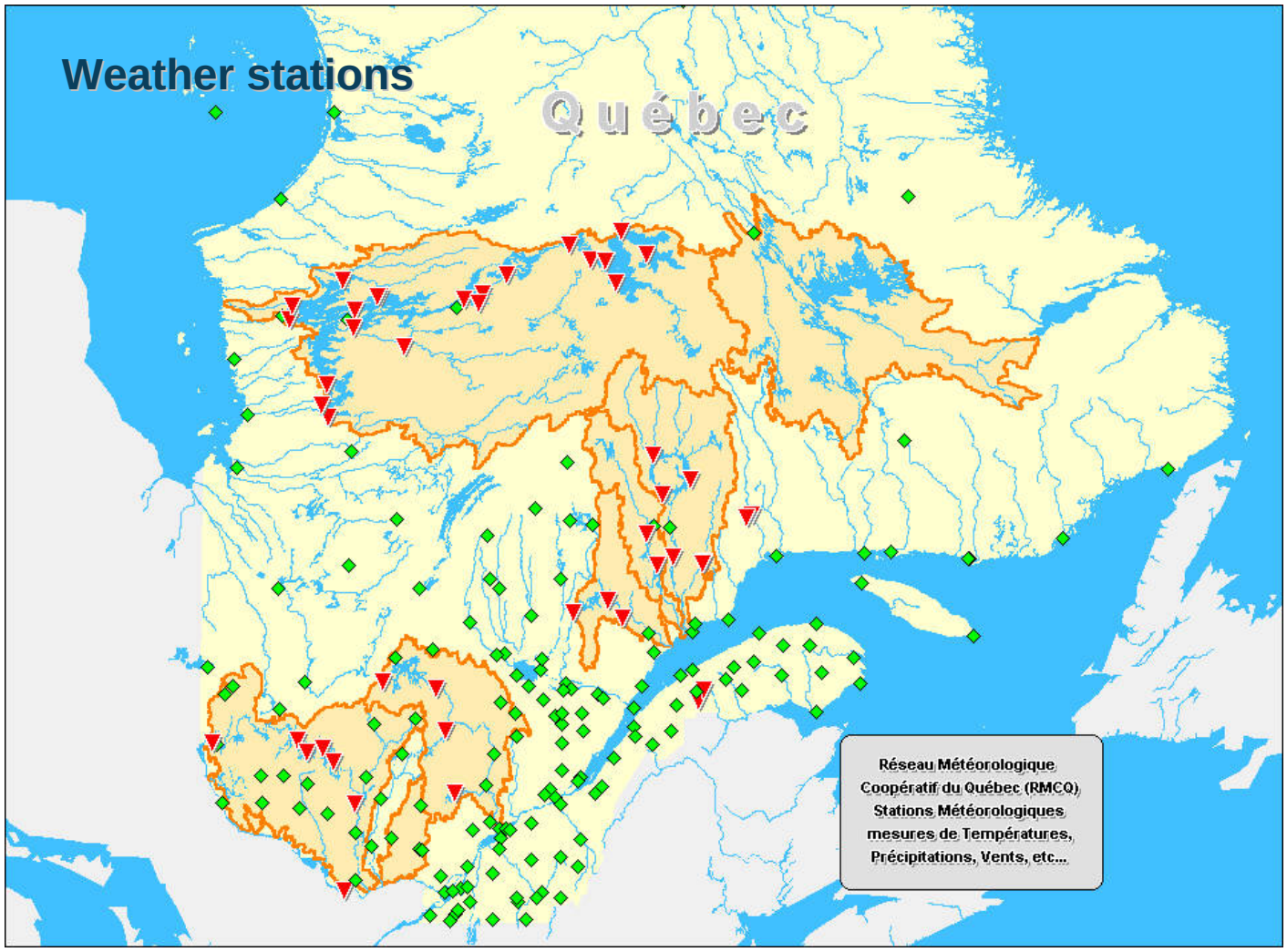
Monitoring of snow and precipitations



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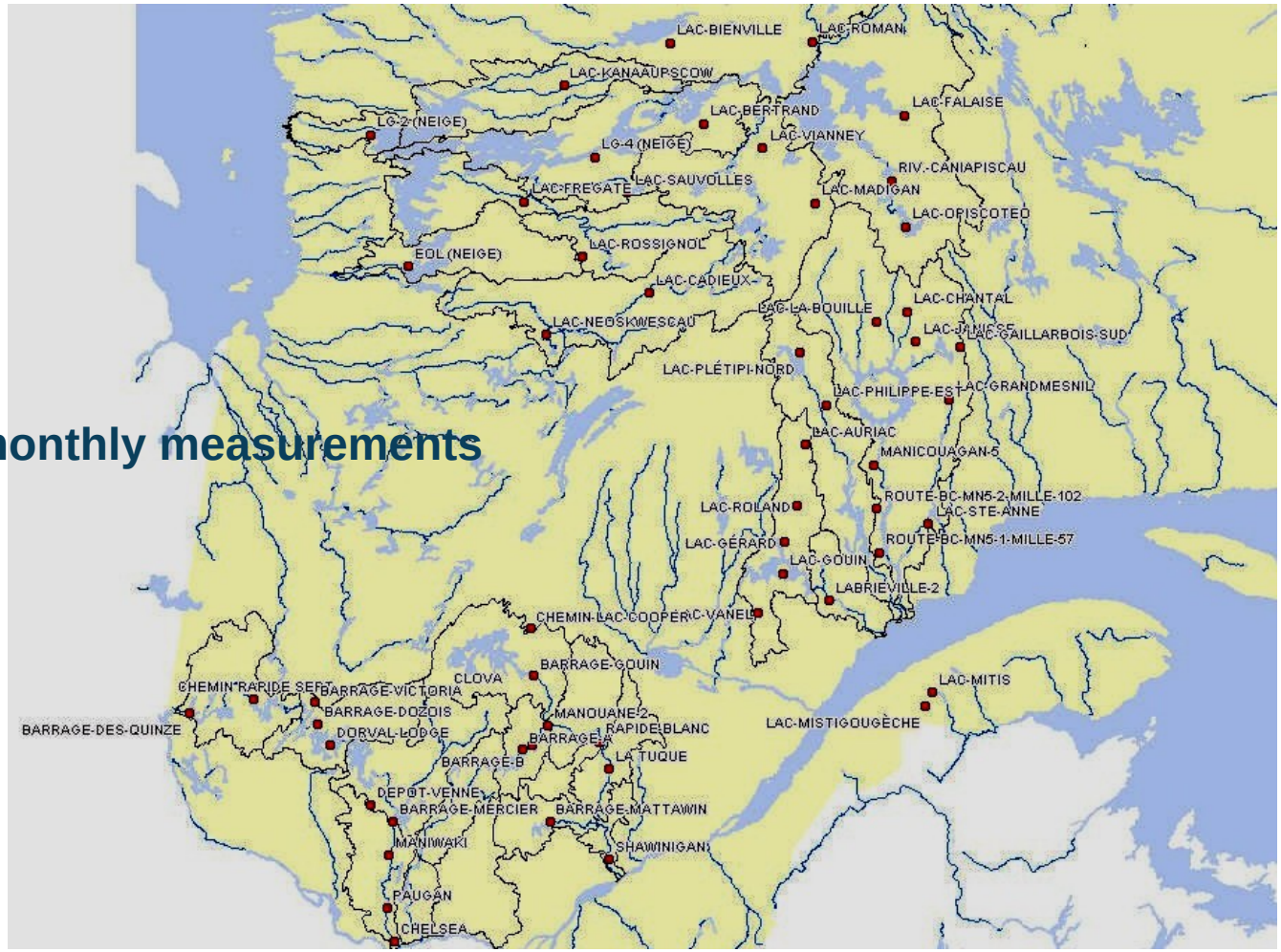
In-situ monitoring of SWE

± monthly measurements



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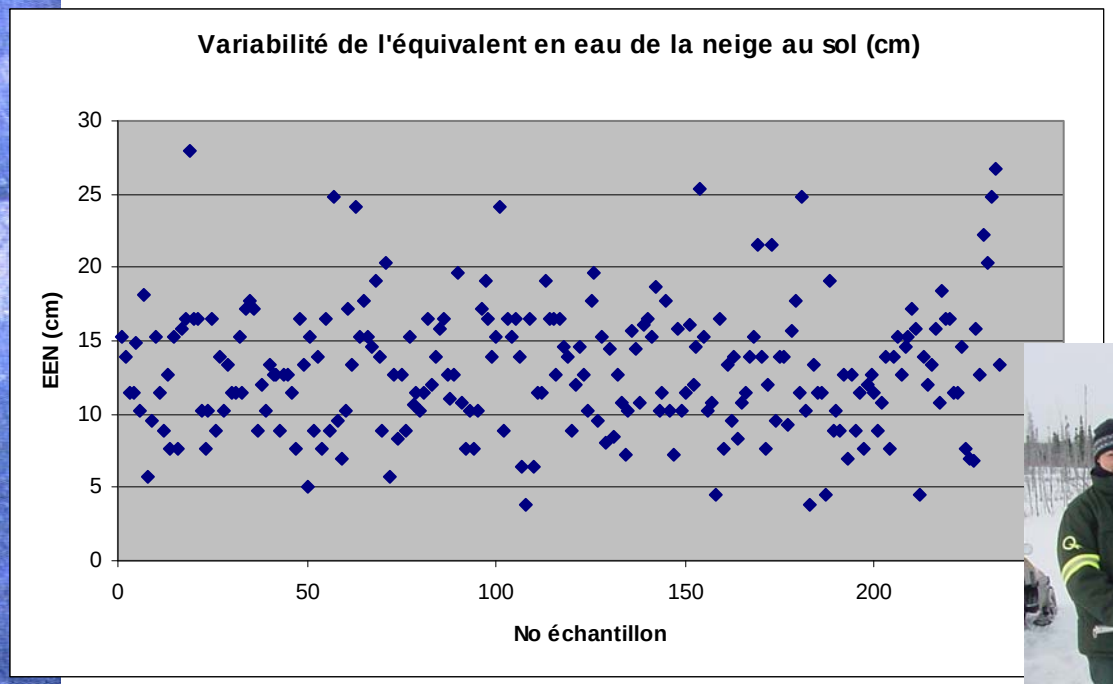
DIFFICULT TO ESTIMATE THE SWE

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



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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

- ✓…

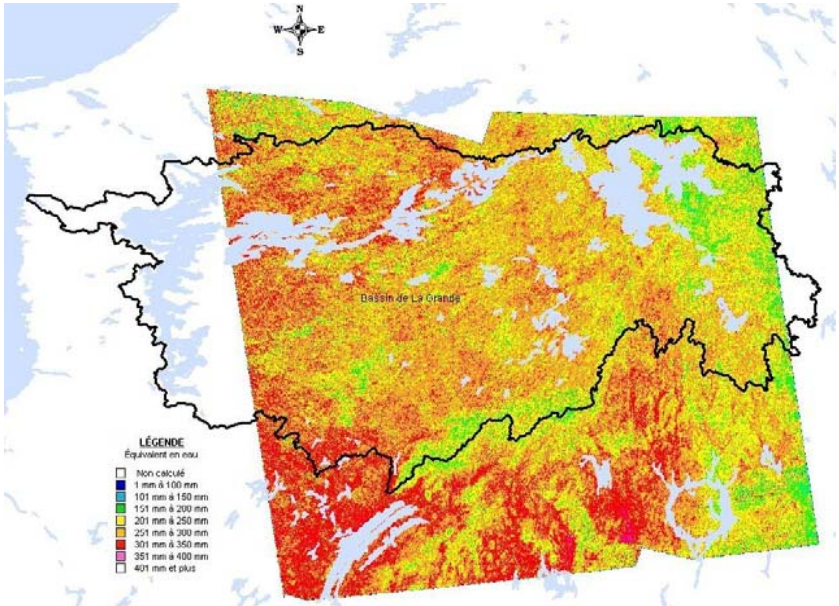
NEEDS

- ✓ **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.**

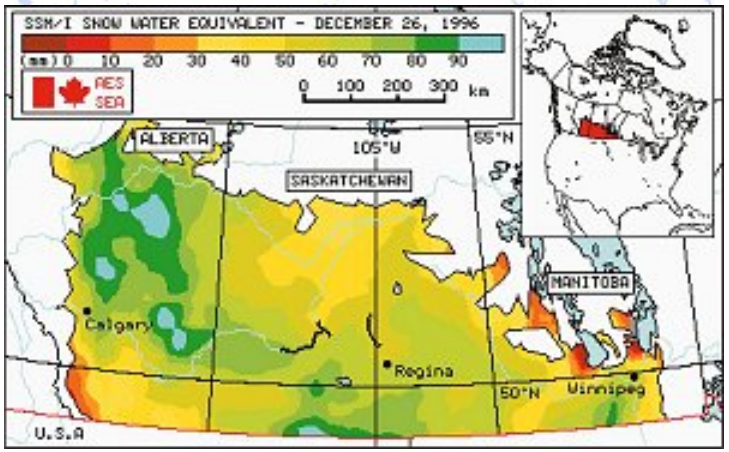
SOME INTIATIVES TO MEET NEEDS

Satellite remote sensing

✓**EQEAU: RADARSAT**



✓**SSM/I: passive microwaves**



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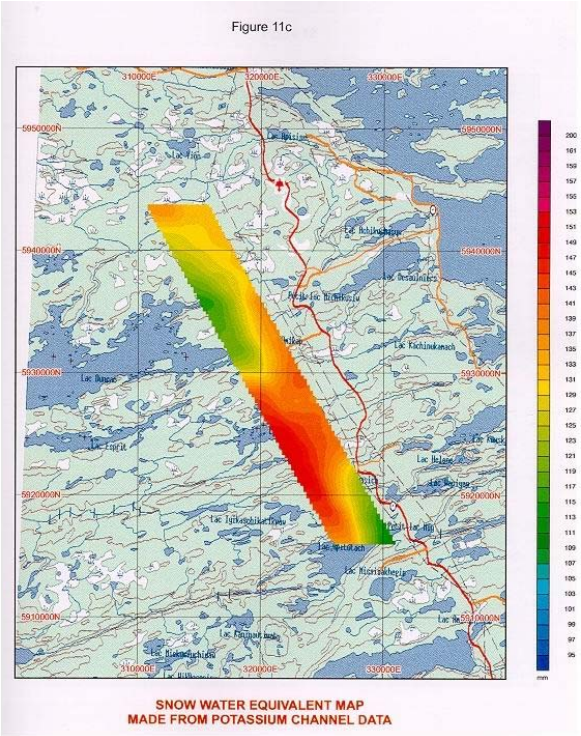
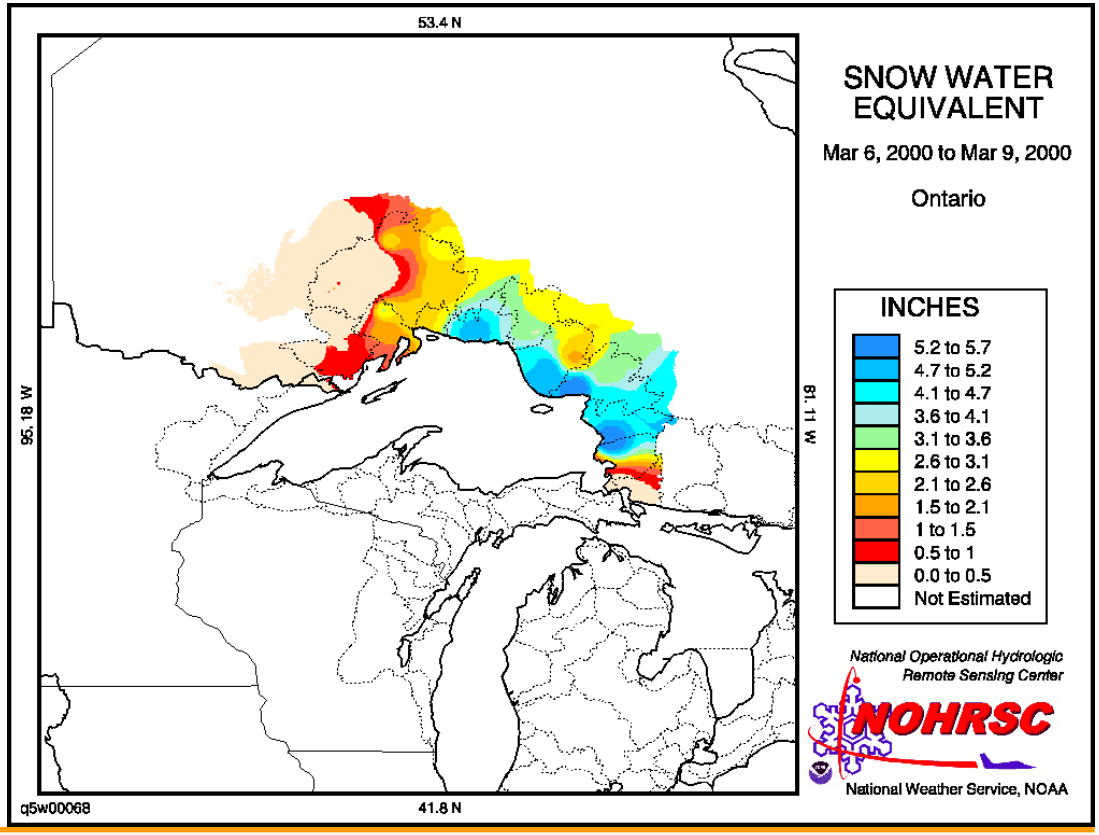
AIRBORNE GAMMA SENSORS

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





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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 caracteristics of the snow pack.

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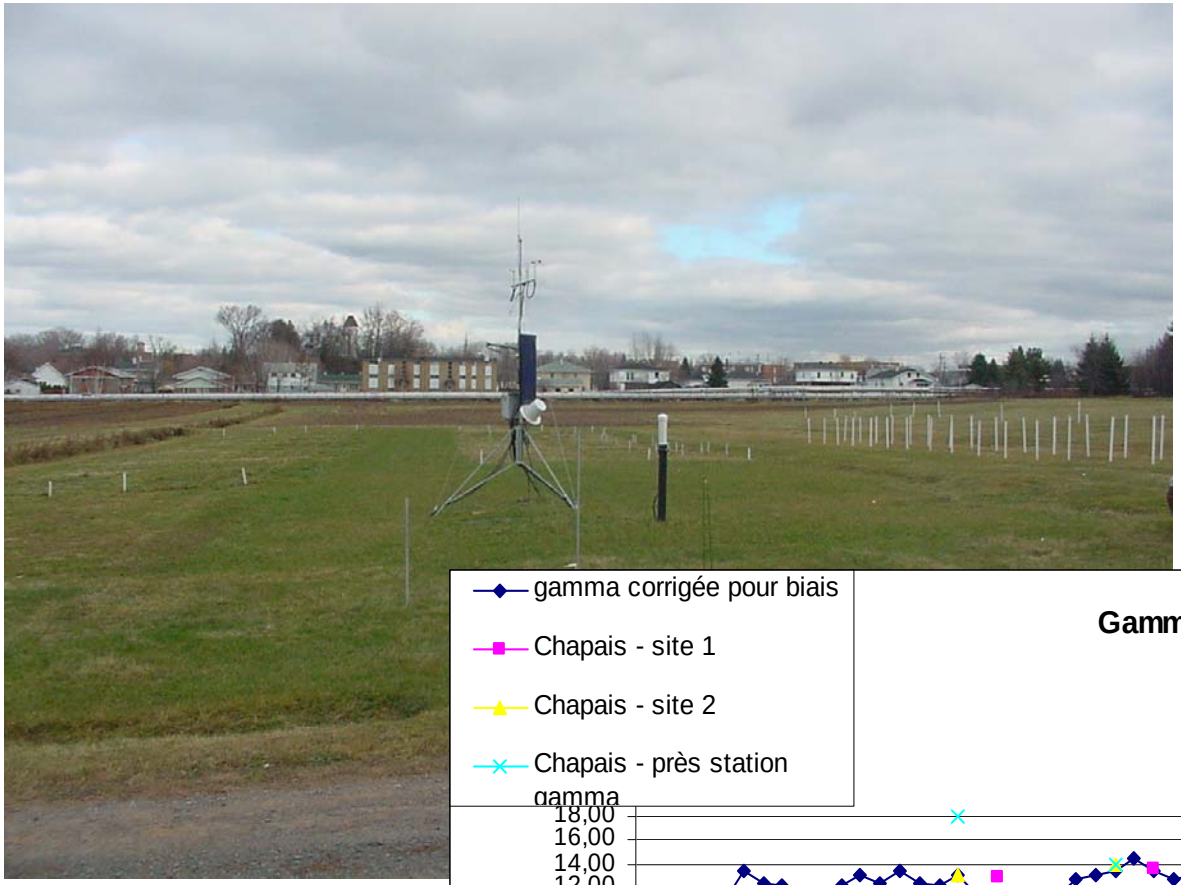
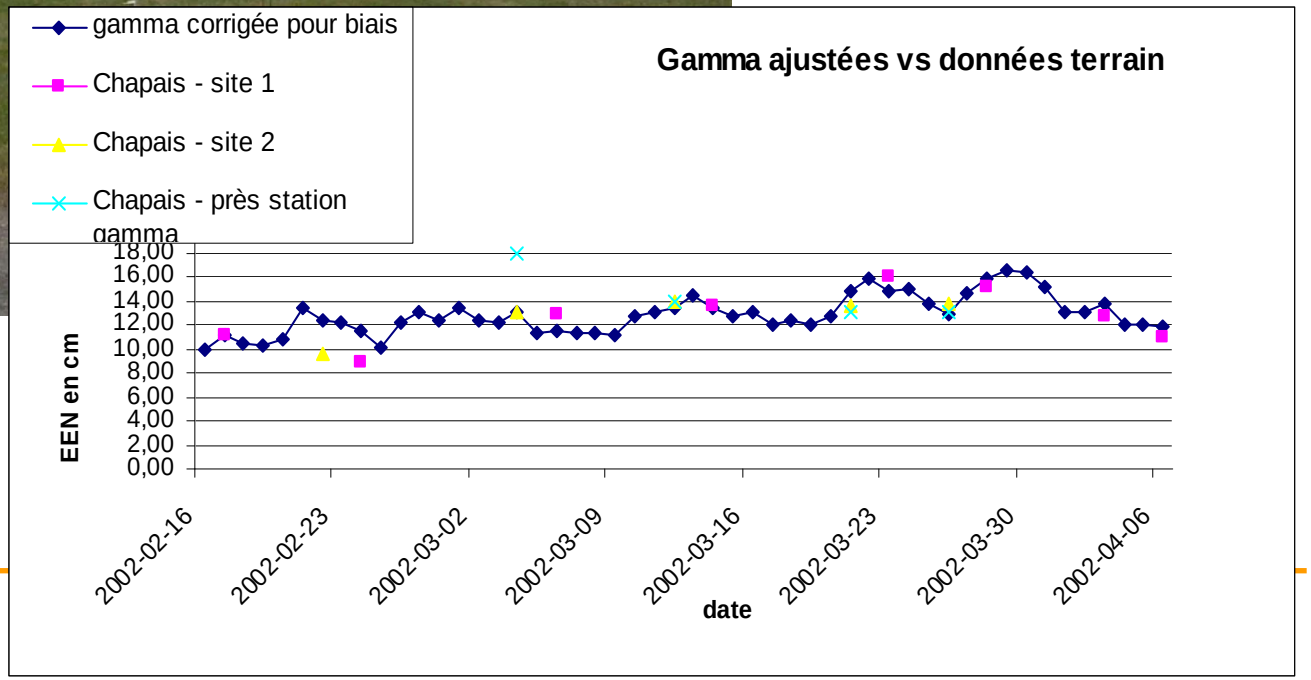
IN-SITU COSMIC RAYS SENSORS





OTHERS AVENUES WERE ASSESSED

Laser sensors

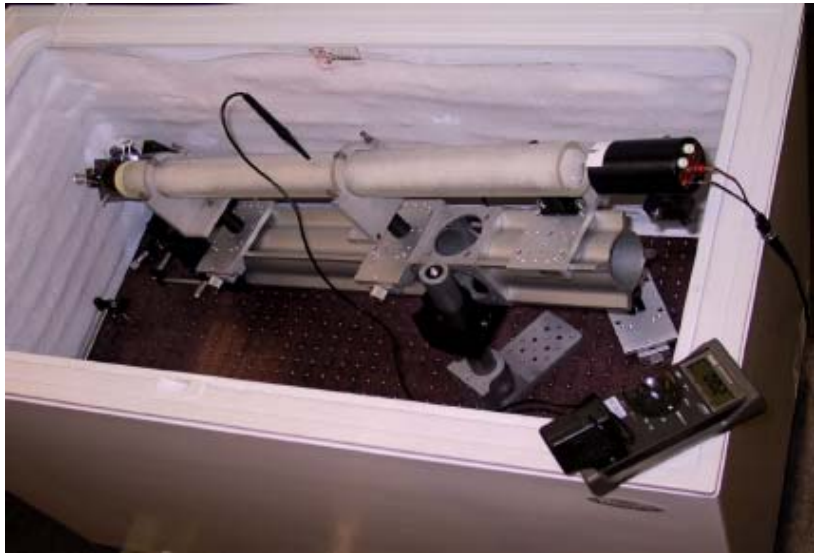
Coupling of models

Rainsat

Weather RADARs

G P R

N R C (EDF)



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H.Q. Current initiatives
Hydrometeorological Data

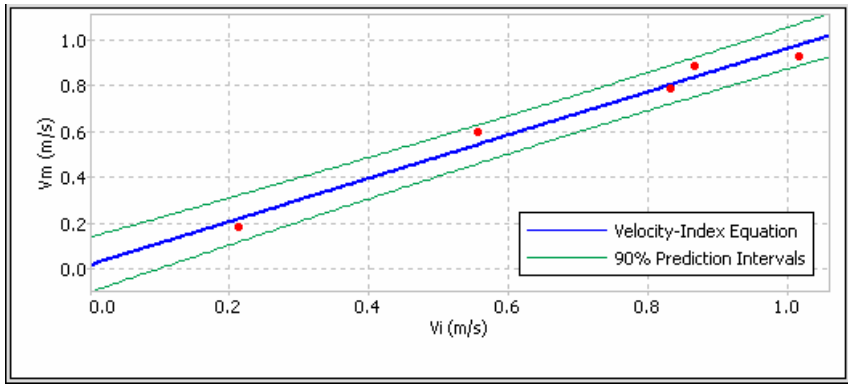
Discharge measurements – Doppler

Velocity Index: successful field tests

Margin of error ~ 5%

River models Q2D

Application to open flow and flow under ice.



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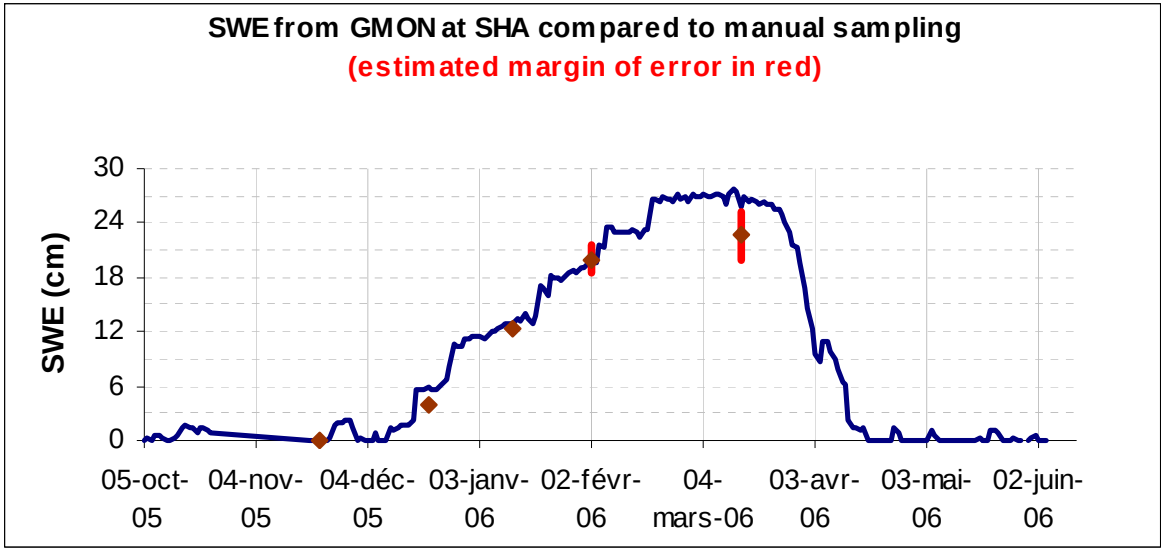
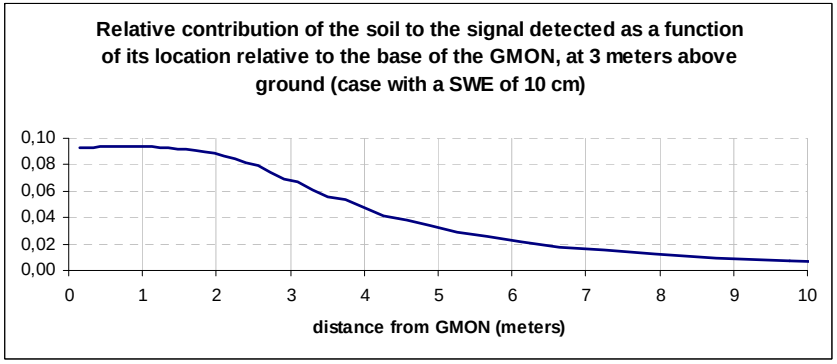
H.Q. Current initiatives
Hydrometeorological Data

GMON (*Gamma MONitoring*)





+

Soil moisture (additional work required)

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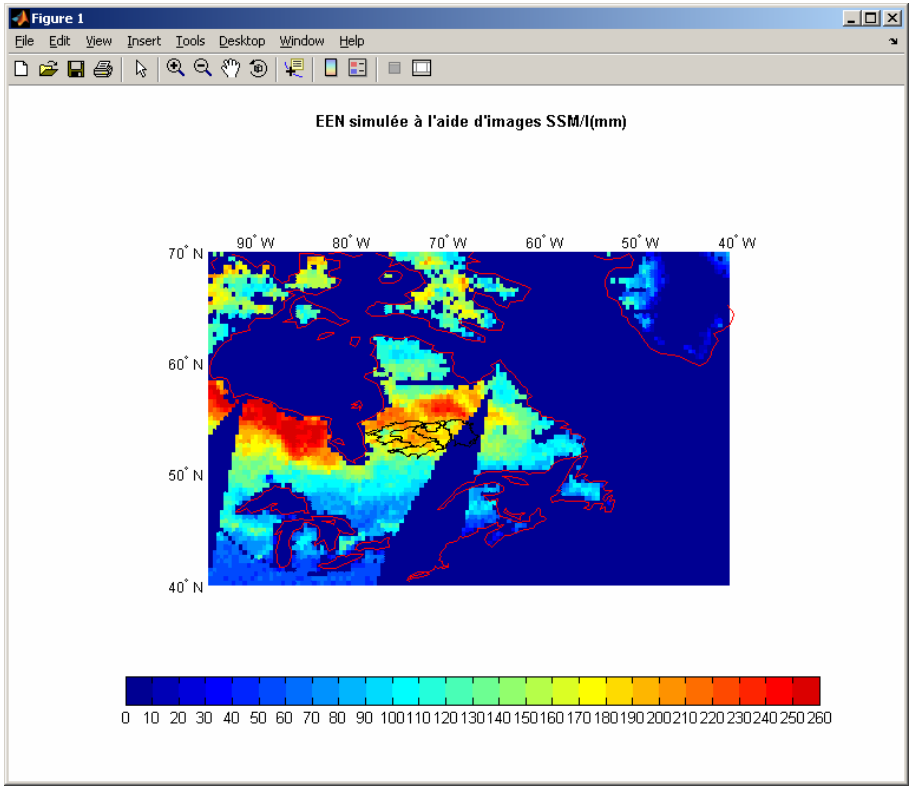
H.Q. Current initiatives
Hydrometeorological Data

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



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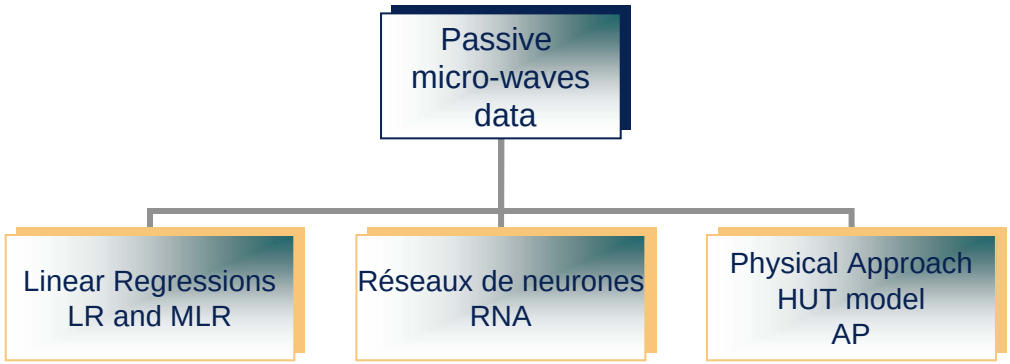
H.Q. Current initiatives
Hydrometeorological Data



Linear Regressions LR and MLR	Réseaux de neurones RNA	Physical Approach HUT model AP
SWE < 150 mm	SWE 100 – 150 mm	SWE > 10 mm
Error ~ 15 -20 %	Error ~ 10 –15 %	Error ~ 10 %

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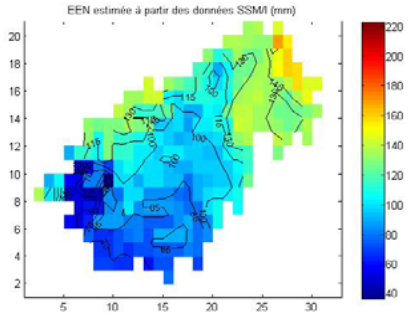
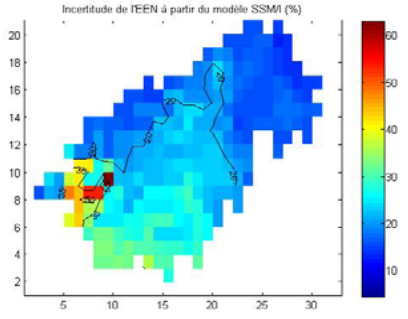
H.Q. Current initiatives
Hydrometeorological Data

- **Merging data over a grid**

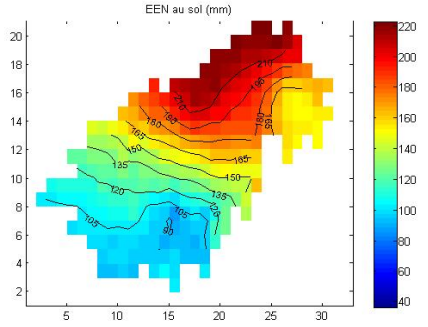
SSM/I derived data

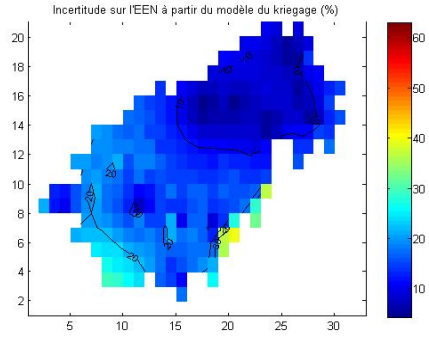




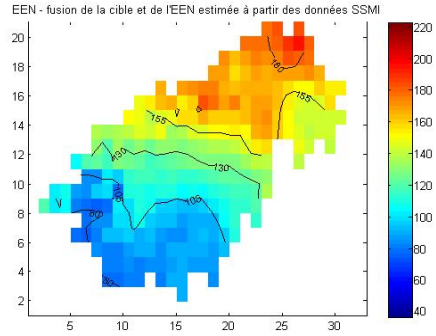
Margin of error

In-situ data





Margin of error



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Thank you