Application of SWAT and MODFLOW models to simulate groundwater flow in a coastal multi-aquifer system in Puck region (northern Poland)

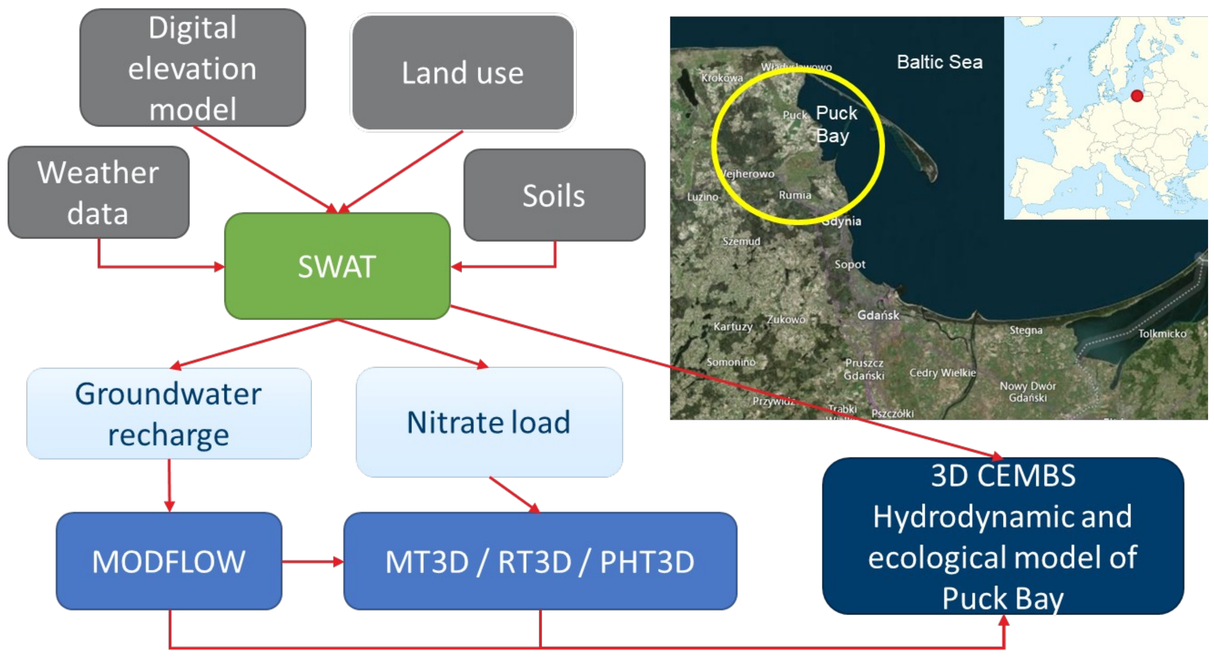
Adam Szymkiewicz[1], Beata Jaworska-Szulc[1], Dawid Potrykus[1], Dominika Kalinowska[1], Paweł Wielgat[1], Piotr Zima[1], Anna Gumuła-Kawęcka[1], Małgorzata Pruszkowska-Caceres[1], Lidia Dzierzbicka-Głowacka[2]

[1] *Gdańsk University of Technology, Gdańsk, Poland;* [2] *Institute of Oceanology of the Polish Academy of Sciences, Sopot, Poland*

46TH IAH CONGRESS MALAGA 2019
GROUNDWATER MANAGEMENT AND GOVERNANCE
COPING WITH WATER SCARCITY

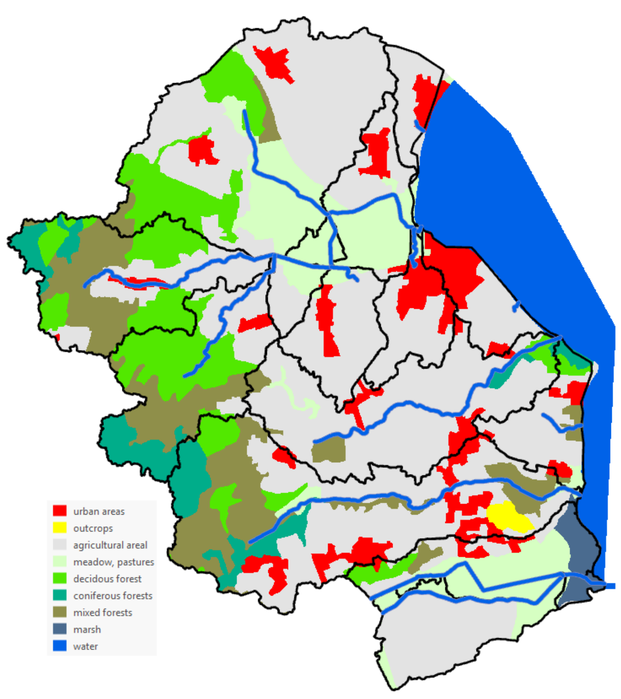
Motivation and objectives

- **Puck Bay is a shallow bay of the southern Baltic Sea, vulnerable to contamination and eutrophication**
- **Project WaterPUCK:**
  - **Prediction of nutrients and pesticide inflow from the land**
  - **Investigation of the role of submarine groundwater discharge**
  - **Coupling of models for surface and susbsurface flow and contaminant transport**



Land use

60% argiculture (wheat, canola, oats, potatoes, pastures), 29% forests (pine, beech), 11% urban areas

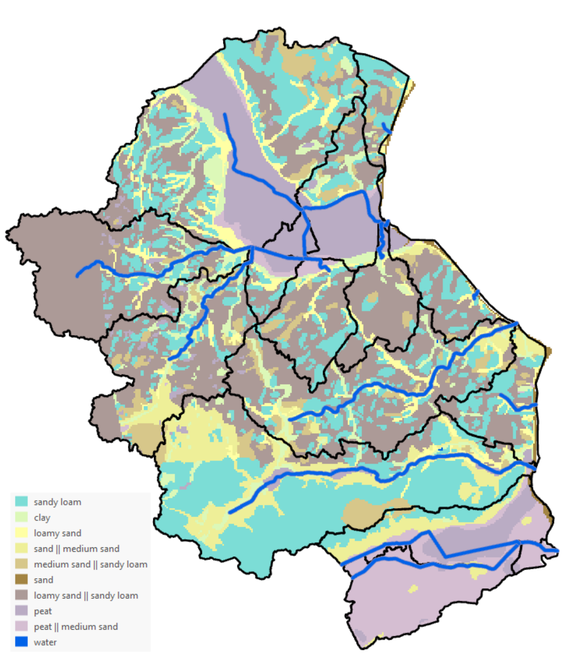


Groundwater recharge

Average values for the period 2000-2009, calculated by SWAT

Soils

Glacial till, sand and peat

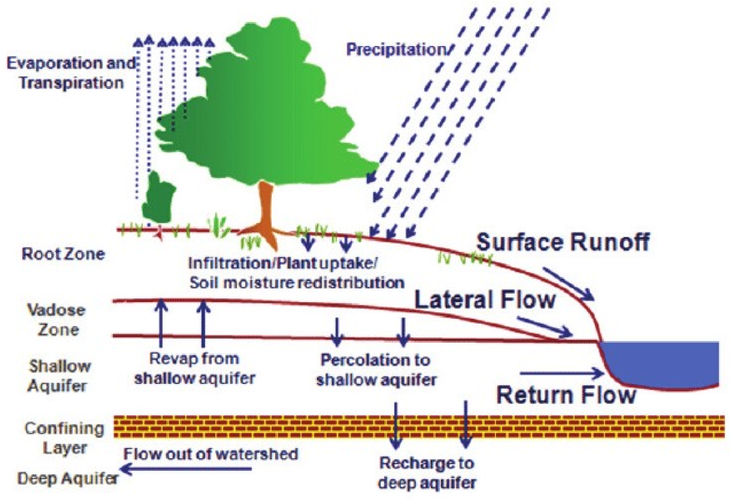


Groundwater head contours

First Quarternary aquifer

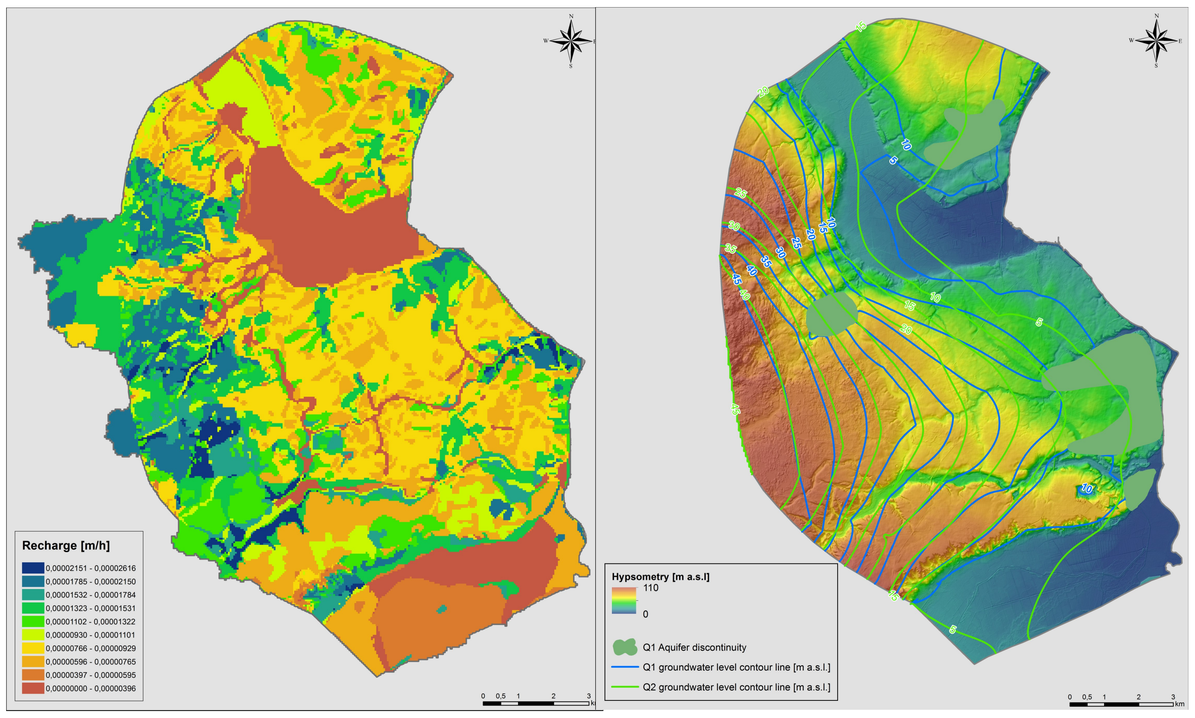
SWAT (Soil Water Assessment Tool)

- Hydrological processes
- Transport and fate of nutrients and pesitcides
- Provides input data for groundwater model:
  - Recharge
  - Nitrate load



Groundwater model

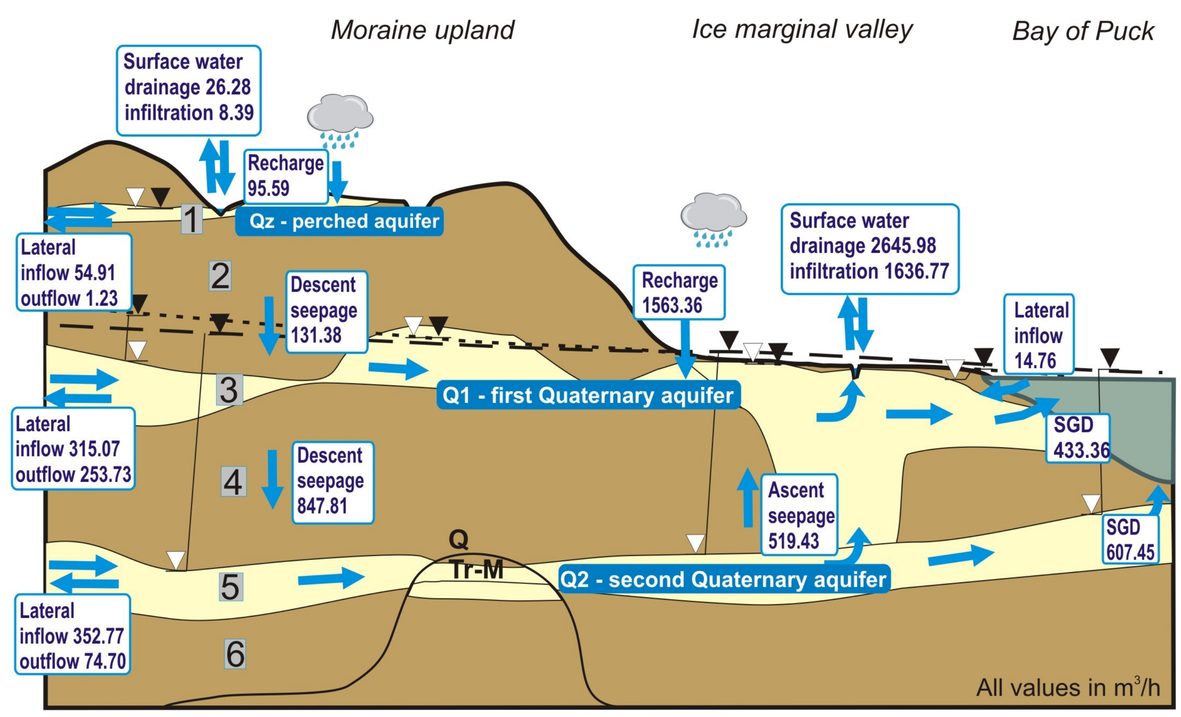
- Complex geology: 6 layers, 3 aquifers, ca. 730 000 cells (MODFLOW-NWT (GMS))
- Calibration carried out for steady state using recharge values from SWAT and observed groundwater levels (nned for simulatanous calibration of SWAT and MODFLOW)
- Water budget based on preliminary simulations showed significant role of SGD



Recharge / precipitation ratio

Average precipitation 620 mm / year, average evapotranspiration 440 mm / year
Recharge strongly depends on land use and soil type

	Crops	Grassland	Forests
Peat	0.08	0.05	0.08
Peat / Sand	0.08	0.04	0.08
Clay	0.07	0.04	0.06
Sandy Loam	0.11	0.11	0.10
Loamy Sand / Sandy Loam	0.15	0.15	0.13
Sand	0.22	0.22	0.16



This research was funded by National Centre for Research and Development (NCBR), Poland, in the framework of the project BIOSTRATEG3/343927/3/NCBR/2017 "Modelling of the impact of the agricultural holdings and land-use structure on the quality of inland and coastal waters of the Baltic Sea set up on the example of the Municipality of Puck region – Integrated info-prediction Web Service WaterPUCK" – BIOSTRATEG Programme.