Transformative sensor **T**echnologies and **S**mart **W**atersheds (TTSW) for Canadian Water Futures

GWF Inception Meeting

PI: Claude Duguay – Project Manager: Marie Hoekstra

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Goal of TTSW

Develop, improve, and test transformative technologies ('smart' sensor networks; terrestrial, sub-orbital, and satellite remote sensing systems) which will be implemented on a pan-Canadian scale and targeted to support water futures issues throughout cold regions.

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WP 1: Terrestrial sensors and 'smart' sensor networks
Lead: David Rudolph

OBJECTIVES & PROGRESS

1. **Improve measurements of environmental parameters in cold regions** through the development and improvement of ground-based sensors.

- Testing underway for most recent Acoustic Sounding of Snow (SAS3) system (collaboration with Campbell Scientific)
- Portable Waveguide Spectrometer being tested in lab at U of T through collaborator Honeywell

2. **Establish a pan-Canadian network of 'smart' hydrologic field observatories** to support environmental monitoring.

- New field observatory established by a joint team from TTSW and Northern Water Futures near Norman Wells for hydrologic and ecologic monitoring
- Alder Creek watershed in southern Ontario is focus for initial work on 'Smart' data logging platform being jointly developed through TTSW and Solinst Canada
   - Field testing planned for Summer 2018

WP 2: Drone, airborne, and satellite remote sensing
Lead: Claude Duguay

OBJECTIVES & PROGRESS

1. **Improve drone platforms and sensors for operation in cold weather**

- Currently testing thermal infrared sensor on quadcopter from company Draganfly which can operate in cold conditions (-30°C)

2. **Improve quantification of snow water equivalent (SWE) and near-surface soil moisture/freeze-thaw state**

- Co-I Kelly has received funding for unique Ku and L-band Synthetic Aperture Radar (SAR) system called CryoSAR.

- Instrument is being planned for airborne deployment

WP 2: Drone, airborne, and satellite remote sensing
## Lead: Claude Duguay

OBJECTIVES & PROGRESS

3. **Develop the design concept of a microsatellite mission for freshwater quality monitoring** including reflectometer and hyperspectral sensor.

- Initial meeting with Honeywell on 10 November, 2017

- GNSS-R instrument to be tested at York University April 2018 through collaborator Honeywell

- Hyperspectral instrument being developed by Honeywell engineering - at prototype stage

- TTSW holding first Microsatellite Water Mission workshop on 24 January 2018 to promote involvement with water research community and define objectives and requirements of the mission
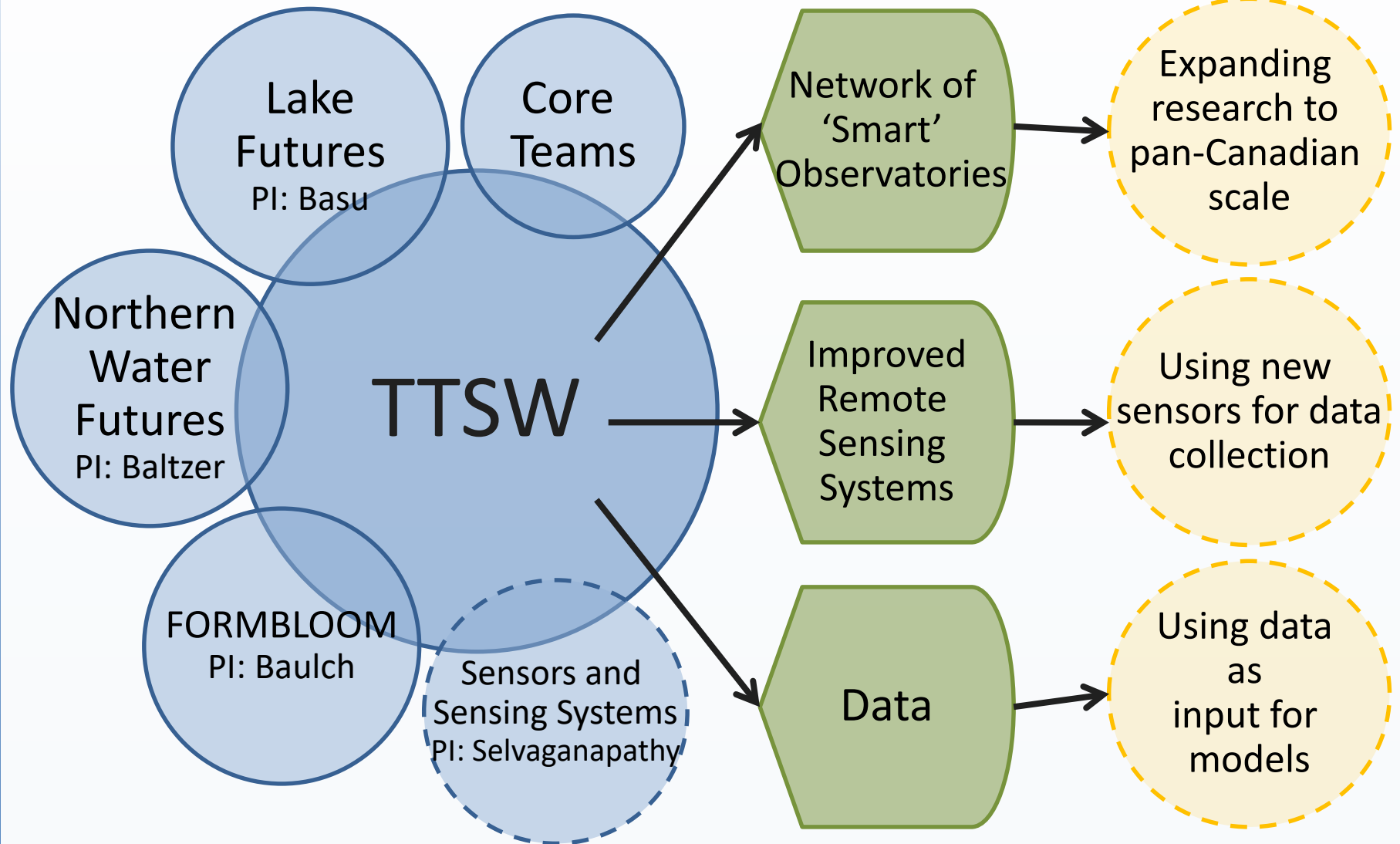
Involvement with UW Core Members * need update

Data Team (*TBD*)

Modelling Team

- Model-data assimilation systems for inland water quality forecasting and analysis (*Teng Xu*)
- Biogeochemical reaction networks for carbon, nutrients and contaminants (*TBD*)
- Multiscale watershed hydrological flow and water quality modeling (*TBD*)
- Cold regions lake modeling: ice dynamics, circulation, nutrient cycles and algal blooms (*Homa Kheyrollah Pour*)
- Ecosystem services valuation, water accounting and hydroeconomic modeling (*TBD*)
- Regional flow and chemical fluxes within the variably saturated subsurface (*TBD*)

Technical Team

- Remote sensing (*Kiana Zolfaghari*)
- Smart watershed lab (*Marianne VanderGriendt*)
- Smart watershed field (*TBD*)
- Smart sensors network (*TBD*)
- Water quality and aquatic ecosystem (*TBD*)

Knowledge Mobilization Team (*Kara Hearne*)