Update on the implementation of SMAP at ECCC

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**Canadian Land Data Assimilation System (national 2.5 km)**

- National Surface and River Prediction System (NSRPS)
- High-Resolution Deterministic Prediction System (HRDPS)

**Canadian Land Data Assimilation System (global 15 km)**

- Regional Ensemble Prediction System (REPS)
- Global Deterministic Prediction System (GDPS)
- Global Ensemble Prediction System (GEPS)

(SMAP at ECCC Operations... through CaLDAS)

SMAP (tech transfer still to be confirmed)
National Surface and River Prediction System

**ANALYSIS**

- **HRDPS (atm)**
  - Forcing

- **CaLDAS (w/ SMAP)**
  - 2.5 km, SVS-based SPS, ensemble CaPA, surface and satellite obs.
  - Pseudo-analyses of surface runoff, subsurface lateral flow, drainage

- **DHPS (hydro)**
  - Continuous cycle, 1 km, assim. of river discharge obs.

**FORECAST**

- **HRDPS (atm)**
  - Days 1-2 forcing
  - Analyses of soil moisture, snow depth, land sfc. temperatures
  - Forecasts of surface runoff, subsurface lateral flow, drainage

- **HRDLPS (land)**
  - SVS-based SPS
  - National 2.5-km grid
  - 6-day forecasts

- **GDPS**
  - Days 3-6 forcing

- **DHPS (hydro)**
  - 6-day forecasts 1km
  - Streamflow analyses

- **DHPS (hydro)**
  - Streamflow forecast

**Streamflow forecast**
Example of the impact of the assimilation of SMAP+SMOS in CaLDAS on hydrologic analysis system

Nelson River shown here

Two experiments forced by CaLDAS-sat and ensemble precipitation analyses

Period of 20190701 to 20191031

Analysis mode, but no assimilation of river flows (to better isolate the effect of SMAP and SMOS)

Blue: DHPS (hydro) forced with CaLDAS control member (no assimilation)

Red: DHPS (hydro) forced with median of CaLDAS analyses (w/ SMAP + SMOS)

(PROVIDED by ETIENNE GABORIT)
List of proposed modifications

CaLDAS with **SMAP**, SMOS, AIRS, CrIS, and IASI

SVS land surface scheme instead of ISBA

Update to land surface fields

+ a few other changes, including:

* Flux spatial filtering, orographic form drag, dynamic z0h/zom,

* Delage (1997) stable layer, effective resistance for flux agg.*
Global Deterministic Prediction System

Evaluation vs own analyses, screen-level, humidity, summer 2019

RMSE difference
NEW minus OP (mean 72h - 144h)
vs own analyses

Blue caldas+svs (w/ SMAP) better
Red OI+isba better
Global Deterministic Prediction System

Summer 2019, screen-level, humidity (dew point), Canada

(vs surface obs)

Blue OI+ISBA (OP)
Red caldas+svs (smap)

STDE

All 00 UTC runs

~ 1 km

96-h runs

(vs EnVar analyses)
Global Deterministic Prediction System

Plan “A” versus Plan “B”… a difficult choice?

ScoreCard against ECMWF
(-% change in RMS error)

Summer 2019
Northern extratropics

A
Innovations from both surface and weather prediction groups
Caldas (w/ SMAP)

Northern ET
Δnwp-index
+ 1.82 %

B
Innovations from only the weather prediction group

Northern ET
Δnwp-index
+ 2.53 %

STDE improvement averaged over 10 days and over Canada

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SURFACE (vs obs)

(ADAPTED from a PRESENTATION by VINCENT FORTIN)
A few words

SMAP used successfully in land and river prediction system (now in the process of being transferred at ECCC Operations)

Technological transfer more difficult for NWP

Not clear at this time when other NWP systems will be implemented with CaLDAS and SMAP

Several articles on the way related to this effort of the last few years