Near Real-Time Water Monitoring Data Assets Collected, Managed, Analyzed and Disseminated by Ontario’s Surface Water Monitoring Centre

Groundwater Data Framework Workshop

November 24, 2015
Grand River Conservation Authority
Outline

- Surface Water Monitoring Centre
- Monitoring Data Flows and Information Infrastructure
- Surface Water Monitoring Centre - Services
- Drought Monitoring in Ontario
- Groundwater Drought Monitoring
- Soil Moisture Drought Monitoring
- Open Data via OGC – WaterML2.0 - Kisters KiWIS
Surface Water Monitoring Centre


- 4 staff rotate through a cycle of 2 roles
- **Duty Officer** is in charge of decision-making, communication and after-hours duties
- **Daily Planning Cycle** staff performs analysis and reports to DO and ensures operational functions
What We Do

Flood Forecasting
- Collect, monitor and use climate, water flow, level and satellite data to predict flood risk in Ontario
- Communicate flood potential and conditions to partners and clients

Drought Monitoring
- Collect, monitor and use climate, water flow, satellite, ground water level and soil moisture data to monitor drought conditions in Ontario
- Communicate drought potential (Level I, II or III) to partners and clients
How We Do It

COLLECT

Analyze/Forecast

Communicate

FLOOD PRODUCTS AND MESSAGES
Lake Erie Seiche
SWMC DHI Model

Fort Erie #onstorm
November 12, 2015

Recorded surge and DHI 24, 36 and 48 hr. surge model forecasts. Port Colborne – December 24, 2015
Monitoring using Remote Sensing and Data Assimilated Products

Operational Use of:

- **RADARSAT** for ice jam monitoring
- **CaPA** for precipitation monitoring
- **MODIS** for monitoring snow covered area and melt
Monitoring using Remote Sensing and Data Assimilated Products

Exploring the Use of:

- Various snow water equivalent (SWE) monitoring products (**SNODAS**, CMC, Globsnow etc.)
- **SMOS** and **SMAP** for soil moisture (flood and drought) and frozen ground conditions
- **GRACE** for understanding coarse scale water storage
SWMC – Data Flows into Wiski Database
Telemetry via GOES Satellite or Phone Line
2200 Gauges/Stations

- Environment Canada (EC) Weather Stations:
- NOAA Weather Stations:
- Environment Canada (EC) –MNRF –Other Cost Share Gauges: Stream Gauge Stations: ~ 600
- Great Lakes Wave Buoys: 33
- MNRF Fire Weather Stations: 80
- MNRF Ring-of–Fire and Science Stations: 10
- MOECC PGMN Wells: 100
- MOECC Integrated Monitoring Stations: 10
- OPG Stream/Lake level Gauges: 75
- CA’s Rural Storm Water, Special Studies 30
- Parks Canada Gauges: 25
- MNRF/OPG/Parks Snow Courses: 275 (Manual)
- Ministry of Transportation Stations: 25
- PAN-AM Games Weather Stations: 35
Network Maps
CoCoRaHS – In Ontario

- Community Collaborative Rain, Hail & Snow Network
- MNRF Primary Sponsor in Ontario
- Volunteer based data collection (180+ in Ontario)
- SWMC purchased 75 units for northern distribution (fire/district staff/communities)
- Dr. Pearson at Laurentian is working with Far North First Nations to integrate into elementary school programs
Automated Snow Sensors - Gamma Ray

- New technology allows Snow Water Equivalent (SWE) to be sensed in real-time.
- Flood Forecasting in Ontario is being hampered by our limited knowledge of on-the-ground snow conditions. Current snow surveys (275 stations) are manual and data acquired only every 14 days.
- Stations to be telemetered via GOES Satellite directly into MNRF Kisters database
- MOECC is testing two new Campbell Scientific Snow Sensing units at their Dorset Research Centre.
- Five additional sensors deployed across the province.

Source: Brent Smith (MNRF)
WISKI Users in Ontario
MNRF, MOECC, CAs (21 of 36), OCWA (600 Facilities)
**WISKI Web Pro**

- All SWMC data assets are included – 100+ years
- Web based application
  - Contains water levels, stream flows, snow pack, precipitation and other parameters
  - Merges different sources of data – EC, WSC, MNR Fire Weather, DFO, Parks Canada
- Available to water managers and community members involved in emergency response
SWMC Extranet

Allows individuals responsible for water management in Ontario to gain access to SWMC information on:

- **Flood Forecasting, Low Water, WISKI Web Pro, Cost Share Agreement Information**

**Flood Forecasting**
- Weather Forecast Maps
- API Model Outputs
- Storm Surge Outputs
- Weather RADAR

**Low Water**
- Condition Reports
- Confirmed Condition Maps
- Indicator Maps and Graphs
SWMC - Drought Monitoring
UN-WMO Classification

Hydrological Drought – Surface Water

Meteorological Drought

Agricultural Drought - Soil Moisture
(under development)
Grafted onto the PGMN

Hydrological Drought - Groundwater
PGMN Refurbishment Projects

- Cooperative MOECC-MNRF Initiative.
- In 2012 – 2013 - 28 Wells refurbished with new FTS, GOES satellite enabled loggers.
- In 2014 – 2015 – 70 Wells refurbished with FTS-Lite GOES enabled loggers.
- Facilitated MNRF real-time access to groundwater level data – for implementation and reporting of groundwater drought conditions.

- PGMN well - being instrumented with FTS loggers.
- Source: Brent Smith
Groundwater Drought Indicator Development
MNRF-MOECC-CA Cooperative Project

- Science lead by MOECC-EMRB and CA groundwater geoscientists.
- Groundwater drought indicator has been developed and programmed within Wiski.
- Well drought status can be queried in near real-time via Wiski WebPro
- Brings groundwater science and data into our provincial Drought forecasting tool-box.
- Delivers on a 10 year-old OLWR commitment.
MNRF-MOECC Pilot Project
Automating 1960/70/80s Hard-Copy Well Hydrographs
Ontario Water Resources Commission
Historical, Estimated and Recent Groundwater Levels

- **1966 TO 1980 MEASUREMENTS**
- **ESTIMATED GROUNDWATER LEVELS 1981 TO 2000 FROM MODEL**
- **2001 TO 2012 MEASUREMENTS**

**SUMMER 1998**
Southern Ontario SMAP (Soil Moisture Active Passive) Satellite pilot project. SMAP Principle Investigator: Dr. Aaron Berg at the University of Guelph.

18 PGMN GEOS-Enabled sites to be equipped with Stevens Soil Moisture Probes.
OGC – WaterML2.0 - KiWIS

- The Open Geospatial Consortium (OGC) is a non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services. The OGC works with government, private industry, and academia to create open and extensible software application programming interfaces for geographic information systems (GIS) and other mainstream technologies. [http://www.opengeospatial.org/](http://www.opengeospatial.org/)

- WaterML 2.0 is the OGC standard information model for the representation of water observations data, with the intent of allowing the exchange of such data sets across information systems. [http://www.opengeospatial.org/standards/waterml](http://www.opengeospatial.org/standards/waterml)

- KiWIS (KISTERS Web Interoperability Solution) is able to both consume and publish real-time hydrological data over the Internet using open standards like WaterML2.0 and SOS. KiWIS can also be placed “on-top” of existing time series data archives, providing a quick and efficient method for disseminating and retrieving data from the Internet. [http://www.kisters.net/wiski-modules.html](http://www.kisters.net/wiski-modules.html)
Global PGMN Data Access – Kisters KiWIS
Via any Web Browser

Timeseries values list (for PGMN 220)
http://lrcgikdcapmdw21:8090/KiWIS/KiWIS?
service=kisters&type=queryServices&request=getTimeseriesValues&datasource=0&format=html&ts_id=875721042&from=2010-01-01&to=2012-01-01

Timeseries Graph (for PGMN 220)
http://lrcgikdcapmdw21:8090/KiWIS/KiWIS?
service=kisters&type=queryServices&request=getgraph&datasource=0&format=jpg&ts_id=875721042&from=2010-01-01&to=2014-01-01&width=1000&height=400
Real-Time Data Access via Kisters KiWIS
GRCA and QRCA Examples

Grand River CA KiWIS URLs

Values for station at Doon
http://kiwis.grandriver.ca/KiWIS/KiWIS?
service=kisters&type=queryServices&request=getTimeseriesValues&datasource=0&format=html&ts_id=8677042&from=2015-10-01&to=2015-11-23

Graph of several Doon Timeseries.
http://kiwis.grandriver.ca/KiWIS/KiWIS?
service=kisters&type=queryServices&request=getgraph&datasource=0&format=jpg&ts_id=8677042,12487042&from=2015-10-01&to=2015-11-23

Quinte CA KiWIS URLs

Values of Ottawa Int’l precipitation values
http://waterdata.quinteconservation.ca/KiWIS/KiWIS?
service=kisters&type=queryServices&request=getTimeseriesValues&datasource=0&format=html&ts_id=10447042&from=2015-10-01&to=2015-11-23

Values of Ottawa Int’l precipitation values and mean daily temperatures
http://waterdata.quinteconservation.ca/KiWIS/KiWIS?
service=kisters&type=queryServices&request=getgraph&datasource=0&format=jpg&ts_id=10447042,10444042&from=2015-10-01&to=2015-11-23

Note that data sources can be merged into webpages, documents seamlessly
Thank you

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