Water Availability for NAESI

Alain Pietroniro
S & T Branch
Aquatic Ecosystems Research Division,
National Hydrology Research Centre
Environment Canada
Saskatoon, Saskatchewan

Pierre Pellerin
S & T Branch
Meteorological Research Division
Canadian Meteorological Centre
Environment Canada
Dorval, Quebec

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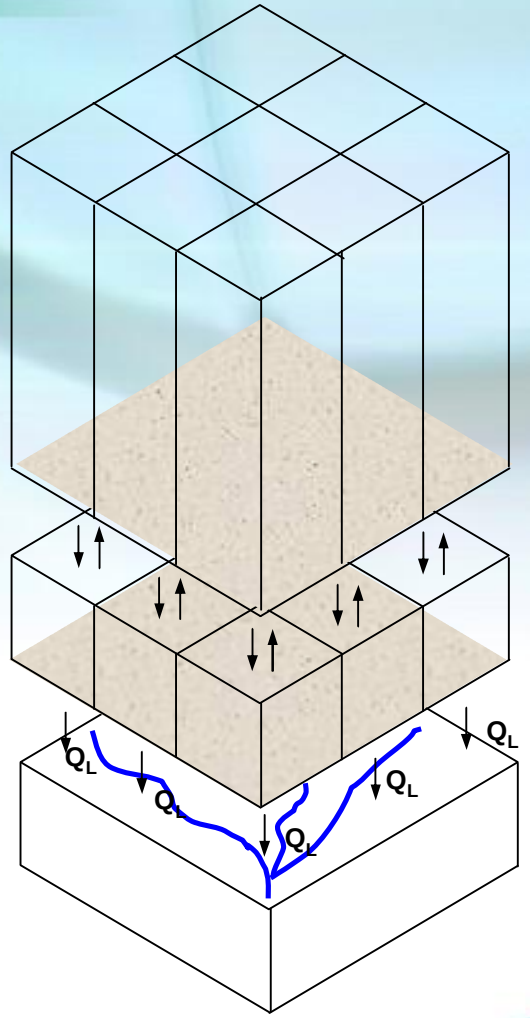
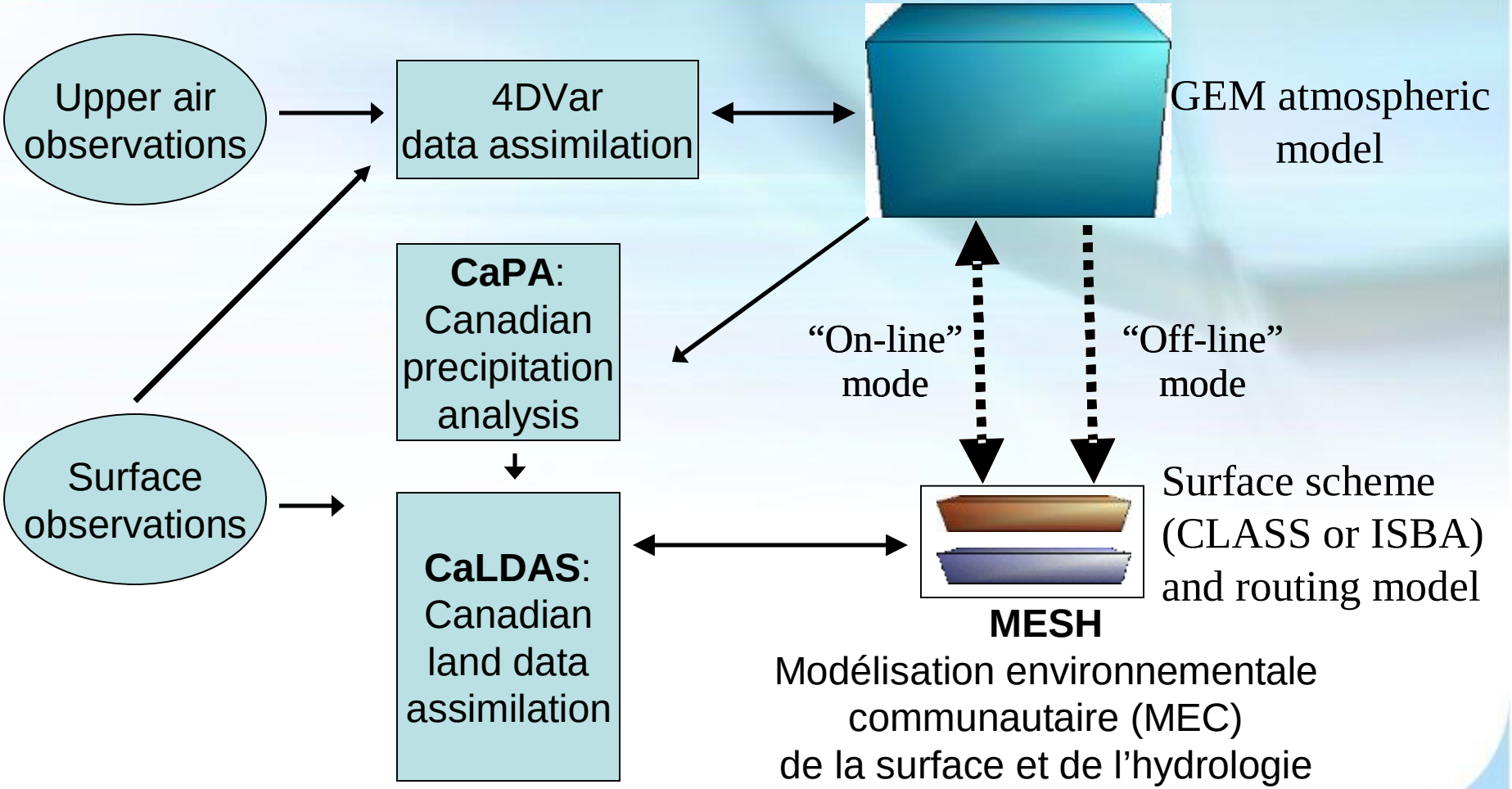
What we do

- Development and evaluation of an integrated modeling framework to estimate water balance indicators (WBI) at the scale of the current Numerical Weather Prediction (NWP) system (15 km) for all of Canada
  - precipitation (liquid and solid)
  - snow water equivalent on the ground (SWE)
  - soil moisture
  - surface water
- Couple this system to a water use and analysis model (WUAM)
- Application and testing of this approach to a specific watershed:
  - South Saskatchewan River Basin (SSRB)
- Modeling challenges similar to DRI
  - DRI will assist in improved parameterization, segmentation and understanding of land-surface interactions
  - EC through NAESI will provide NWP/Data and assimilation finding to DRI community through the duration of the study.
  - Data management is shared through HAL lab and partially funded through NAESI

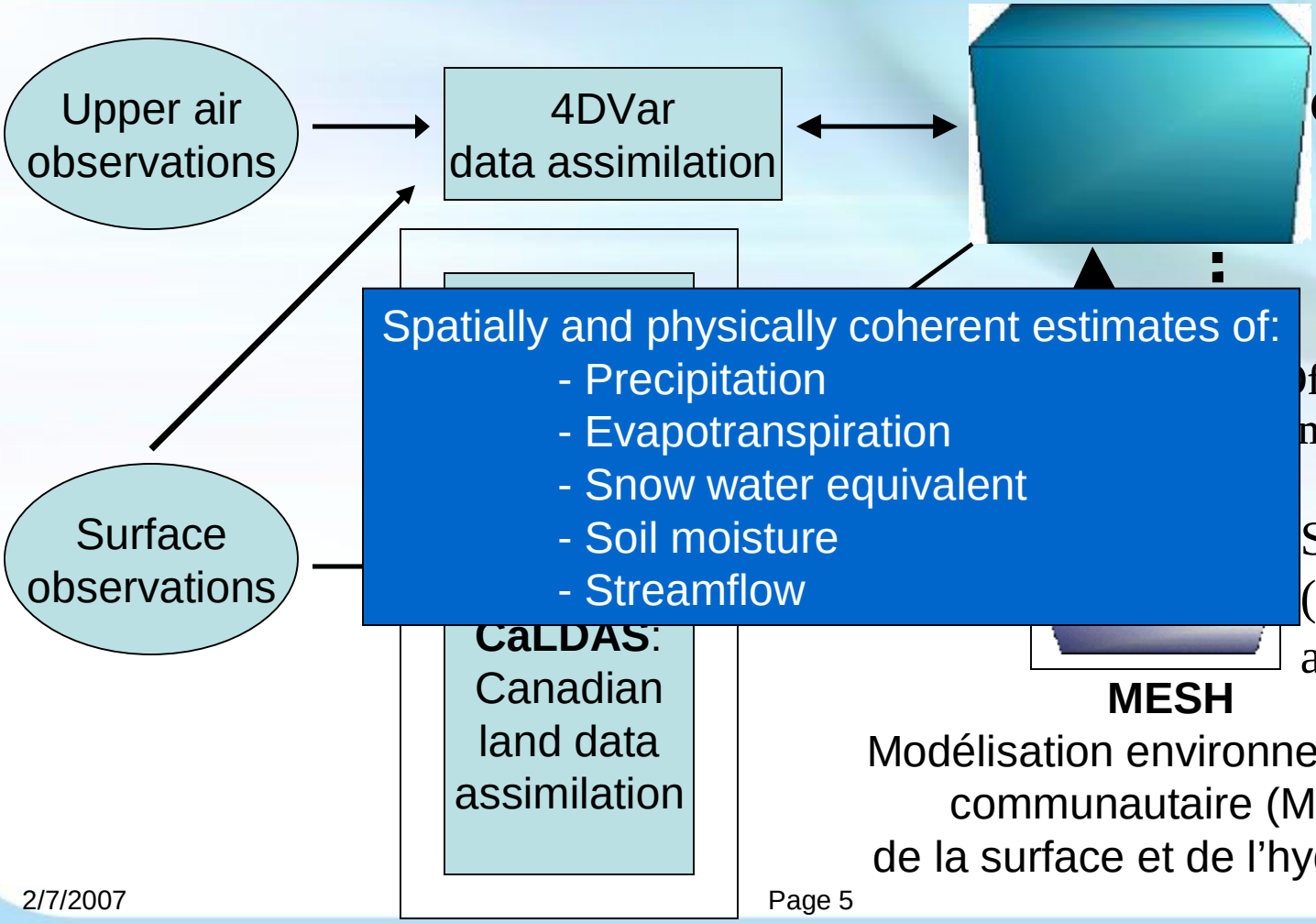


South Saskatchewan River Basin (SSRB)

Environmental Prediction Framework



Environmental Prediction Framework

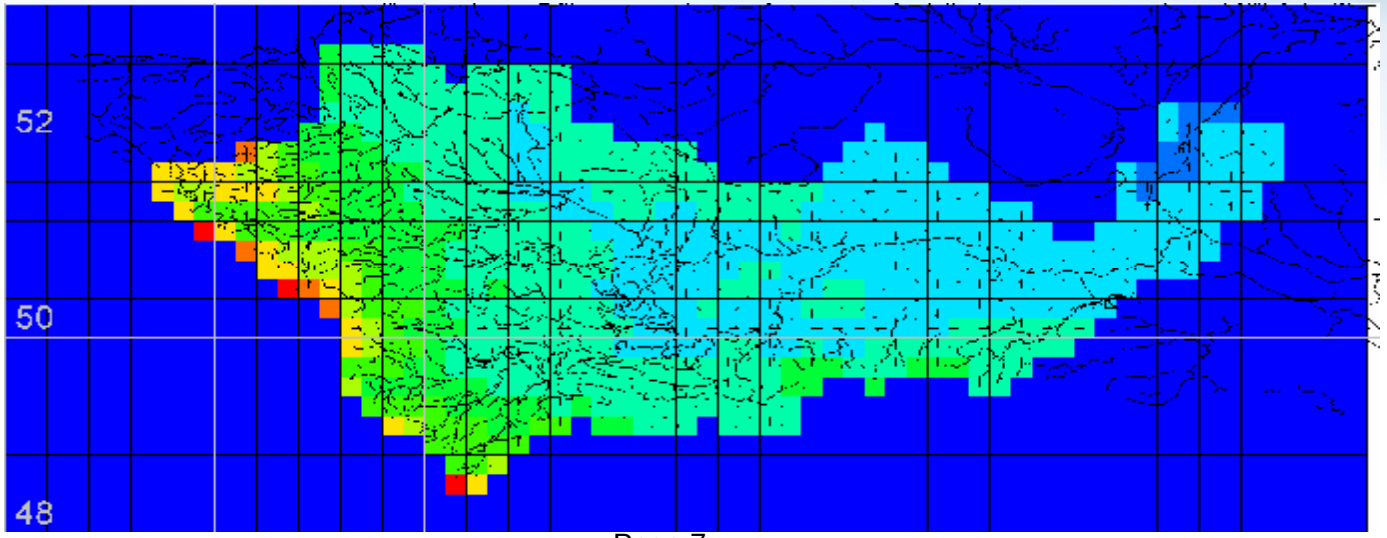


Activities

1. MESH development
2. CaPA development
3. CaLDAS development
4. Assess the validity of MESH, CaPA and CaLDAS products
5. WUAM development and verification
6. Technology transfer

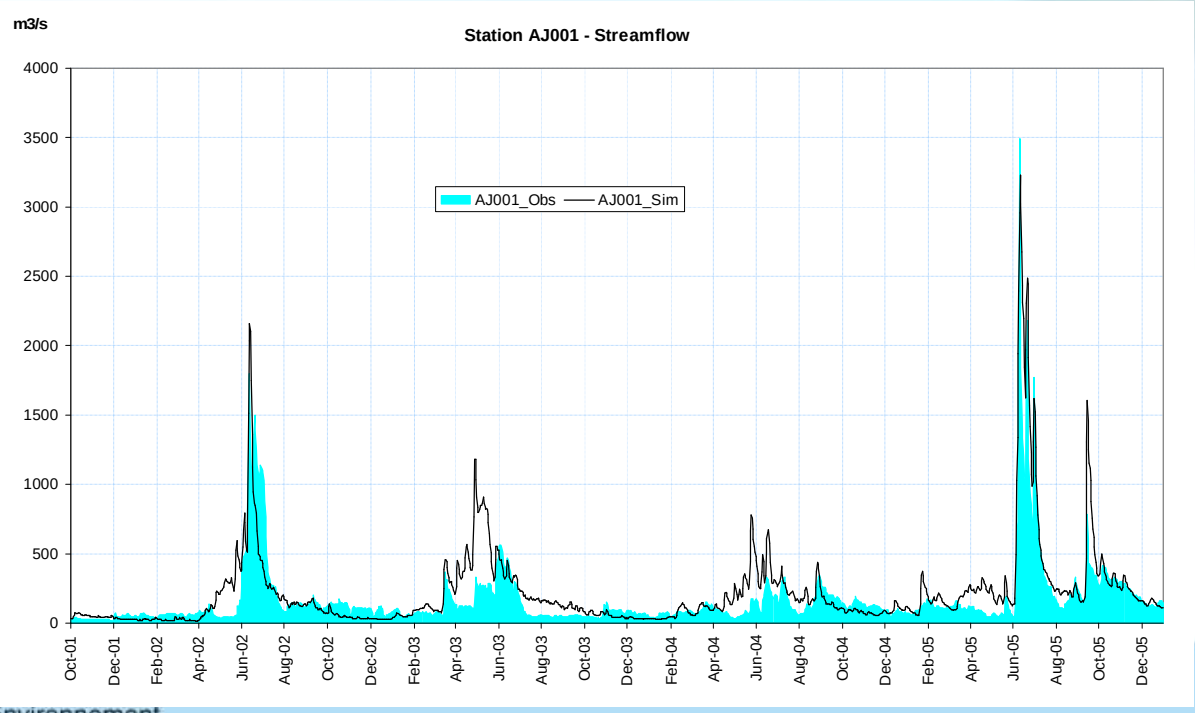
1. Hydrological modelling (MESH)

- Will use WATFLOOD model domain established in previous studies so as to be able to compare results
  - Horizontal resolution: 0.2 degrees
- Both CLASS 3.3 and ISBA land surface schemes will be tested
- Simulation period: 2001-2007



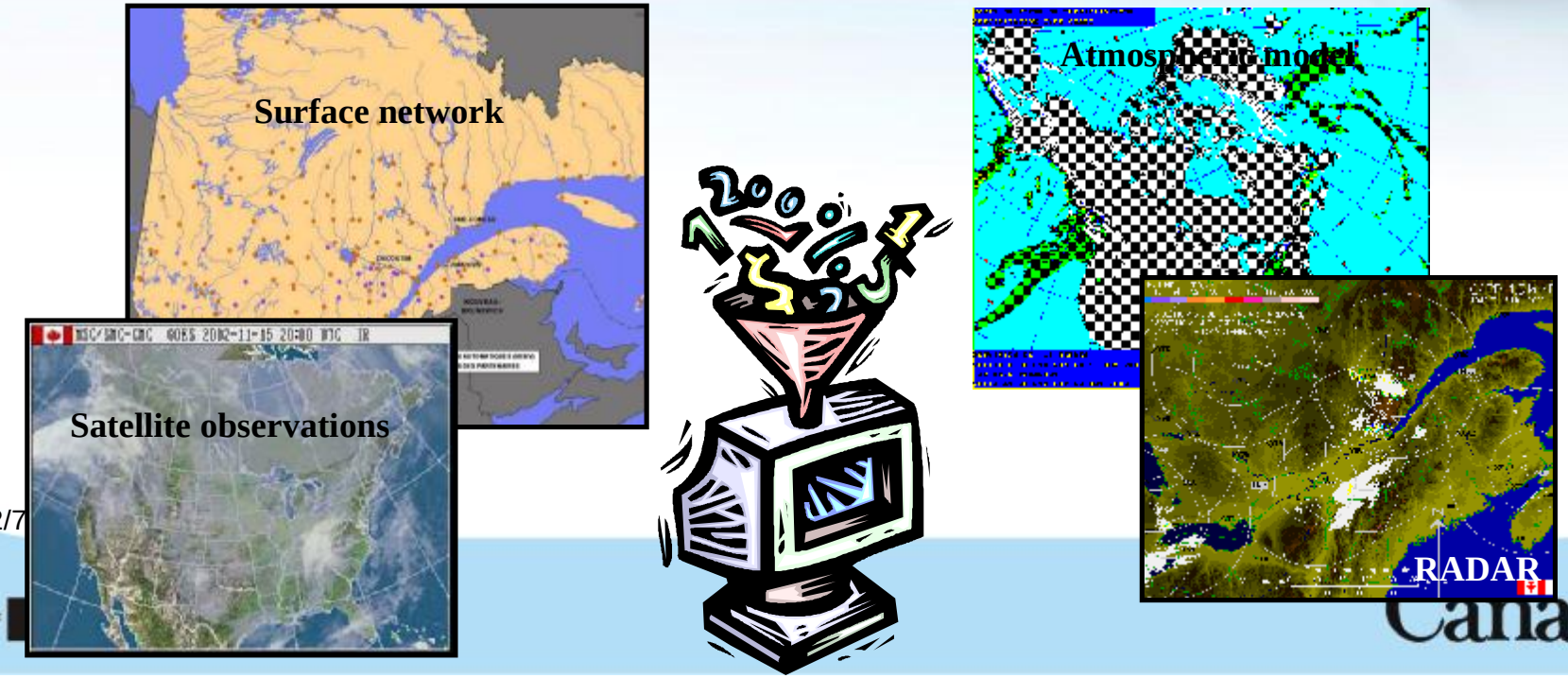
1. Hydrological modelling (MESH)

- South Sask at Medecine Hat (56K km²)
  - WATFLOOD simulation to which MESH will be compared



2. Precipitation analysis (CaPA)

- Combine different sources of information on precipitation into a single, near real-time analysis
  - Analysis of 6h accumulation of precipitation, covering all of North America on a 15km grid
  - Optimal interpolation technique to obtain our best estimate of precipitation



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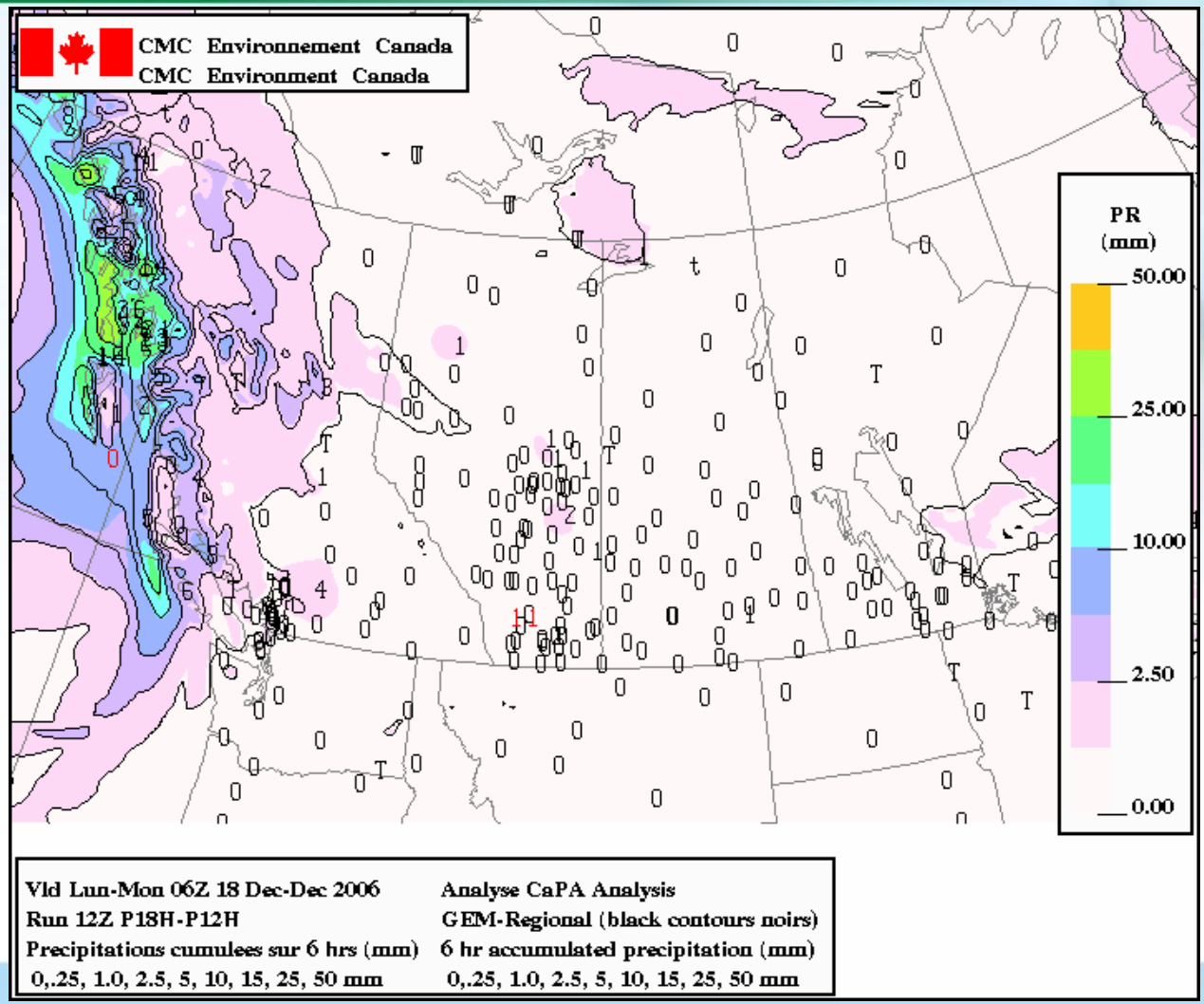
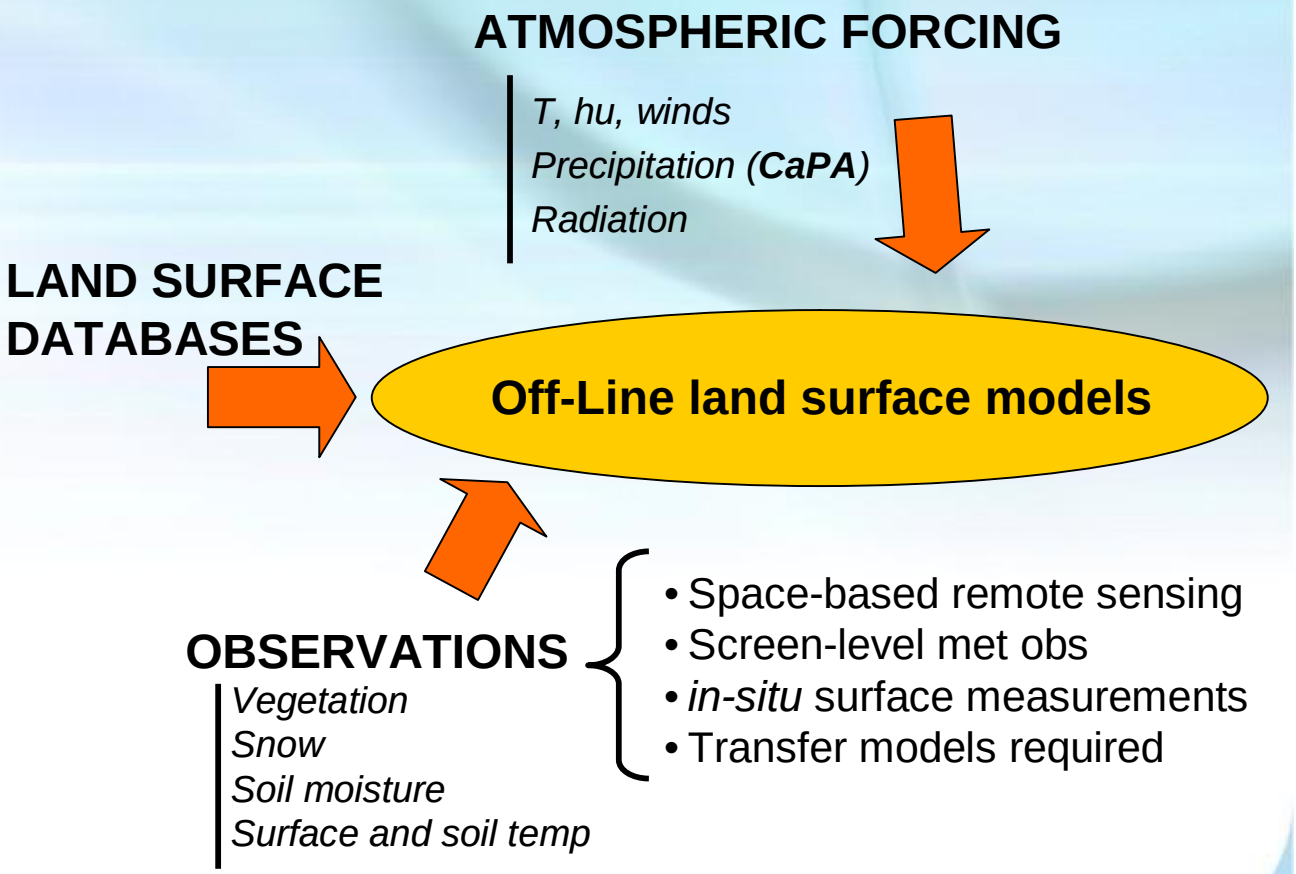


3. Land data assimilation (CaLDAS)

- Biases in energy and water storage can develop in coupled modeling systems due to incorrect representation of physical processes, atmospheric forcing, and surface characteristics.
- Land Data Assimilation Systems (LDAS) driven by observations and constrained by data assimilation have potential to more accurately depict land surface conditions



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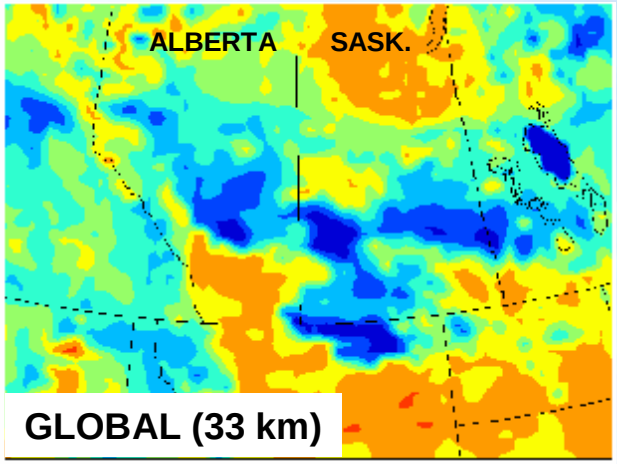
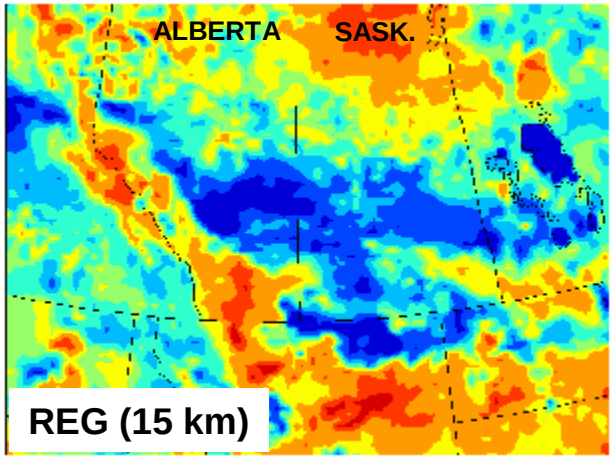
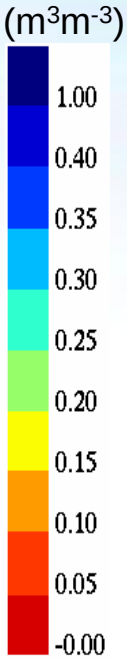


GLOBAL (33 km)

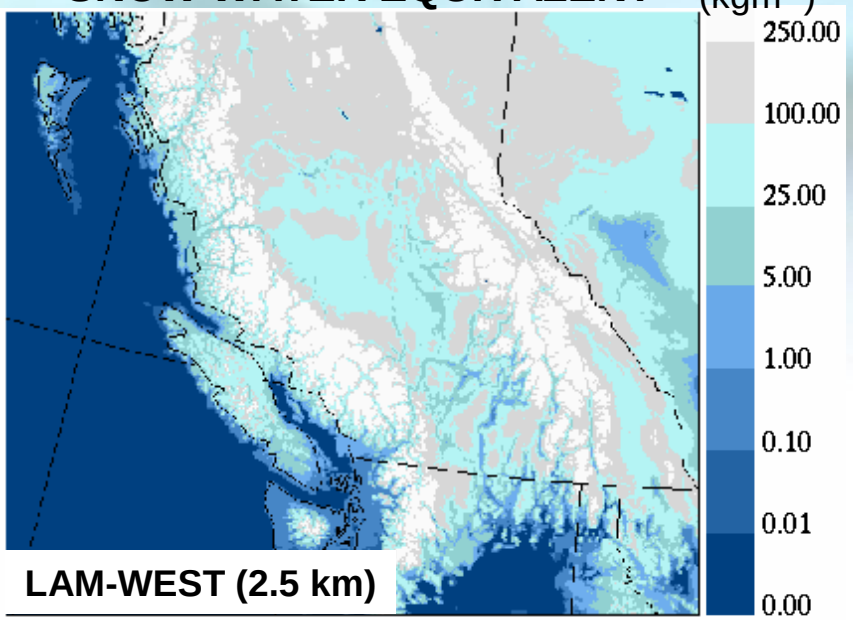


REG (15 km)

SOIL MOISTURE
(valid on
18 Dec 2006)



SNOW WATER EQUIVALENT



LAM-WEST (2.5 km)

(valid on 18 Dec 2006)

4. Assess the validity of the indicators

- Database of historic records (collated for 1998-2005)
  - Precipitation
  - Naturalized flows
  - Snow on the ground
- Data Collections for 2006 and 2007
  - Eddy covariance for ET flux assessment
  - TDR Soil Moisture network for soil moisture validation and assimilation
  - Discussions with AAFC Irrigation Development Centre (Outlook) for site selection.
  - Deep soil pressure transducer for integrated soil moisture changes

4. Assess the validity of the indicators

10x10km High Density Area (EC) in headwaters of Brightwater Creek:

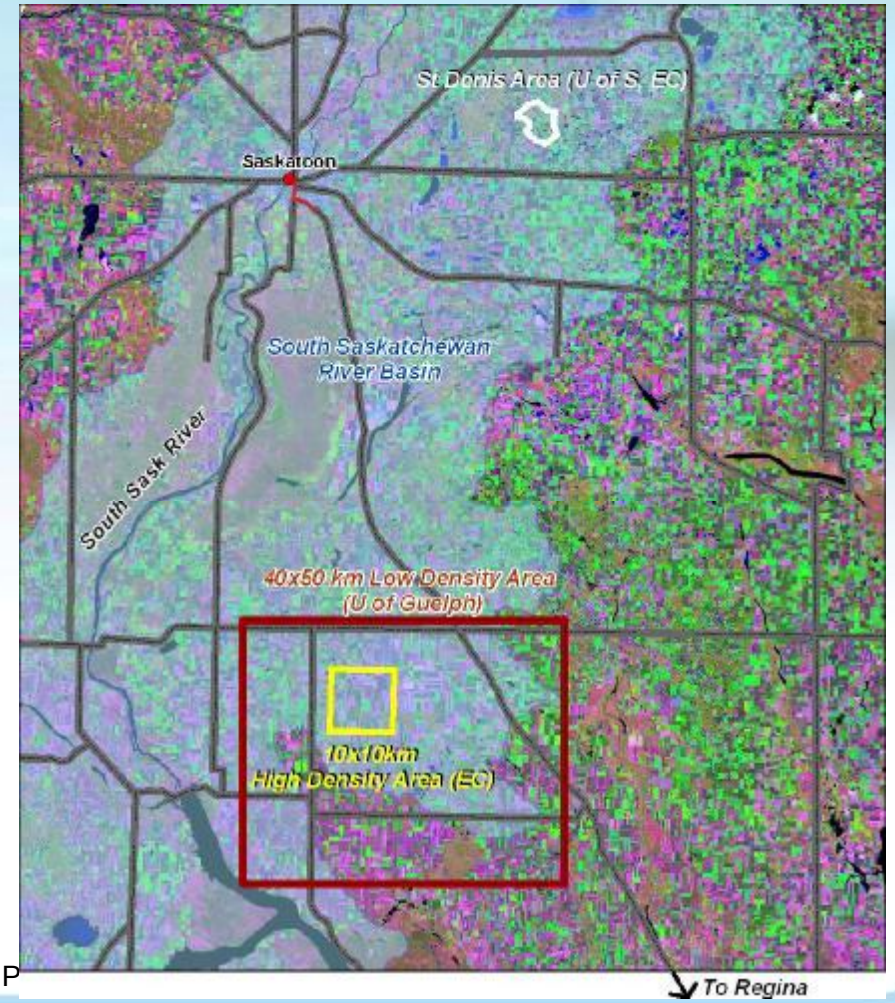
- 20-24 Soil moisture & precip stations
- 1 Energy Flux & Met tower
- 1 Potential deep well lysimeter (new or existing well)
- 13 Snow survey transects

40x50 km Low Density Area (U of Guelph):

- 14 Soil moisture & precip stations

St Denis Area (U of S, EC):

- 1 Energy Flux Tower
- Snow survey transects
- Soil moisture stations (numbers not decided)

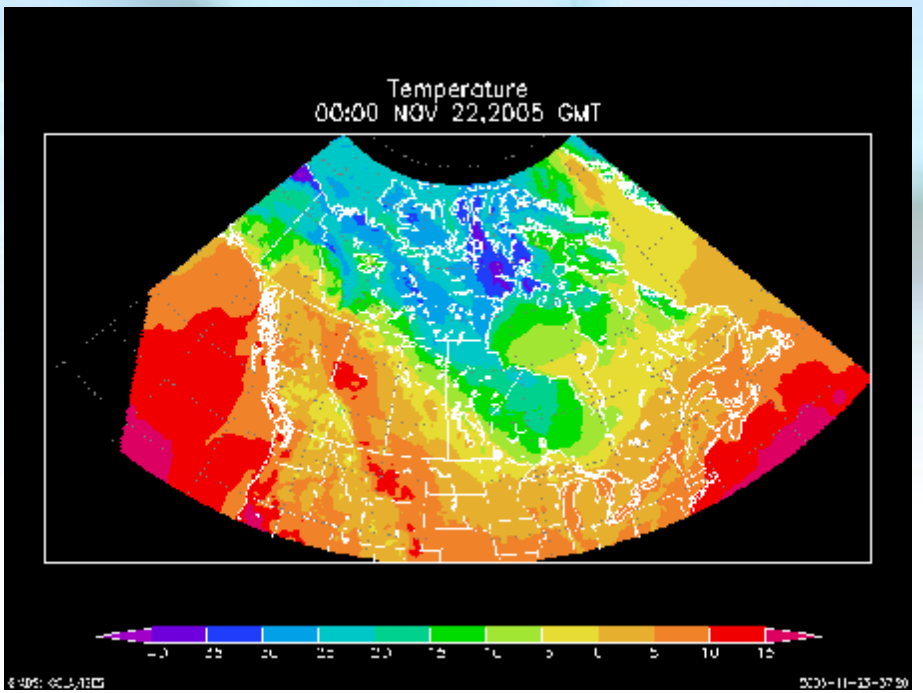


5. Couple MESH with the water use and analysis framework (**WUAM**)

- Used to assess water use and availability for planning purposes.
- Year-to-year analysis for 1998-2005
  - Calibrated on water licenses (not use), observed and naturalized flows
  - Estimates actual use
- Can then be used to predict water use based on predicted flows

6. Technology transfer

- Provide gridded indicators of water availability on the SSRB in easy to use format on a web site
- Use existing prototype developed by the Hydrometeorological and Arctic Lab (HAL)
  - Gridded data project (GDP) geared towards helping hydrological modellers and forecasters make use of NWP products



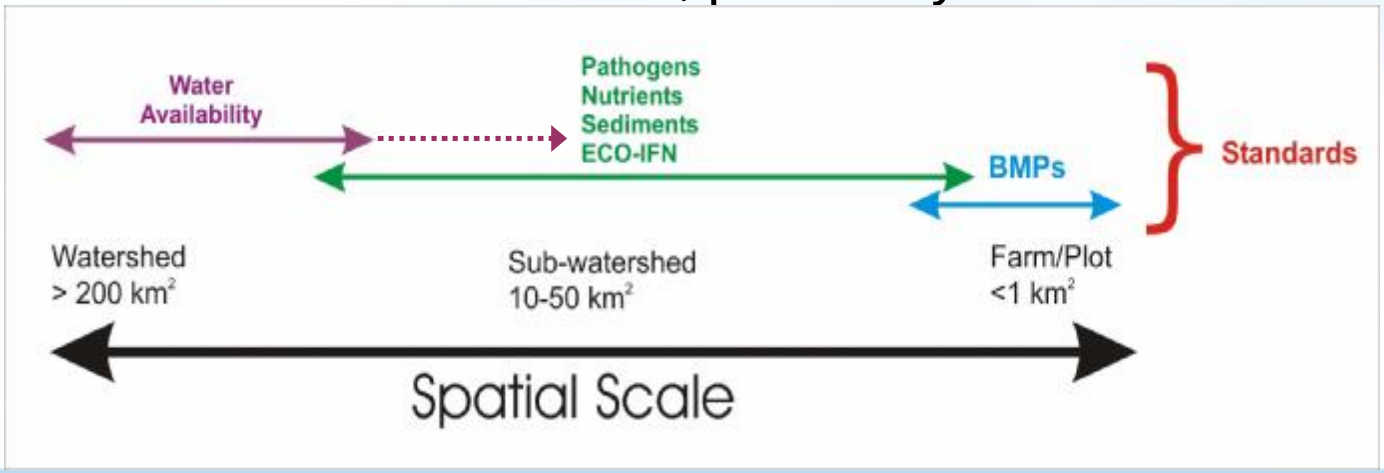
Temperature above 2 meters for Canada, November 22 2005, 00:00 (.gif image)

Next steps: 2007

- Water balance indicators will be developed and assessed over the next year based on:
  - CaPA improvements
  - CaLDAS improvements.
  - MESH model runs
  - results from field experiments
- WUAM will be used to evaluate the sensitivity of predicted water use to modelling errors
  - by comparing results obtained with observed vs predicted streamflow

Next steps: 2008 and beyond

- Methods for downscaling indicators for application to other NAESI standards, e.g. IFN, Pathogens….
- Expand geographic scope to converge with the IFN and other standard research teams, e.g. Okanagan
- Ensure that water balance indicators that prove useful for AAFC become operational products derived from the NWP/EP system
- Work on new indicators, e.g. water temperature
- Increase in horizontal resolution, potentially down to 2.5 km



Study Team

Management Leads: Gilbert Brunet and Fred Wrona

Investigators:

EC
Principal Investigators
Alain Pietroniro (AEIRD/HAL) and Pierre Pellerin (MRD)

Stephane Belair (MRD) - Data Assimilation
Vincent Fortin (MRD) – Precip Analysis and Hydrological Modelling
Dorothée Charpentier (MRD) – Data Assimilation
Isabelle Doré (MRD) – Hydrological Modelling
Bruce Davison (HAL) – Hydrological Modelling
Brenda Toth (HAL) – Hydrological Modelling
Matt Regier (HAL) – Network, Data Manager
Jessika Töyrä (NWRI) – Soil Moisture Network and Remote Sensing
Raoul Granger (NWRI) – Evaporative Fluxes
Garth van der Kamp (NWRI) – Ground Water
Diana Verseghy (CRD) – CLASS model support
Dave Patrick (HAL) – CaPA and Modelling
Atef . Kassem (WPCD) – Water Use and analysis
T. Hamory (WPCD) – Water Use and analysis
Ivan Vouk (WPCD) – Water Use and analysis
David Burke(WPCD) – Water Use and analysis
Jean-Guy Zakrevsky (WSC) – Client Liaison
Michel Jean (CMC) – Client Liaison
Marco Carrera (CMC) – Precip Analysis and Data Assimilation

In collaboration with:
Environment Canada
Anne Walker (CRD) – Remote Sensing
Yves Durocher (MSC) – EC Met station Contact

Agriculture Canada
Jacques Millette – Outlook Irrigation Centre contact
Gordon Bell, PFRA – Saskatoon
Harvey Hill, PFRA - Saskatoon

University of Saskatchewan
John Pomeroy (DRI program lead)
Lawrence Martz – socio-economics

University of Guelph
Aaron Berg – Soil Moisture Network

Alberta Agriculture Food and Rural Development
Ralph Wright – Provincial Met Station Contact

www.ec.gc.ca

Thank you!

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