Investigate spatial differences in water table response associated with rainfall and canal water stage in the C-111 agricultural basin

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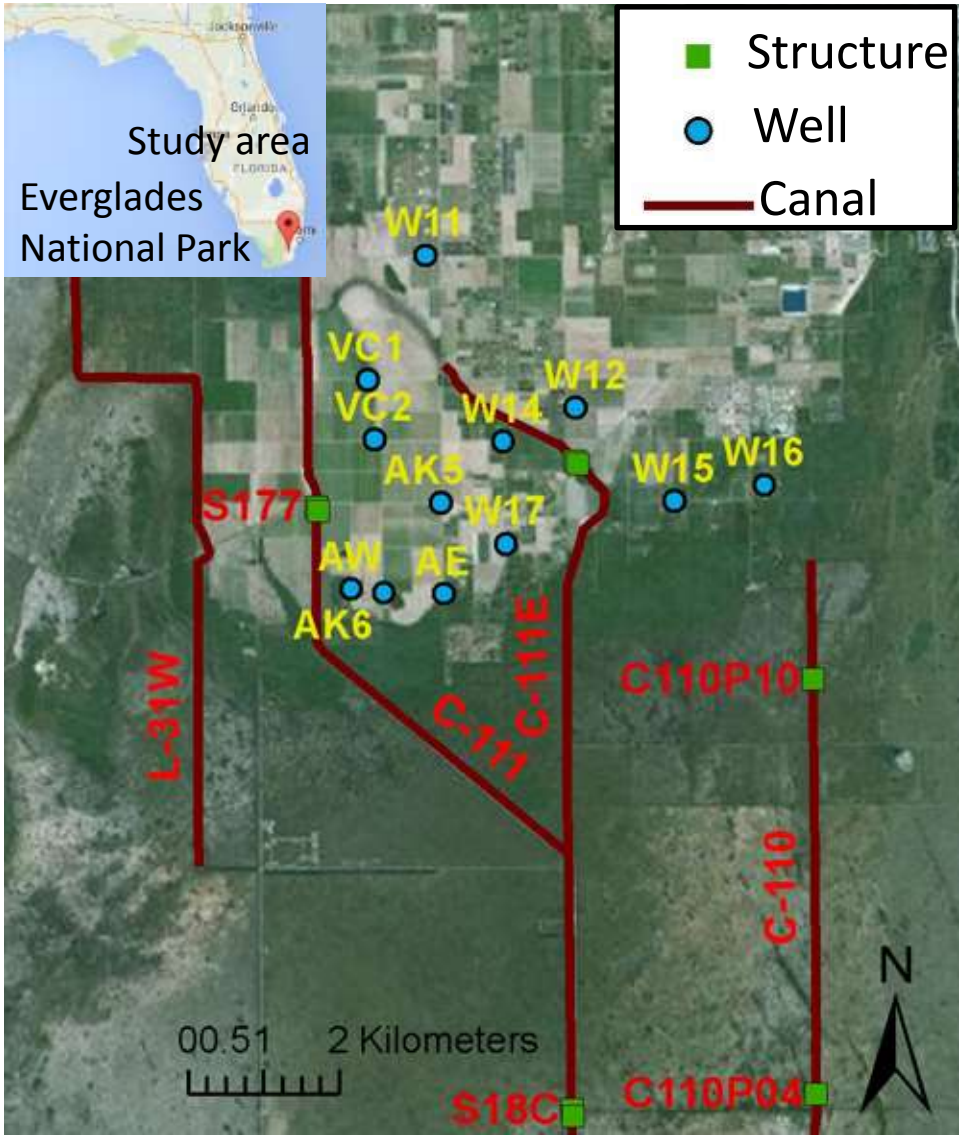
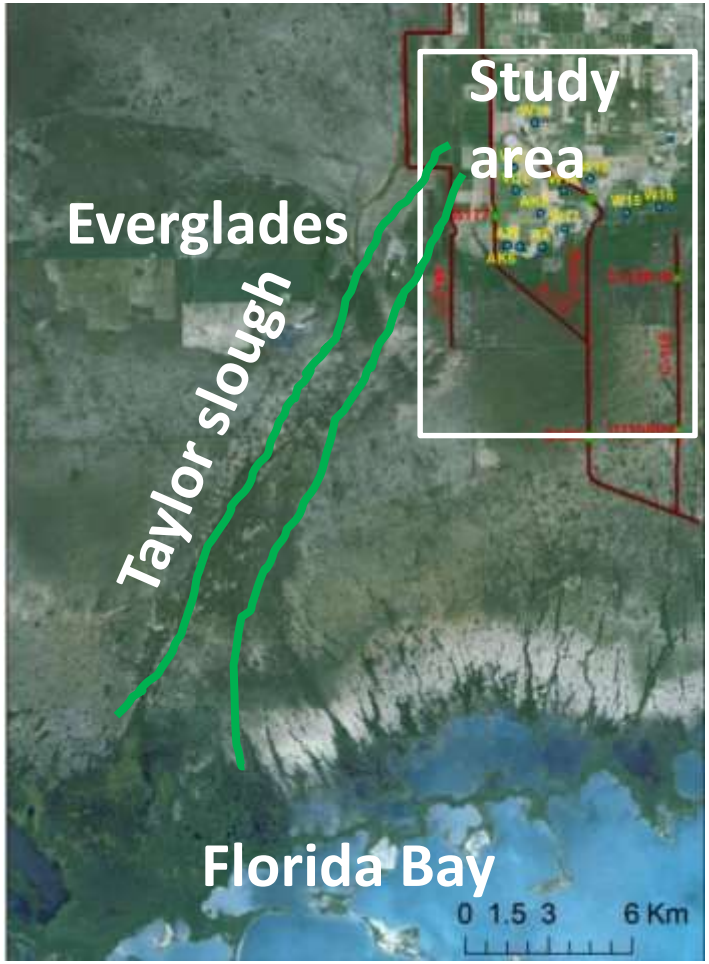
Study area



- Karstic aquifer: highly permeable
- Flat topography: 0.2 to 3.7 m
- Shallow groundwater table: 0.5 to 2.5 m below the ground surface
- Extensive canal systems for flooding protection

Groundwater management



- Hydrological and ecological conditions have been altered
- Groundwater tables are managed by canals, structures, and pumps
- SFWMD completed project construction near canals C111 and C111E
- The new projects were operational by **June 2012** as part of restoration for the ENP

Research objectives

- Evaluate whether significant difference existed in groundwater levels, canal stages and groundwater response to rainfall events between pre-project construction and post-project construction in the project area
- Assess the variation in water table response height/rainfall event size ratio
- Investigate the effect of structural operation on water table response

Methods

- Statistic test implemented to compare the distribution of datasets pre and post project construction
- Water table fluctuation (WTF) method used to estimate rise in the groundwater table peak using master recession curve (MRC method; Nimmo et al. 2015 Groundwater)
- Linear regression used to investigate the relationship between water table response (Rsp) and rainfall events
- MODFLOW-NWT used to investigate the effects of structural operation on water table response

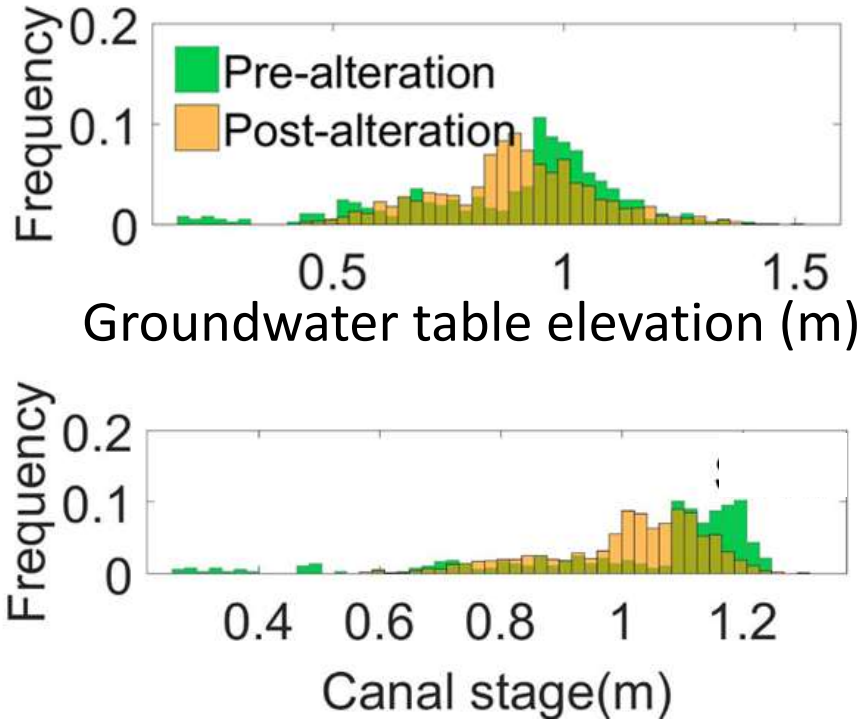
Observation data: Aug 2010-Dec 2016

- Rainfall: collected by NEXRAD (15 min)
- Water table elevation: collected by UF and SFWMD (15 min)
- Canal stage: collect by SFWMD (15 min)

Pre-alteration | Post-alteration

Aug/2010 Jun/2012 Dec/2016

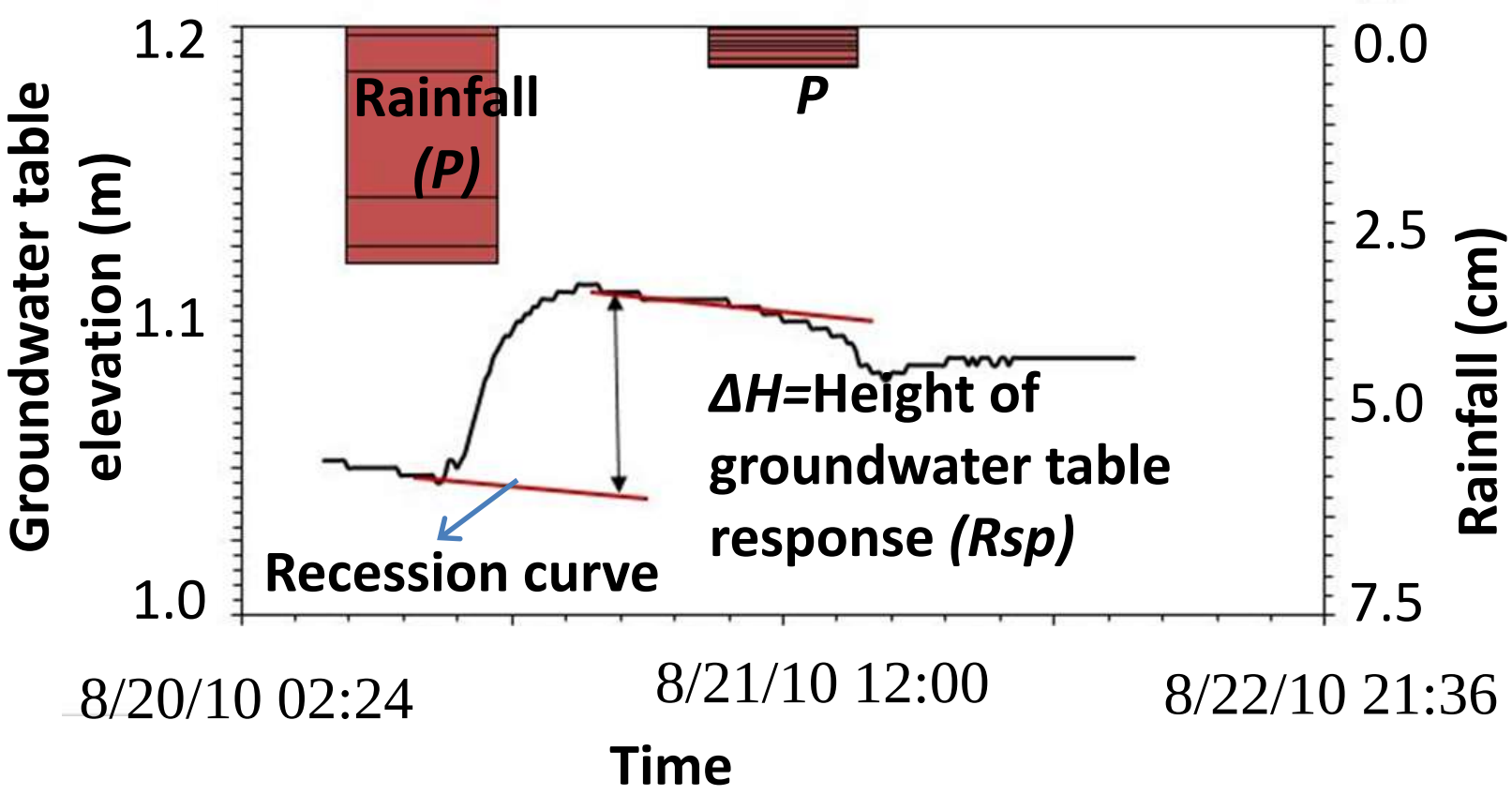
Kolmogorov–Smirnov test results



- Groundwater levels (*GW*) and canal stages (*SG*): significantly different
- Daily rainfall event size: no significant difference

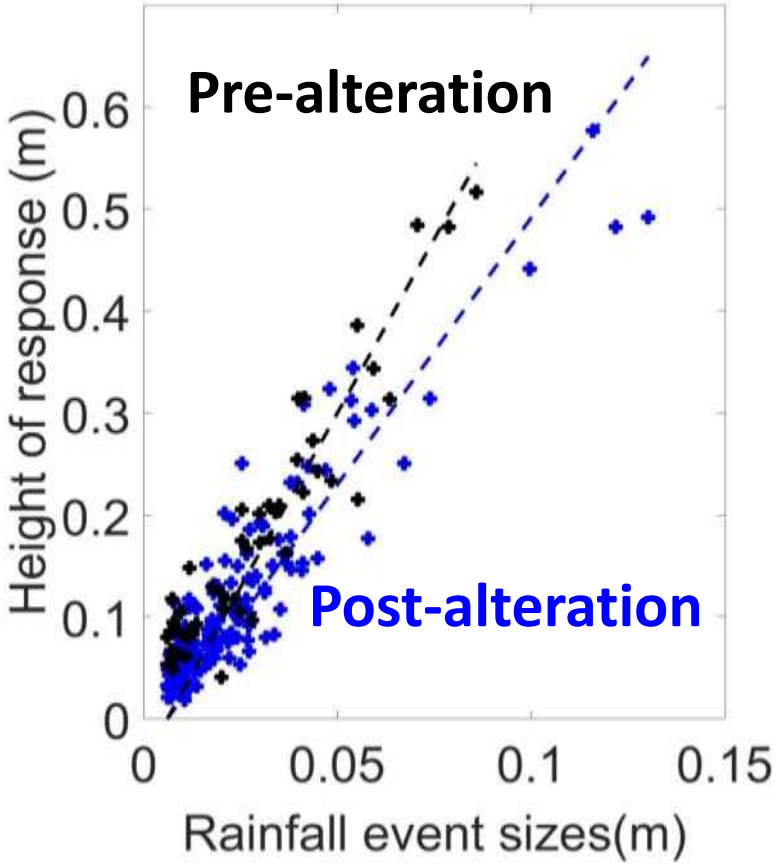
Identify groundwater table response

Height of groundwater table response: rise in the groundwater table peaks induced by rainfall event



Nimmo et al. (2015). Groundwater

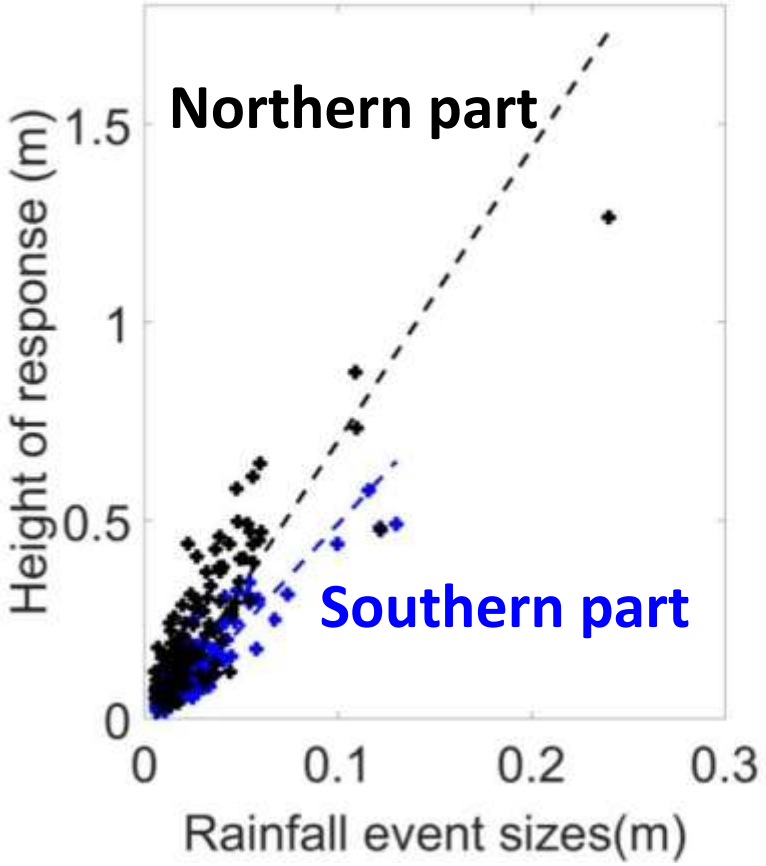
Height of groundwater table response (*Rsp*) vs. rainfall event size (*P*):



- For the same ***P*** and antecedent groundwater table elevation, ***Rsp*** were lower during the post-alteration period

Zhang *et al., Submitted to Hydro. Process (2016)*

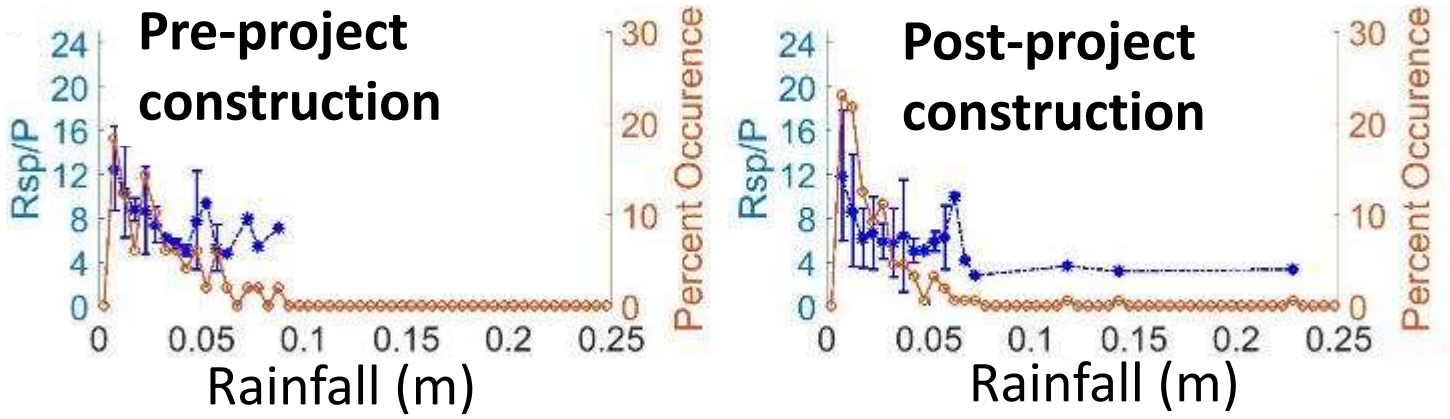
Height of groundwater table response (*Rsp*) vs. rainfall event size (*P*):



- For the same ***P*** and antecedent water table elevation, ***Rsp*** were lower in the south part study area

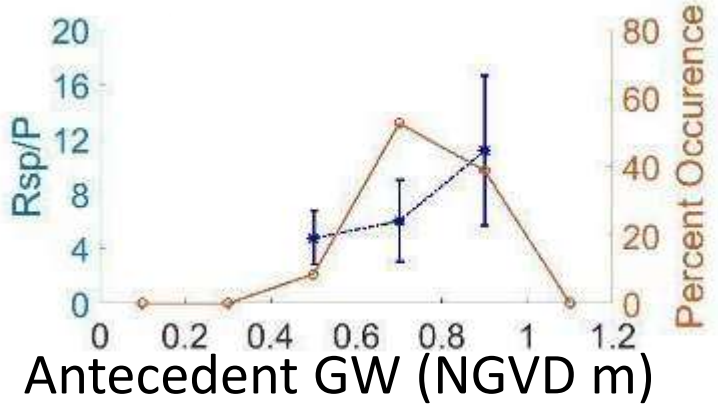
Zhang *et al., Submitted to Hydro. Process (2016)*

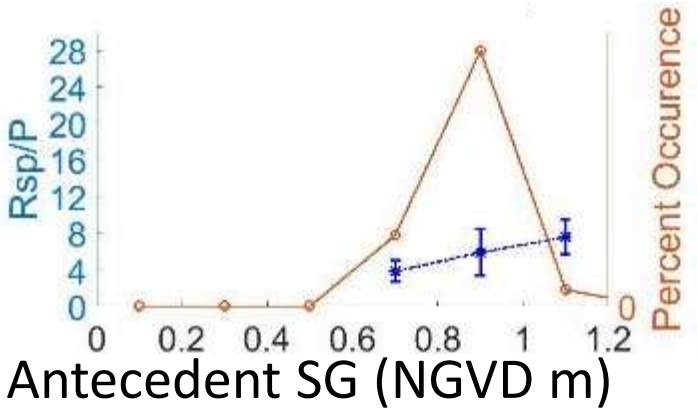
Water table response height/rainfall event size ratio



Large rainfall events produced the lowest *Rsp/P* ratio, indicating that large rainfall events lose more water to overland/ runoff flow

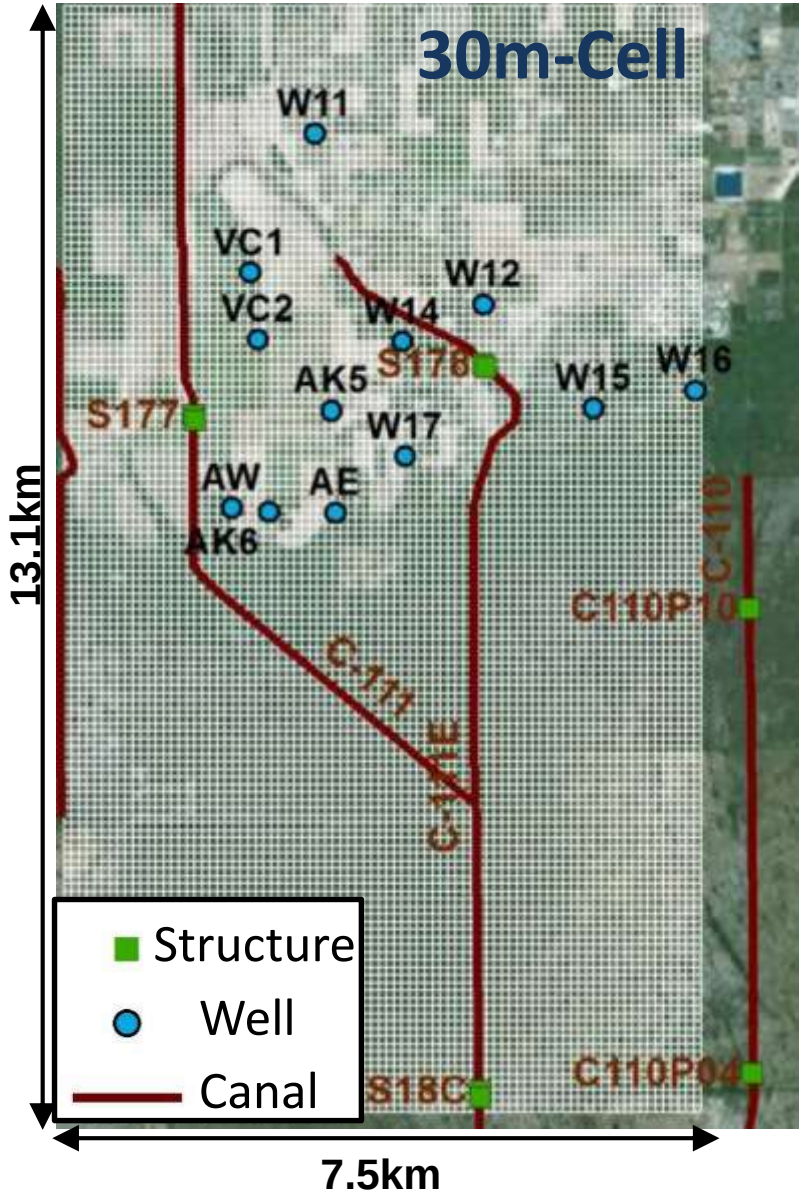
Water table response height/rainfall event size ratio





The lowest *Rsp/P* ratio occurs in dry season, when the soil moisture content is low, so rainfall fills the storage in the unsaturated zone first

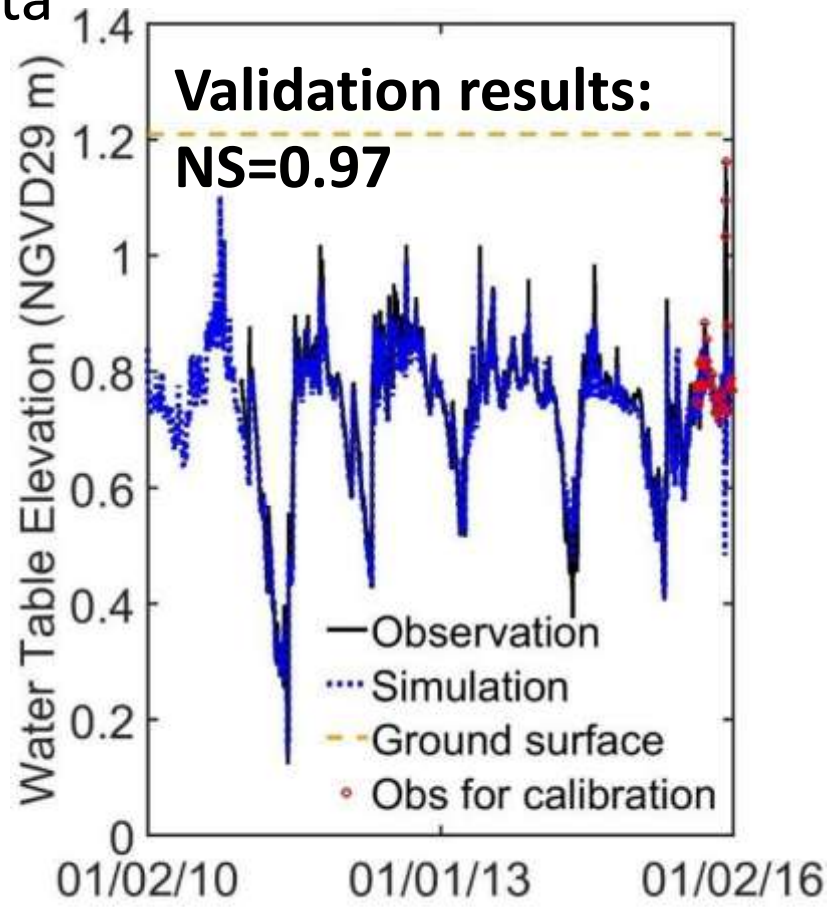
Hydrologic model



- Groundwater: MODFLOW-NWT (Niswonger et al., 2011)
- Canal flow: Surface Water Routing (SWR) code (Hughes et al., 2012)
- Model was calibrated using groundwater table elevation and canal flow data

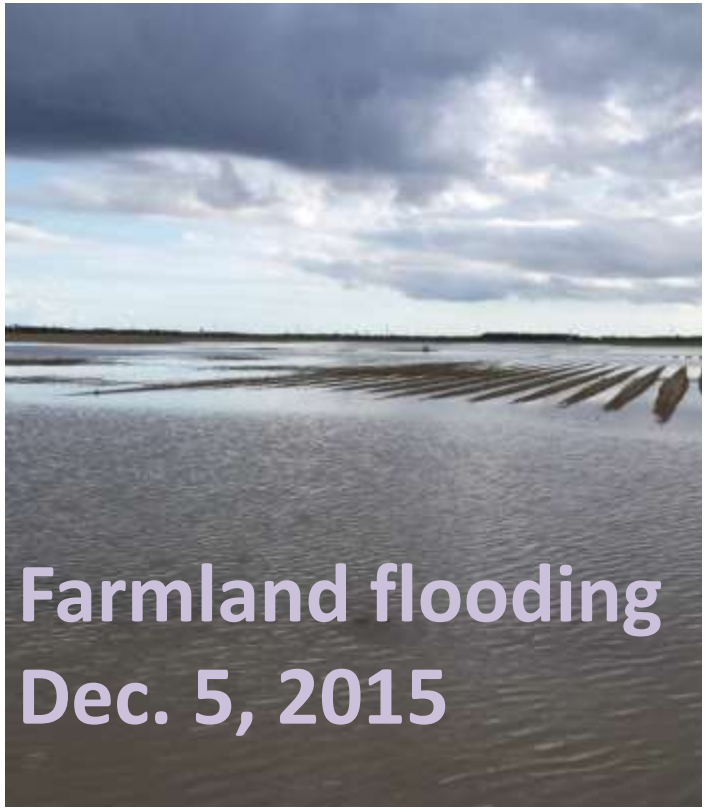
Hydrologic model validation: groundwater table elevation and canal flow

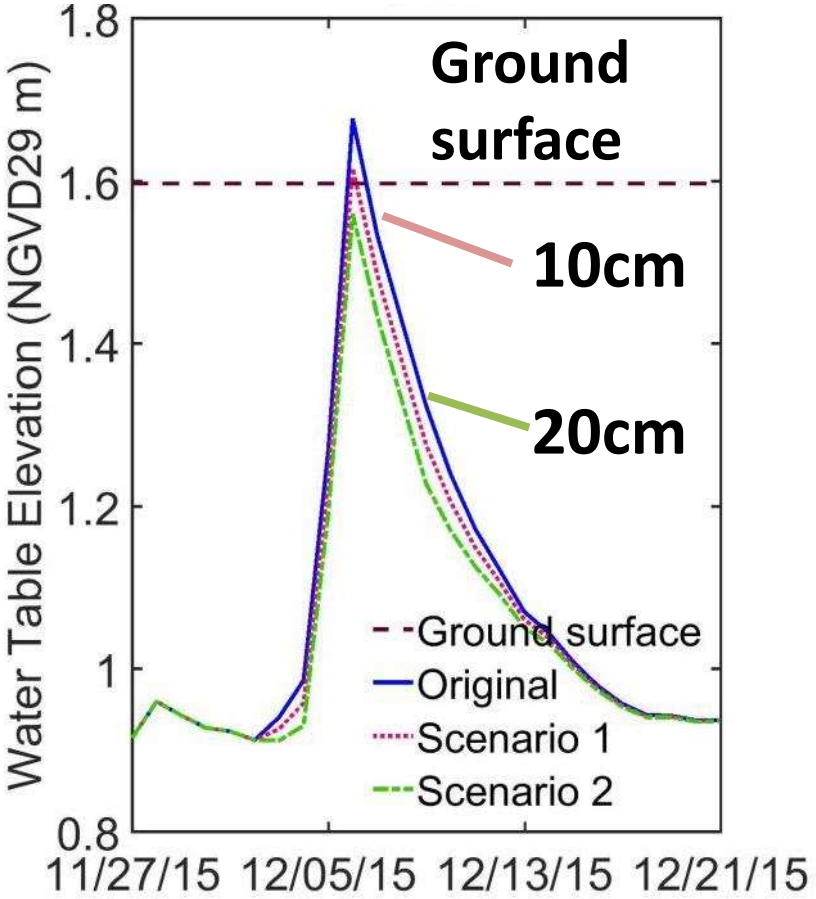
The simulated groundwater levels closely match the observed data



Model application

Canal operation and water table response





Conclusion

- Significant difference exists in groundwater levels, canal stages and the height of groundwater response to rainfall events after construction
- Variability exists in water table response height/rainfall event size ratio, which is attributed to the variation in the antecedent soil water content, rainfall induced runoff and evapotranspiration
- Water table response has been reduced after canal alteration

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