

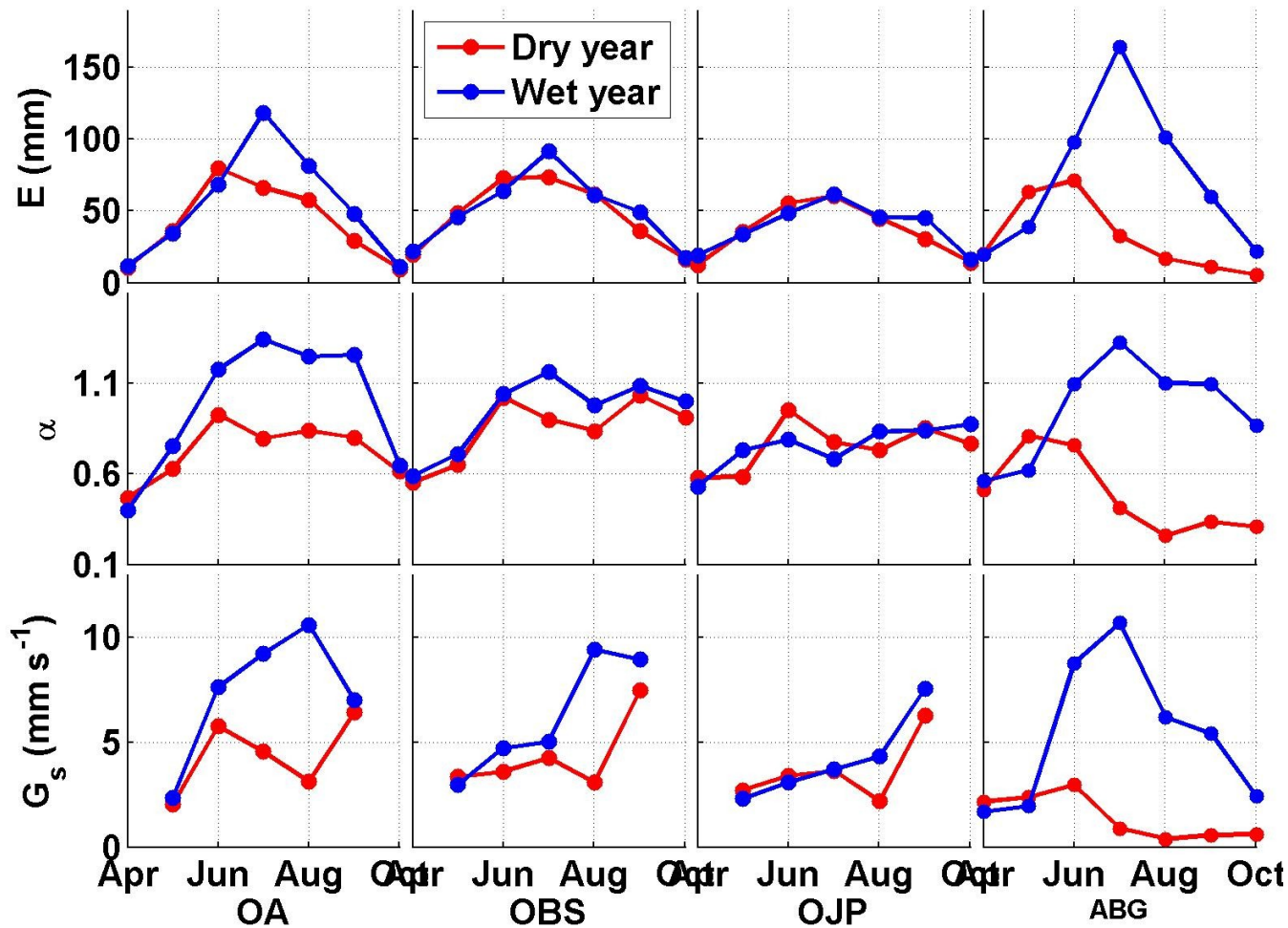
**van der Kamp:**

Characterizing  
drought:



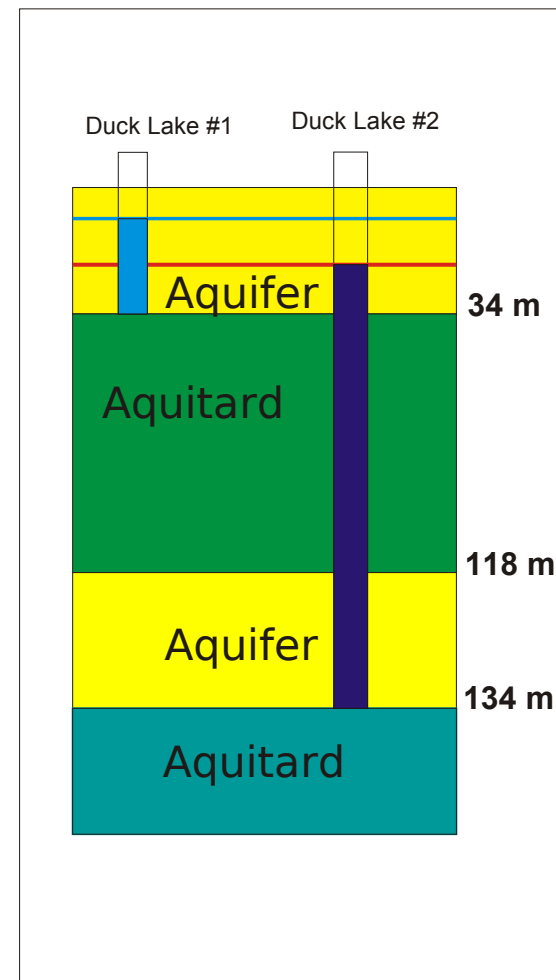
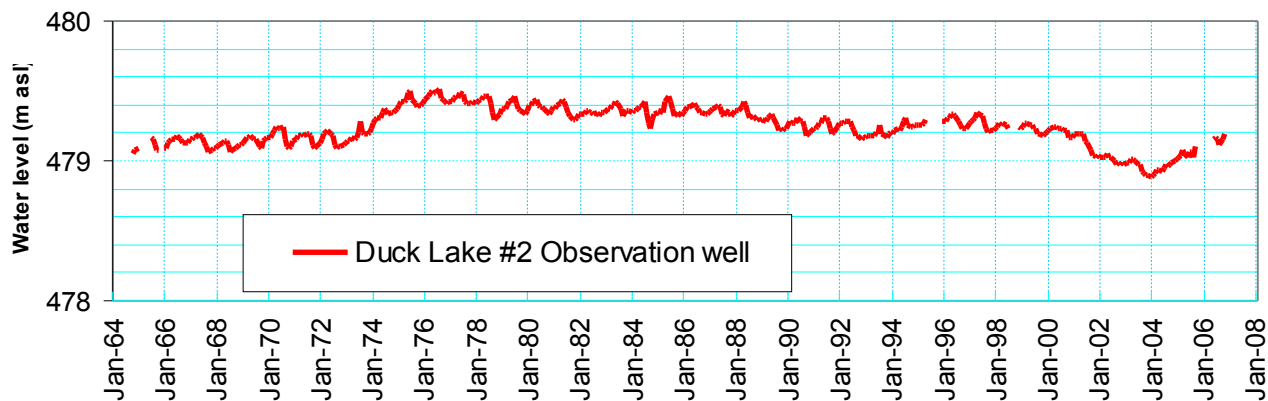
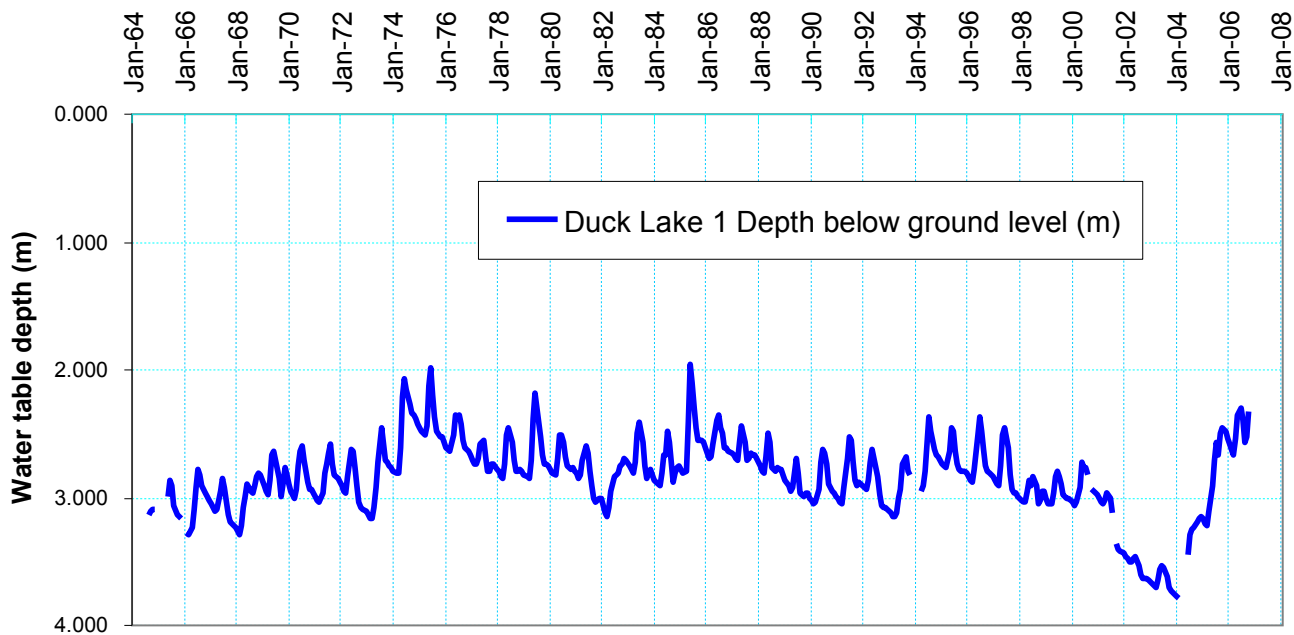
- Comparison of evapotranspiration from forest and grassland **Fluxnet** sites (with Barr and Zhan, Environment Canada).
- **groundwater levels** – water level records for shallow provincial observation wells (with Sauchyn, U of Regina).
- Comparison of geological weighing **lysimeters and GRACE** (with Yirdaw and Snelgrove, Memorial U).
- **Soil moisture** –regional: geological weighing lysimeters (with Anochikwa and Barbour, U of Saskatchewan).

Saskatchewan BERMS Forest flux sites (Old Aspen – OA, Old Black Spruce – OBS and Old Jack Pine – OJP) compared with Alberta Grassland site (ABG): Comparison of Monthly  $E, \alpha$  and  $G_s$  Between Dry year (2003 for SK Sites, 2001 for ABG) And Wet Year 2005 [Zhan *et al. in prep*]

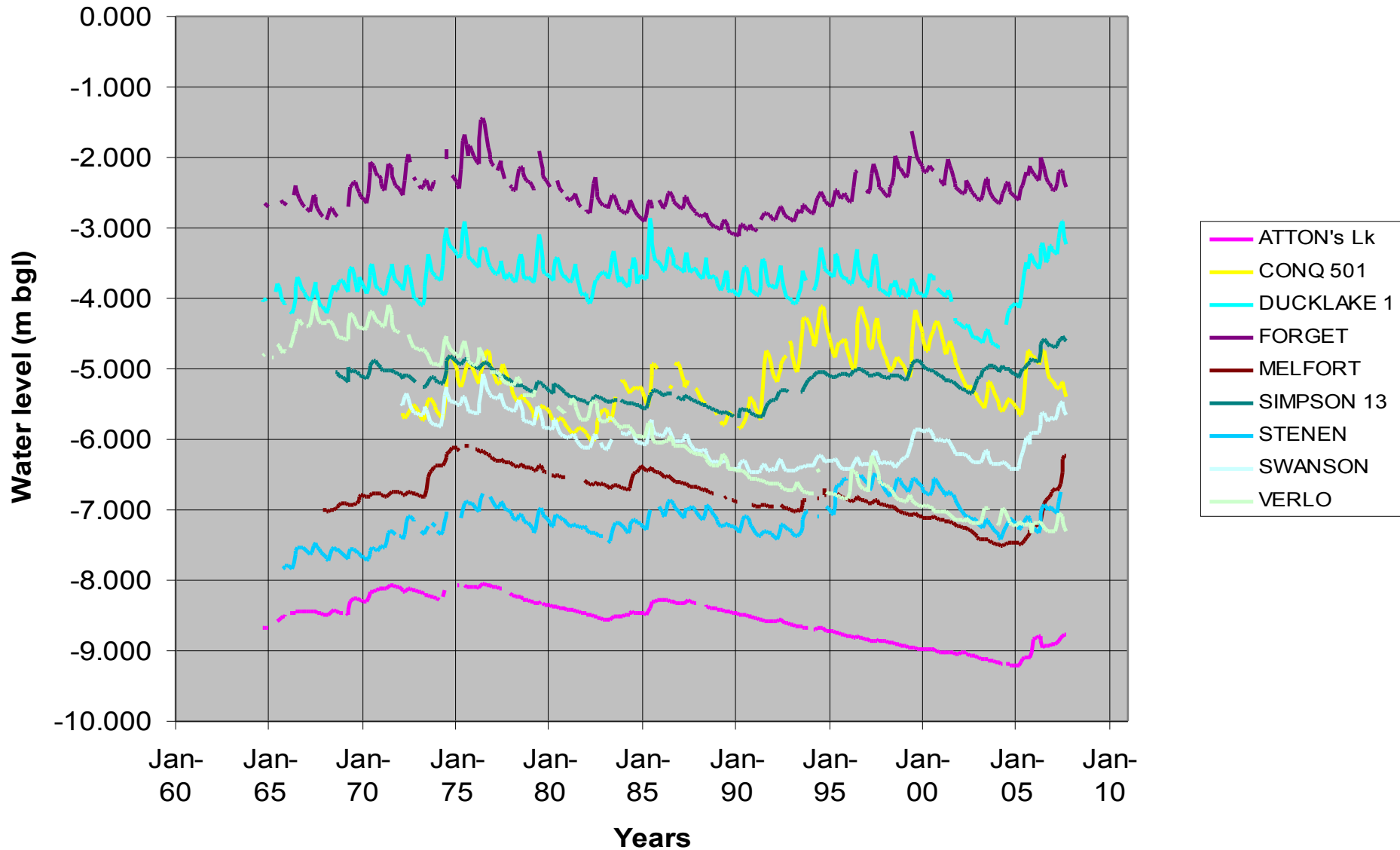


# Duck Lake SK Observation wells: water levels, 1964-2006

[Source: SK Watershed Authority, [www.swa.ca](http://www.swa.ca)]



# Shallow observation wells in SK – water level records 1964-2007: water table depths below ground level (m)



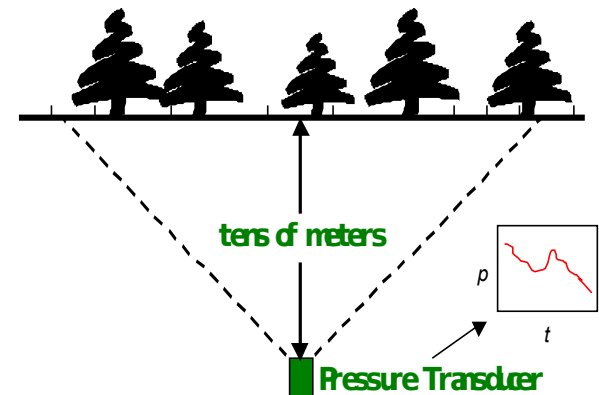


# Overview of the Weighing Lysimeter Instrumentation

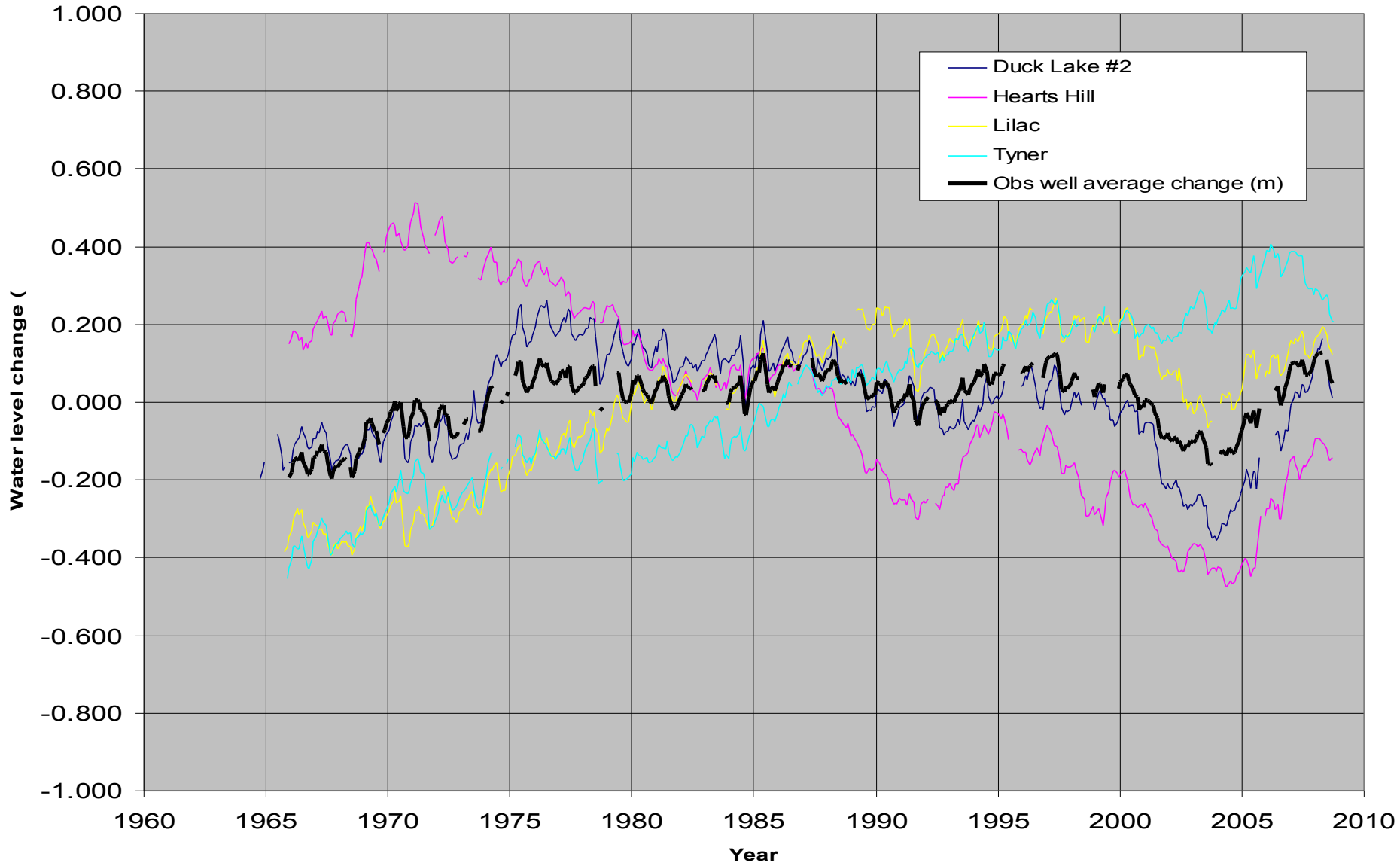
## ► Fundamentals

- Change of mechanical surface loading is instantaneously transmitted to deep saturated formations resulting in change of pore water pressure;
- Piezometers in saturated formations can therefore detect pore pressure changes due to hydrological processes such as:
  - ✓ Snow accumulation;
  - ✓ Rainfall;
  - ✓ Evapotranspiration

### Conceptual Sketch of Piezometric Weighing Lysimeter Installation

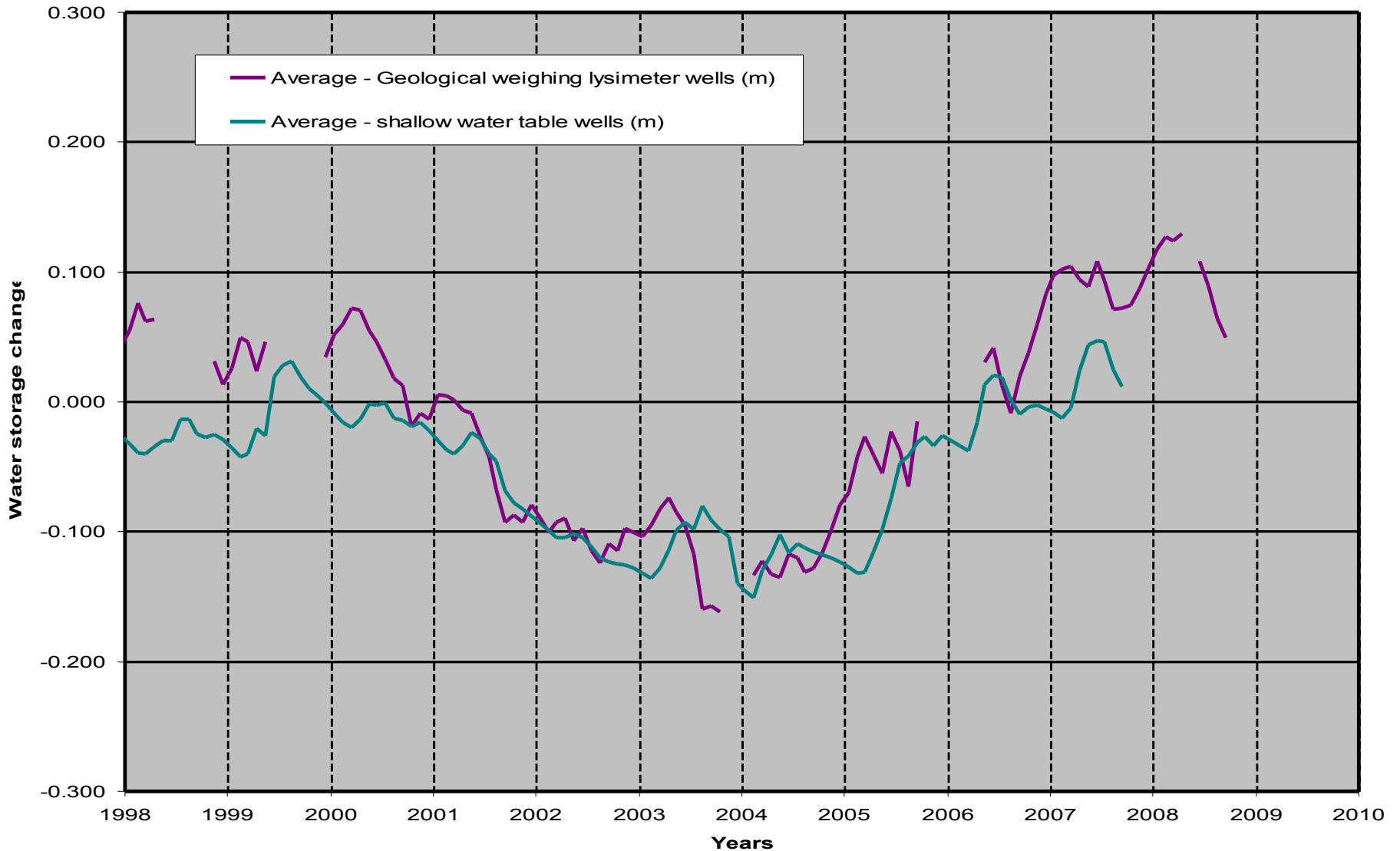


# Deep observation wells = “Geological weighing lysimeters” – southern Saskatchewan, 1965 - 2008



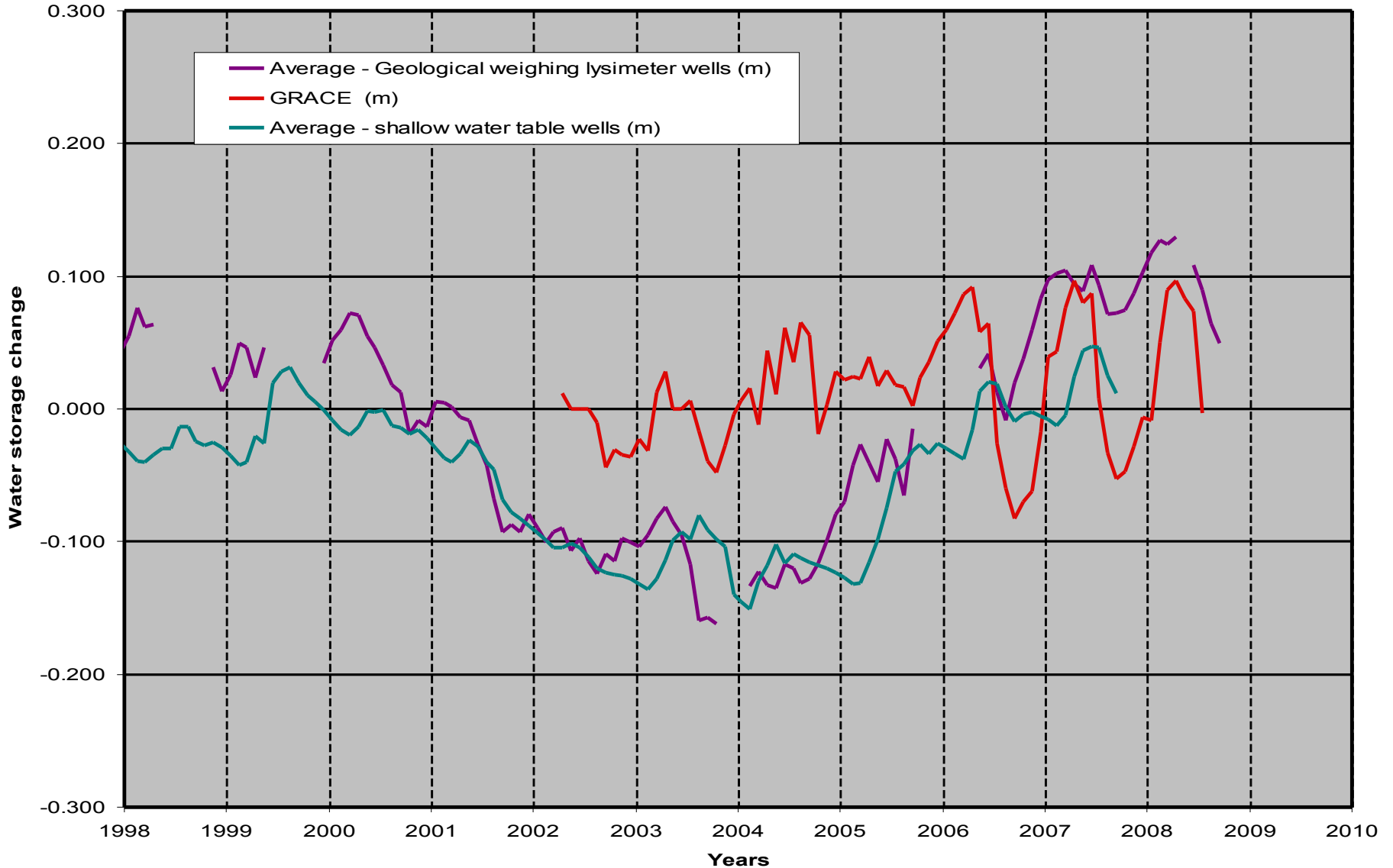
# Regional water storage changes in southern Saskatchewan:

- Average of 4 Geological Weighing Lysimeter wells,
- Average of 9 water table wells.

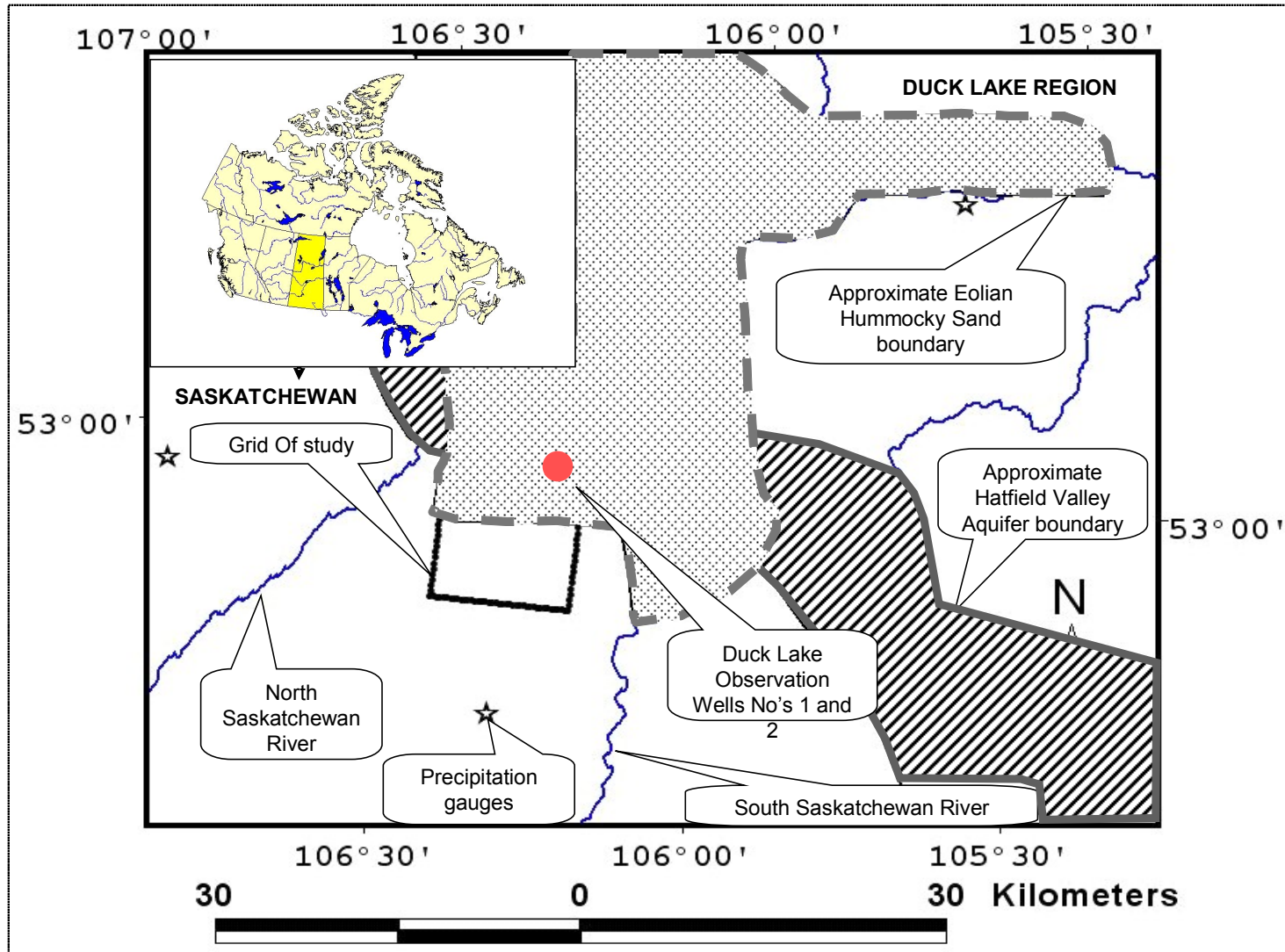


# Regional water storage changes in southern Saskatchewan:

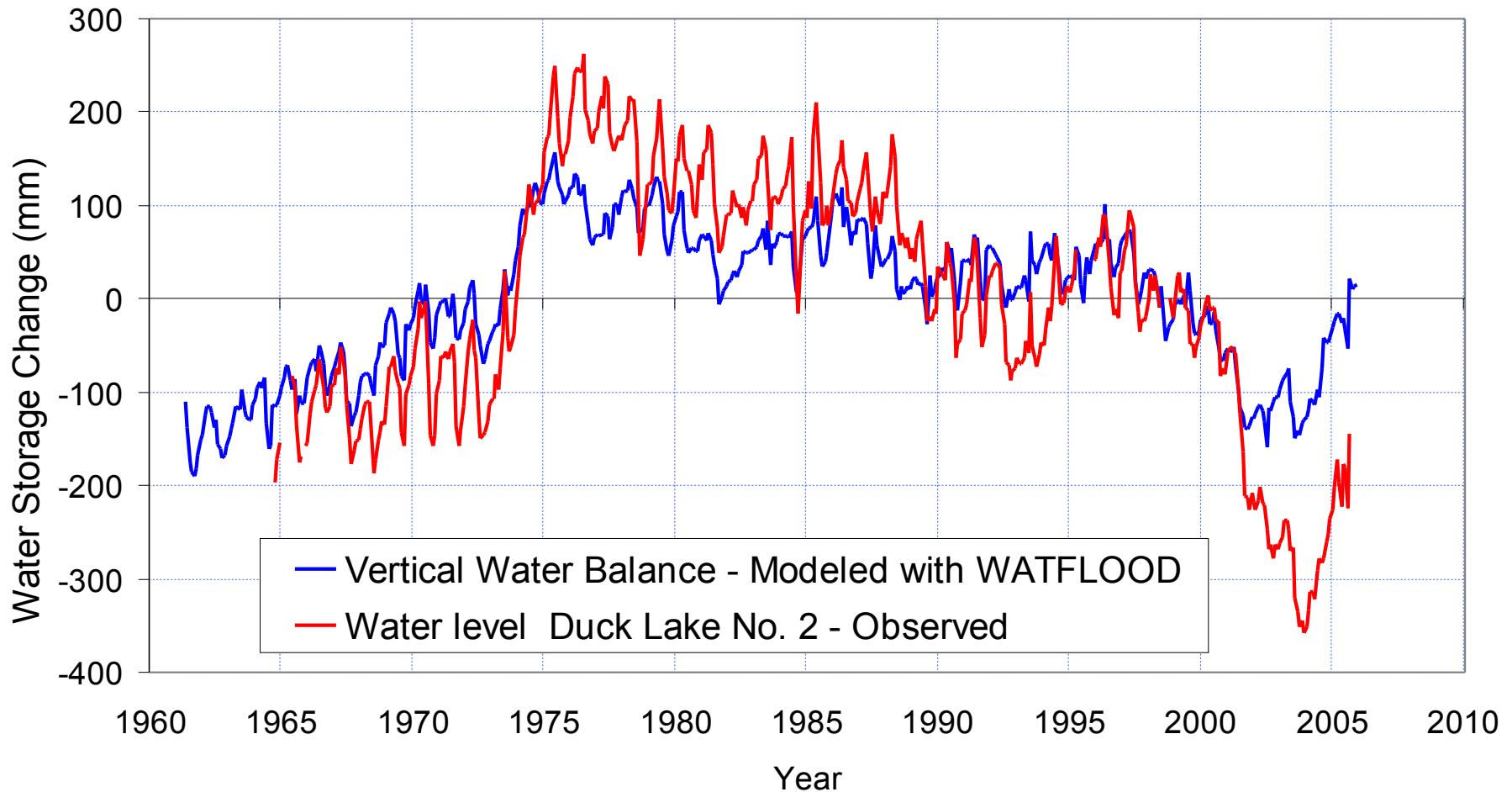
- GRACE for southern Saskatchewan *[provided by Yirdaw and Snelgrove]*
- Average of Geological Weighing Lysimeter wells
- Average of water table wells



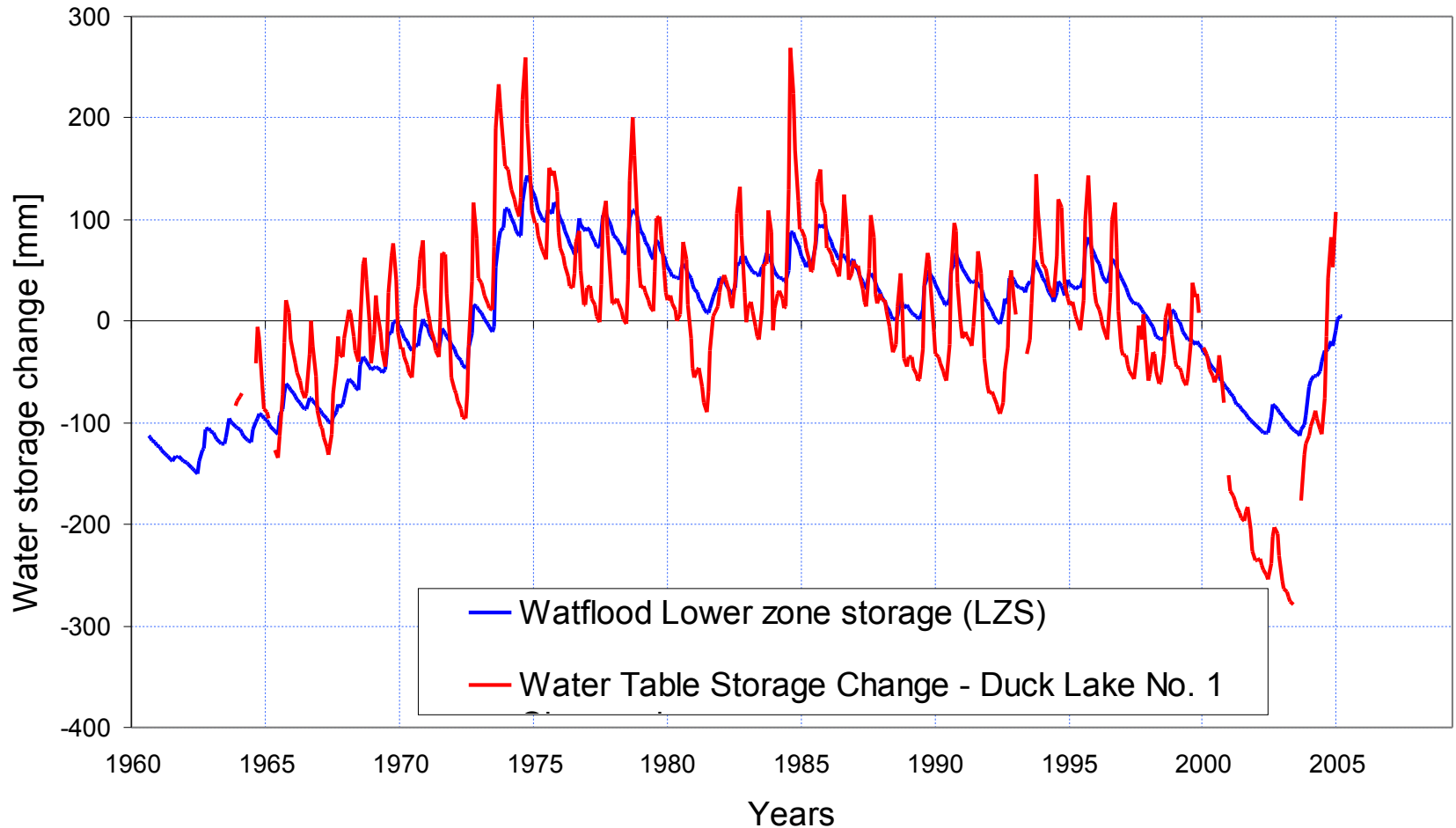
# Location of Duck Lake observations wells and Watflood grid cell *[Marin et al. in prep.]*



# Comparison of Duck Lake No. 2 (geological weighing lysimeter) water level record with Watflood simulation of the vertical water balance

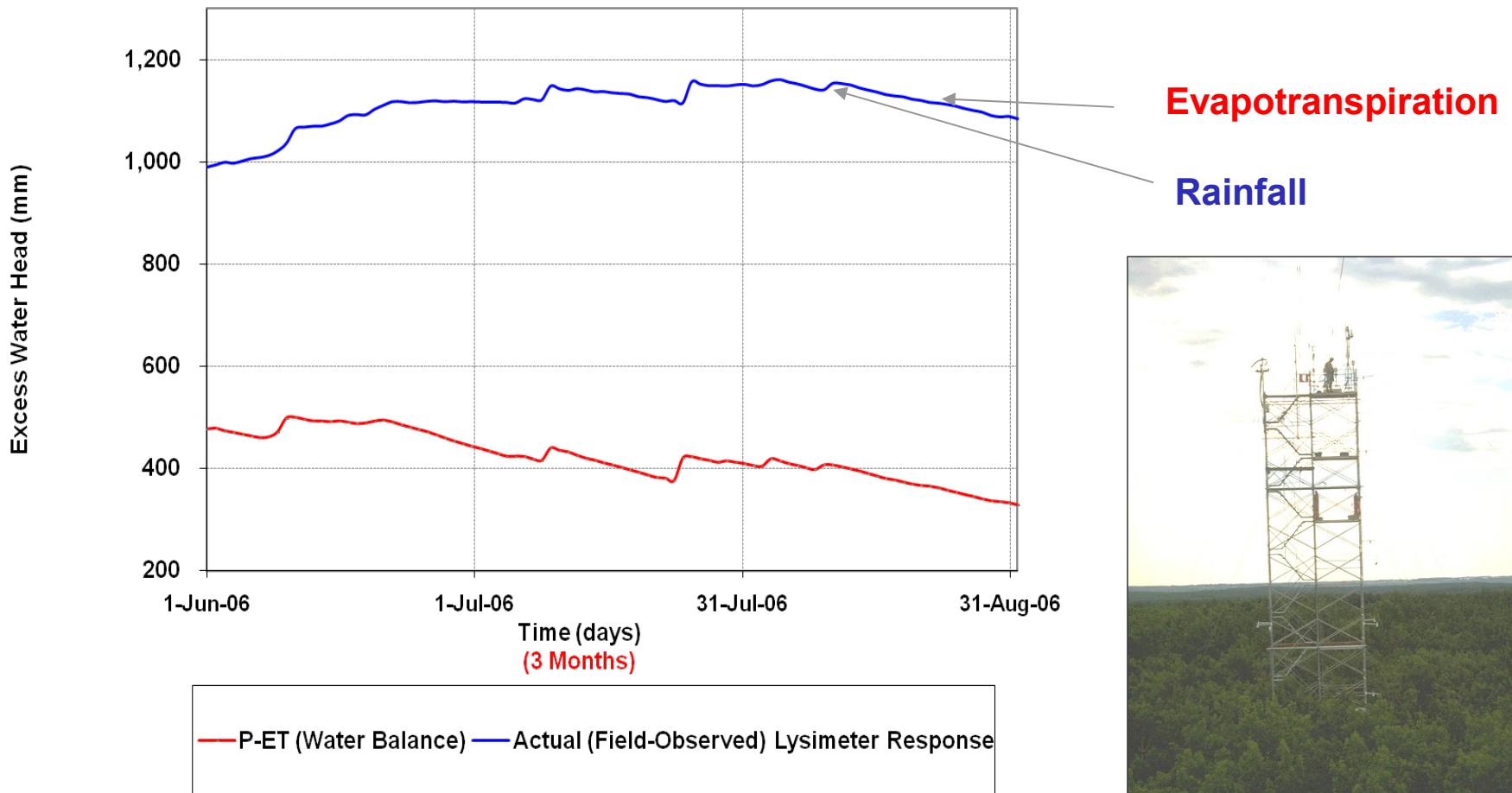


# Comparison of Duck Lake No. 1 (water table storage change) with Watflood simulation of the changes of groundwater storage



# Modeling of Piezometric Lysimeter Response to Rainfall & Evapotranspiration and water table changes (Anochikwa, MSc U of Saskatchewan)

## Old Aspen Forest Summer 2006



— P-ET (Water Balance) — Actual (Field-Observed) Lysimeter Response

(Using Environment Canada Data)

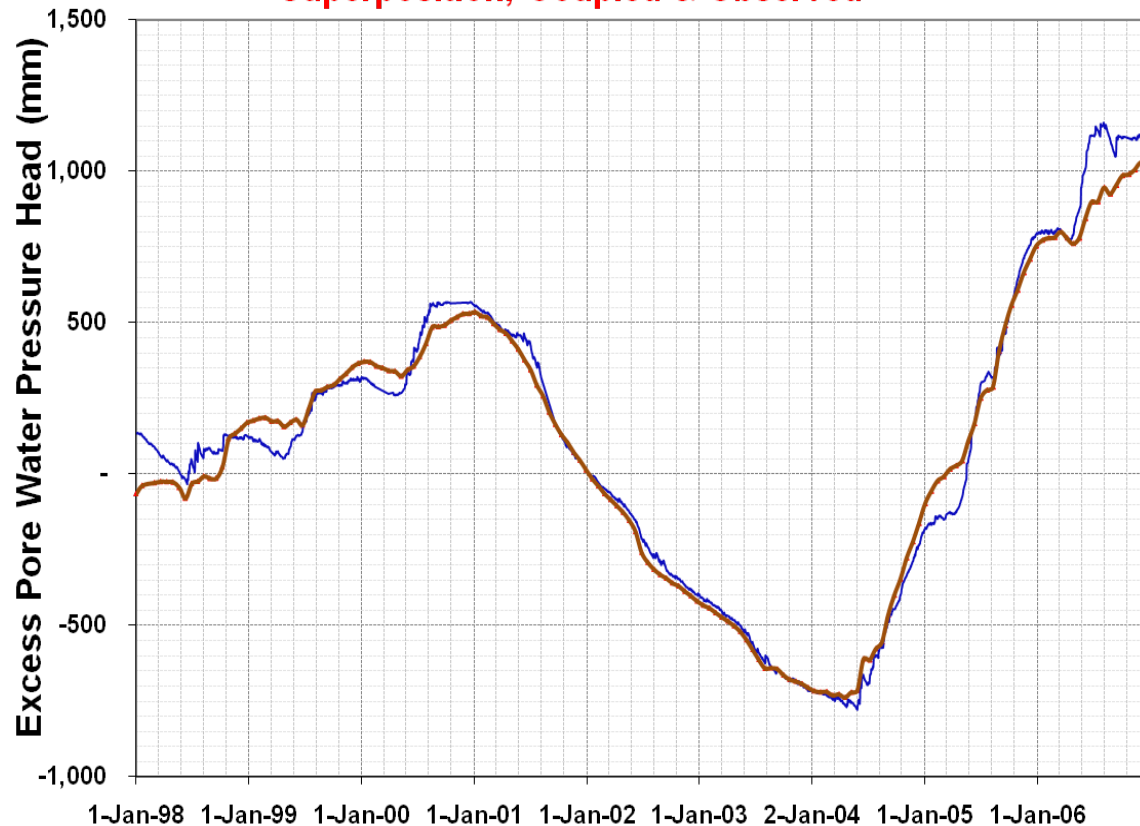


# Simulation of observed lysimeter response using SeepW/SigmaW geotechnical model

Properties	Value
Bbar	0.905
E (MPa)	560
n	0.26
Ss (/m)	1.29E-5
Kv (m/day)	1.2 E-5
D (m <sup>2</sup> /day)	1.94
Characteristic time scale (days)	229

## Old Aspen Forest Site (1998 - 2007):

Superposition, Coupled & Observed



Time (days)

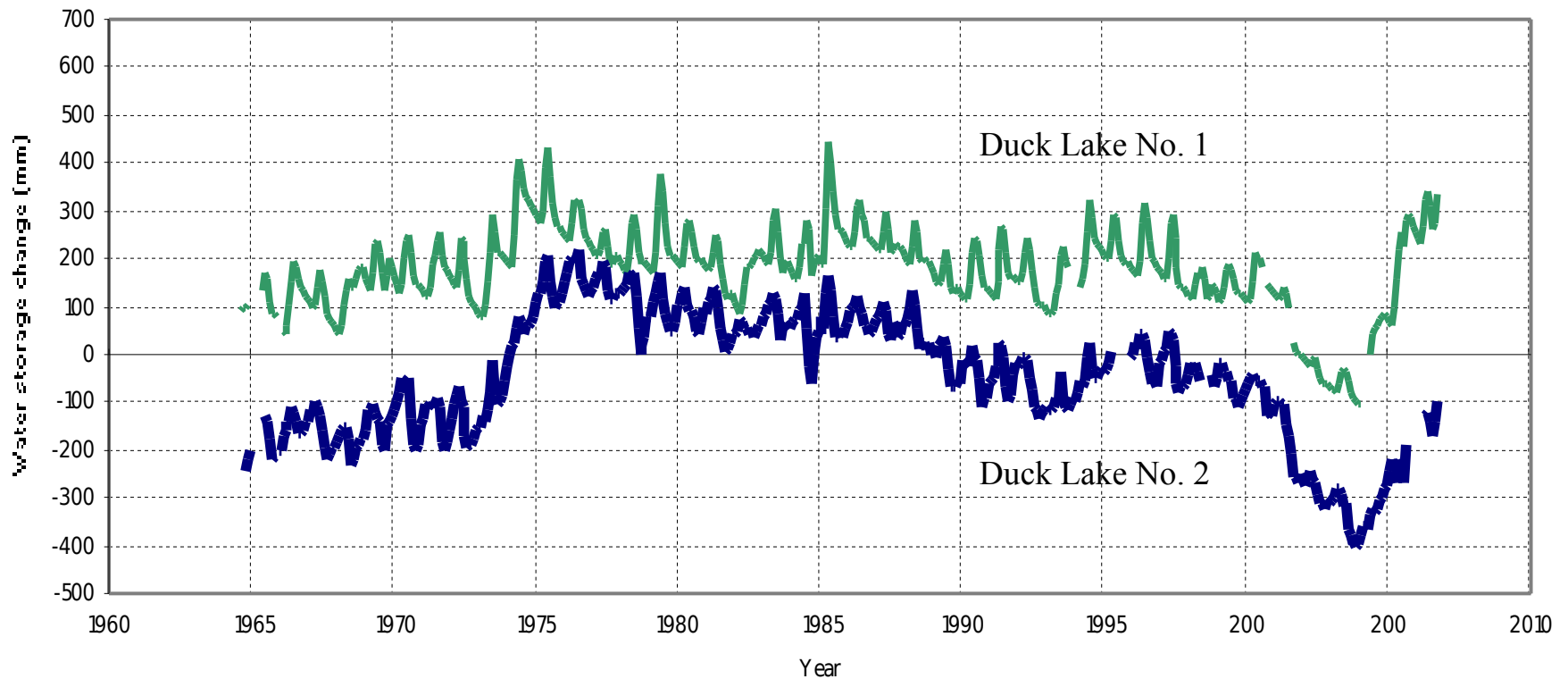
[9 yrs duration]

- Combined H(t) and Load(t) Effect on Deep Piezometer
- Observed Lysimeter Response (Field Data)
- Superposition: [H(t) + Stress(t)]

## Water storage changes observed for Duck Lake SK observation wells 1965-2007:

Duck Lake No. 1 – Shallow water table well with specific yield = 0.30

Duck Lake No. 2 – Deep well in confined aquifer (geological weighing lysimeter)



# Shallow observation wells in AB – water level records 1965-2006: water table depths below ground level (m)

