

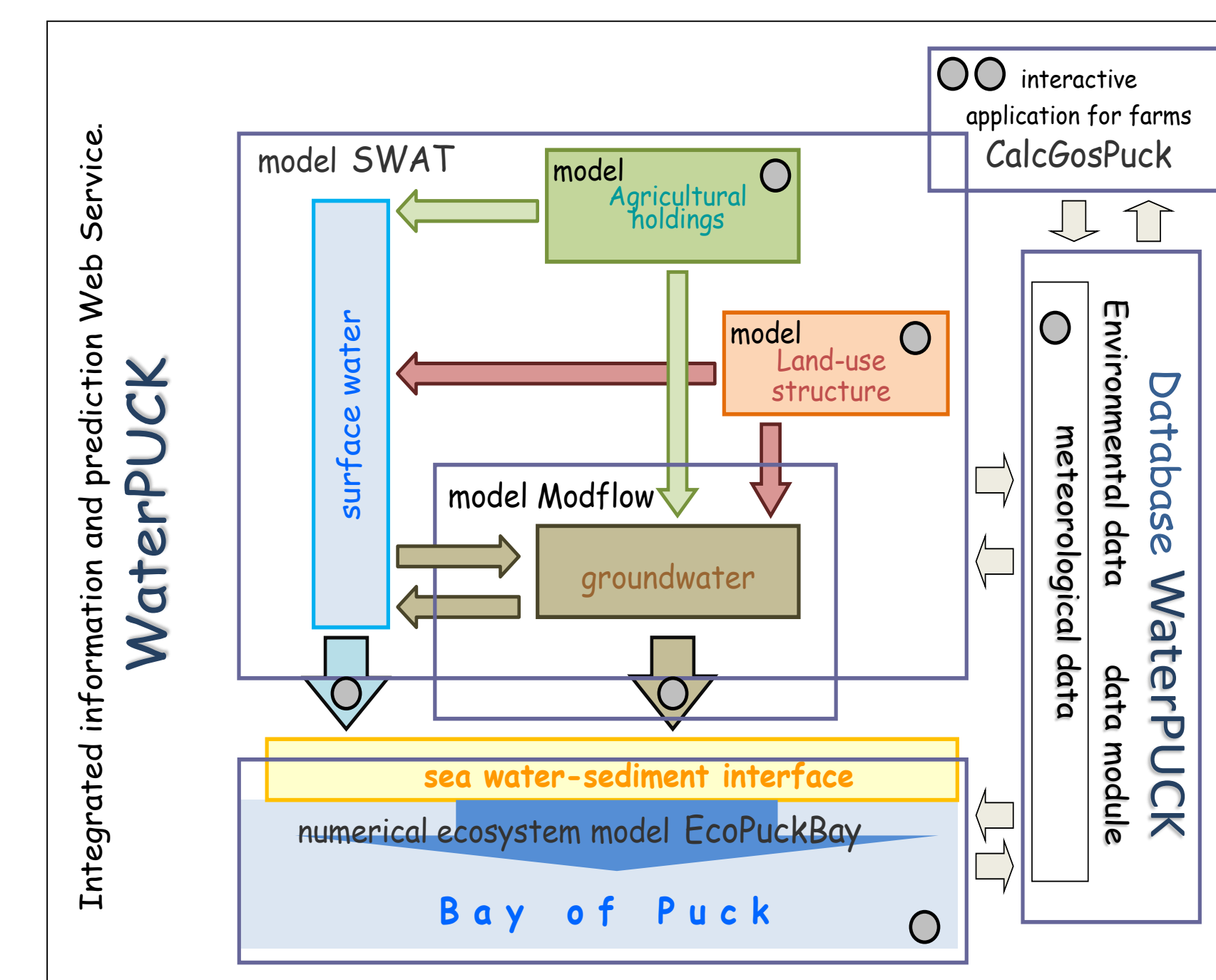
A three-dimensional ecohydrodynamical model of the Puck Bay “EcoPuckBay” - a hydrodynamic part

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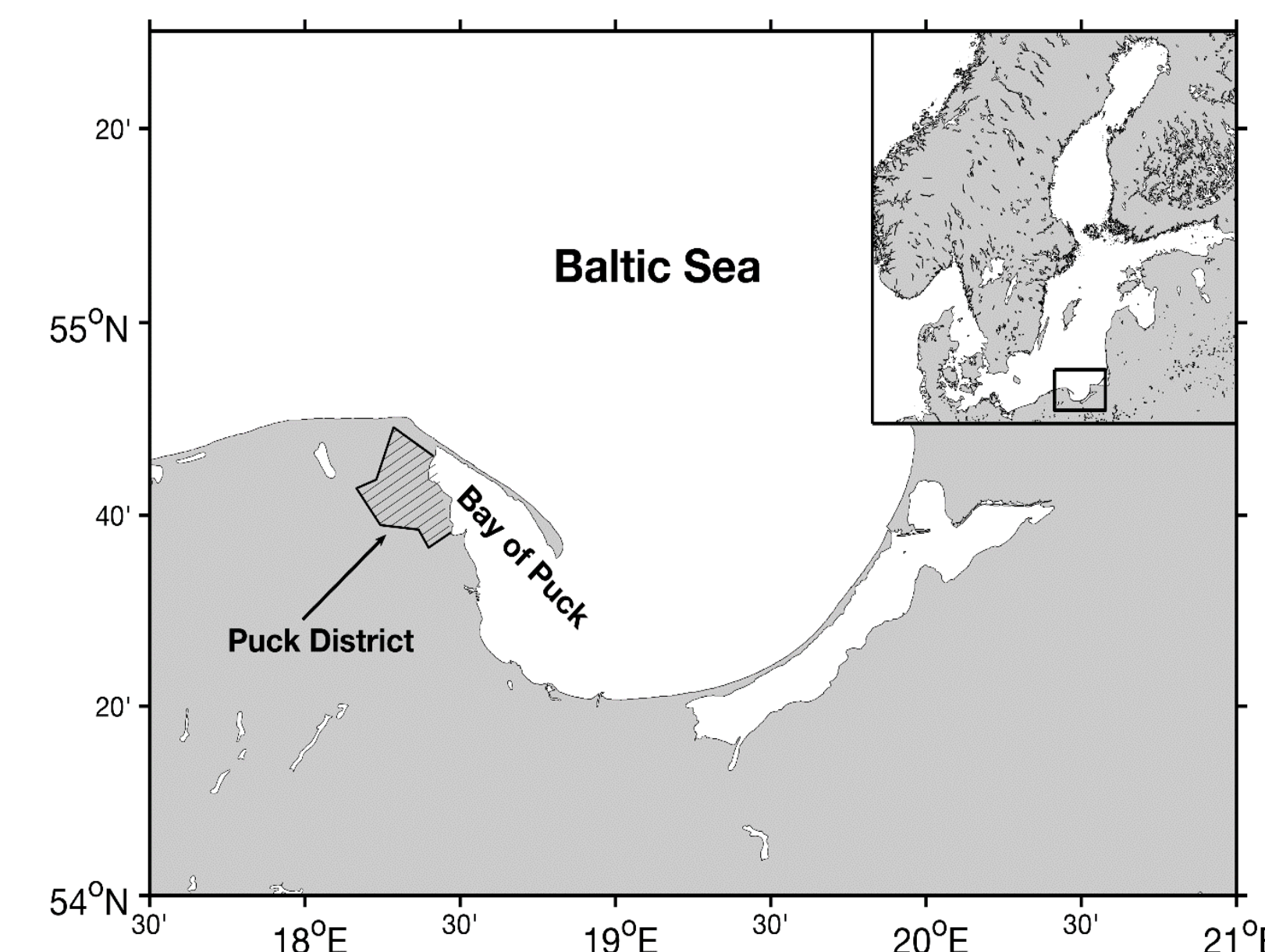
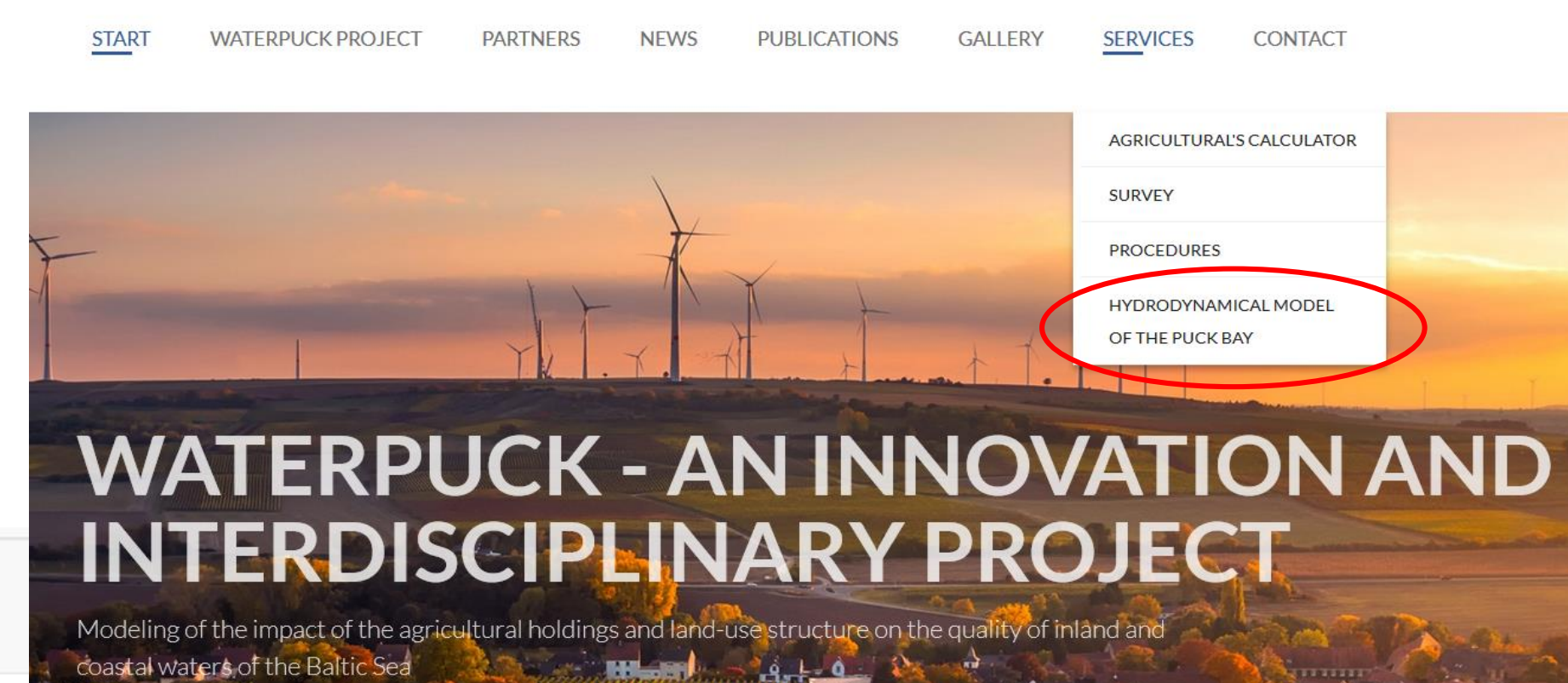
ABSTRACT

A new method – ‘Integrated information and prediction Web Service WaterPUCK’ for investigation influence of agricultural holdings and land-use structures on coastal waters of the southern Baltic Sea is presented. WaterPUCK Service is focused on determination of the current and future environmental status of the surface water and groundwater located in the Puck District (Poland) and its impact on the Bay of Puck (the southern Baltic Sea) environment. It will highly desired tool for land-use and environment management. The WaterPUCK Service is constructed as part of the project with the same name ‘WaterPUCK’ (www.waterpuck.pl). Developed within the framework of this project, the model of the Puck Bay “EcoPuckBay” will be a three-dimensional ecohydrodynamical model of higher vertical and horizontal resolution that assimilates satellite data. EcoPuckBay model consists of active ocean, ecosystem and ice modules, coupled together with active land module (SWAT plus ModFlow) which provide data, such as freshwater inflow and nutrient discharge from rivers and ground, and passive atmospheric module which provide data such as weather forecasts from external sources (UM ICM). From the side of the open sea, boundary conditions will be fed from the three-dimensional model of the ecosystem for the Baltic Sea 3D CEMBS (www.cembs.pl). 3D EcoPuckBay model will generate 72-hour forecast which include currents, temperature, salinity and ice parameters. In addition, the model will forecast ecological parameters i.e. nutrients, pesticides, dissolved oxygen concentration and biomass of phytoplankton and zooplankton in the entire water column. Each of these variables will be calculated with a second-order advection-diffusion, partial differential equation.



WaterPUCK Service (for Puck District) will integrate several models:

- a surface water model based on SWAT,
- a groundwater flow model based on MODFLOW,
- a 3D-ecohydrodynamic model of the Bay of Puck called EcoPuckBay
- an agriculture calculator called CalcGosPuck.



Map of the Puck District and the Buy of Puck

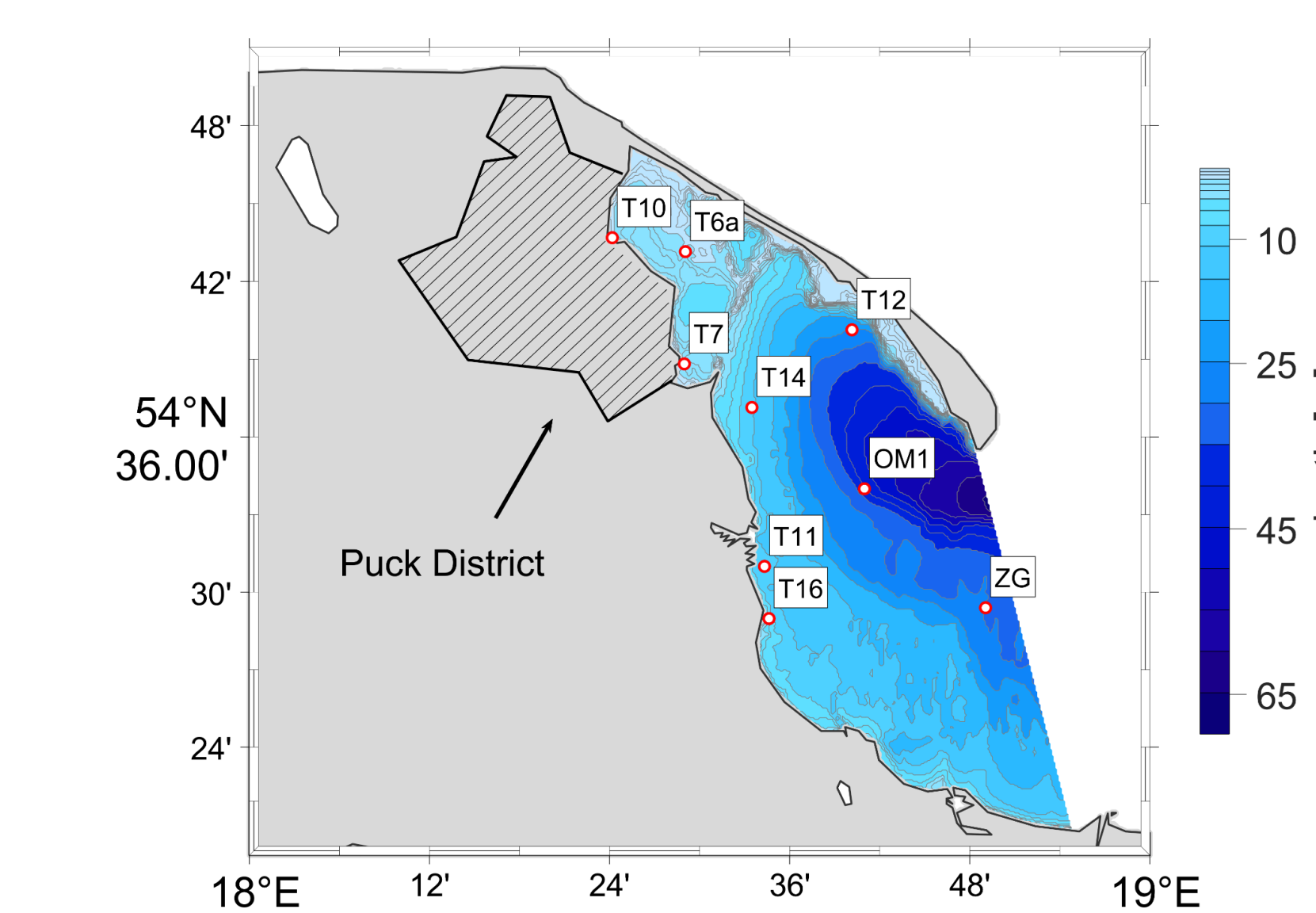
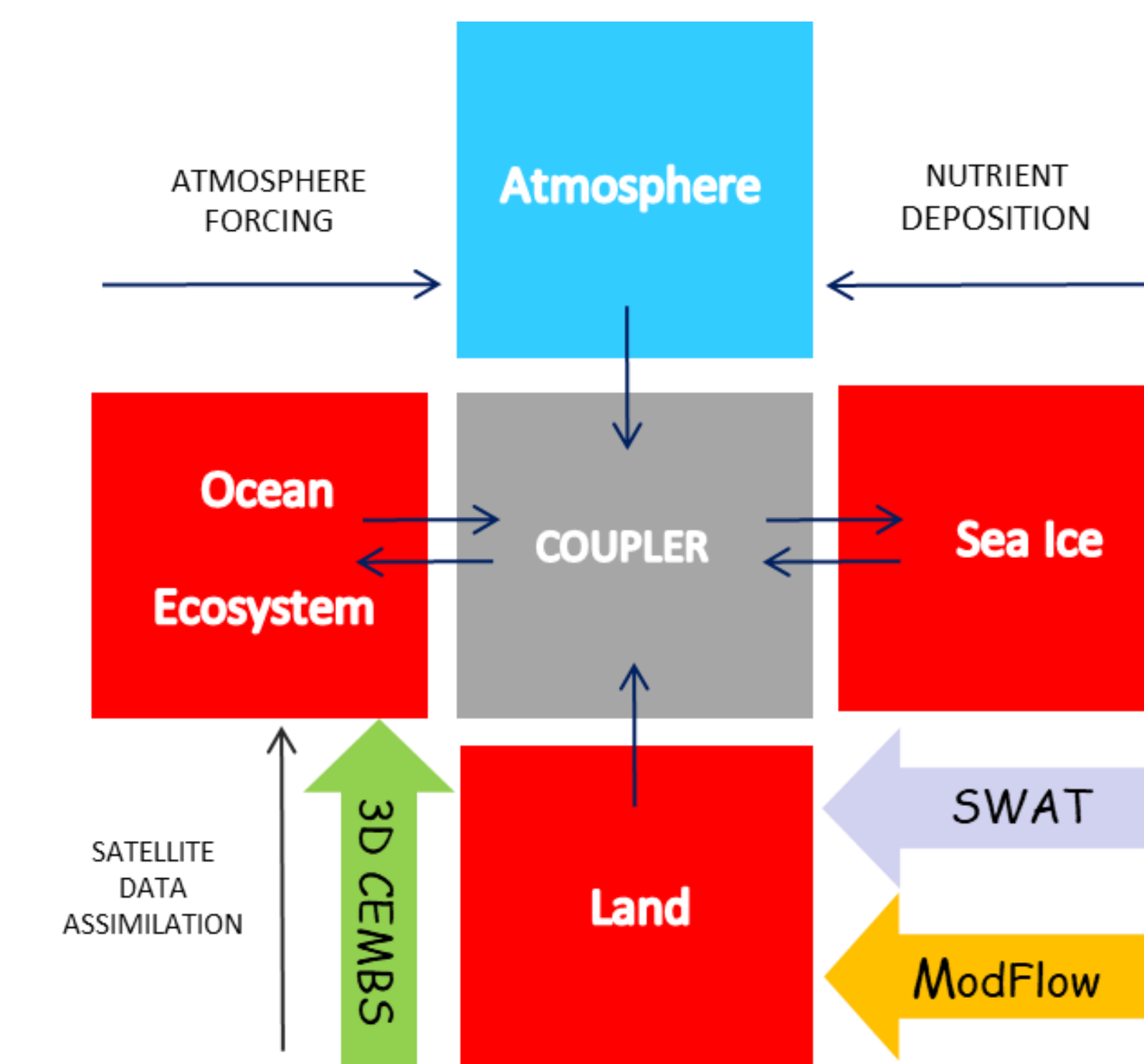
3D EcoPuckBay model

EcoPuckBay model consists of active ocean, ecosystem and ice modules, coupled together with active land module (SWAT model - Soil and Water Assessment Tool plus ModFlow - code for simulating groundwater flow.) which provide data, such as freshwater inflow and nutrient discharge from rivers and ground, and passive atmospheric module which provide data such as weather forecasts from external sources (UM ICM). From the side of the open sea, boundary conditions will be fed from the three-dimensional model of the ecosystem for the Baltic Sea 3D CEMBS (www.cembs.pl). The model horizontal resolution is 1/960°, which corresponds to ca. 115 m grid. Vertically model is divided into 23 layers. The first of 5 layers is 0.4 meters thick. (www.waterpuck.pl)

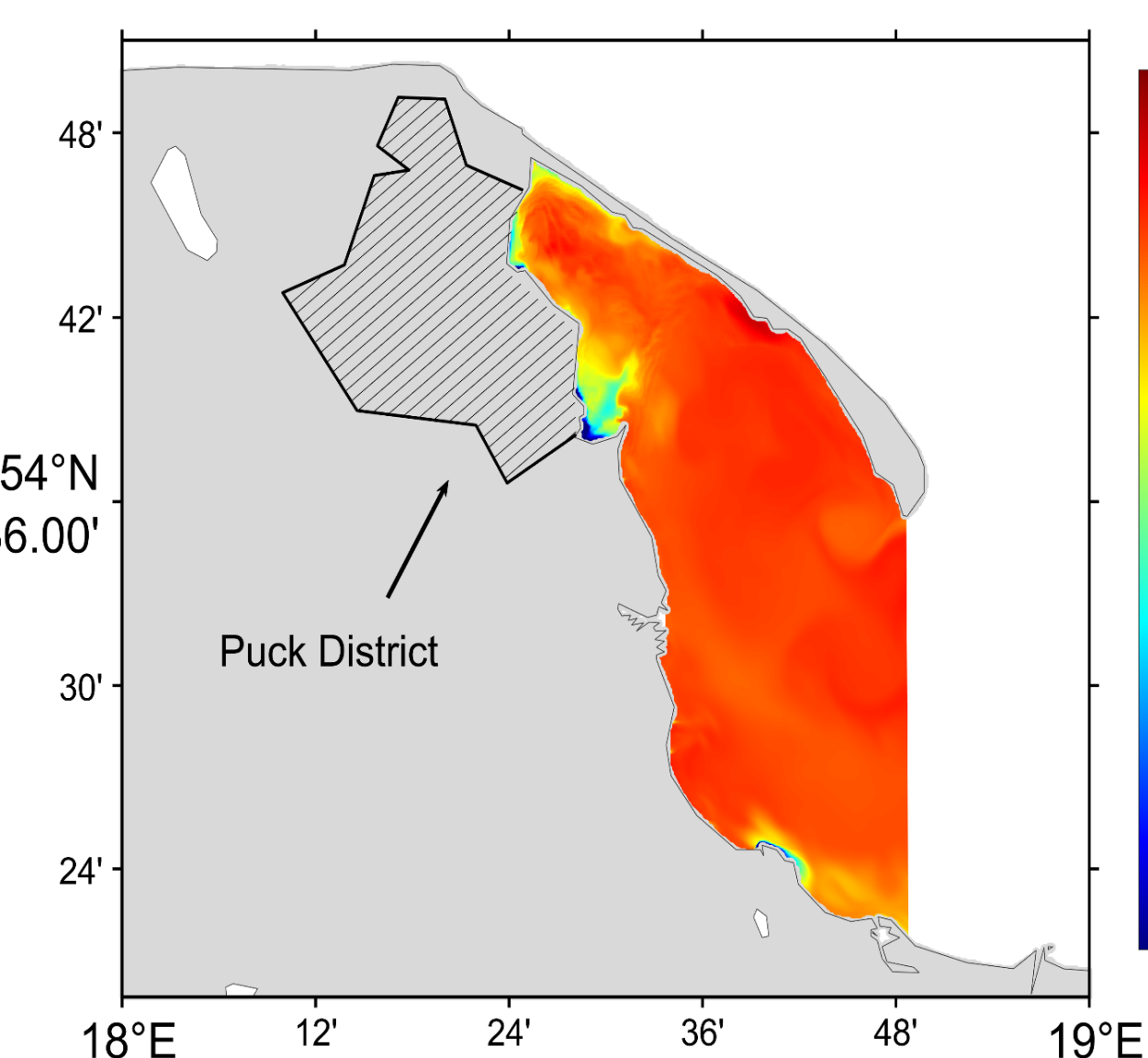
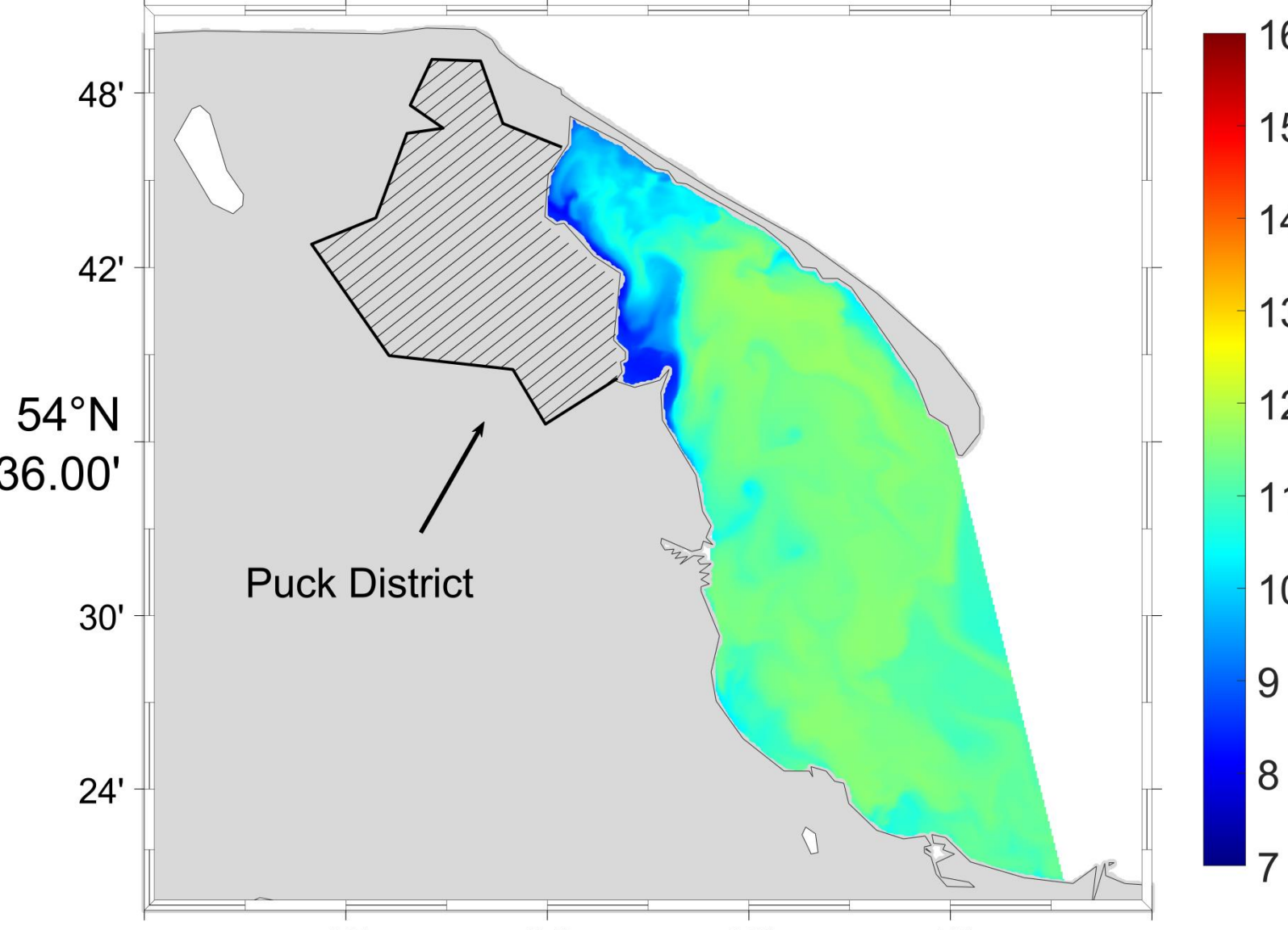
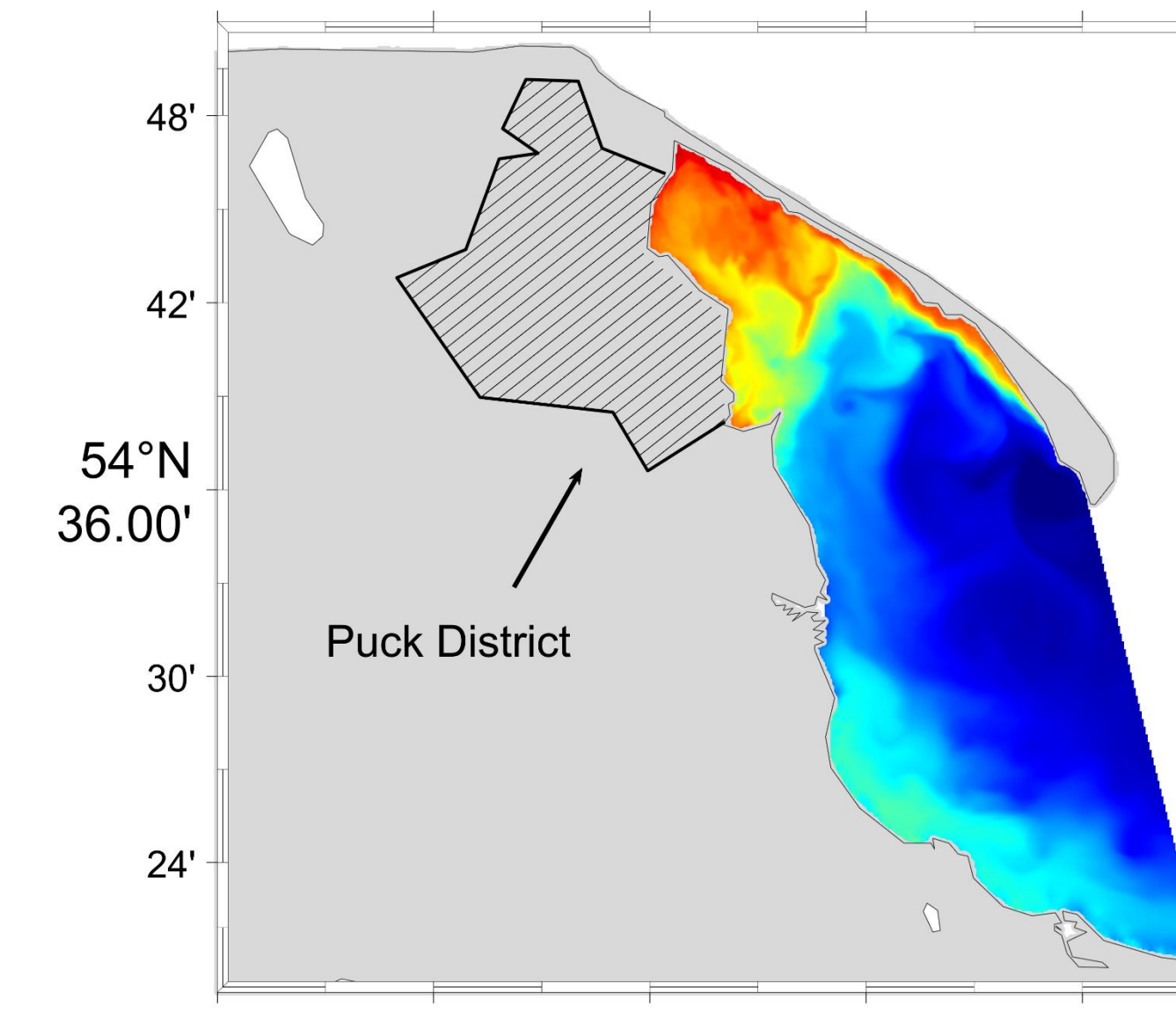
Examples of results

Pearson correlation coefficients between model results and *in situ* measured temperature.

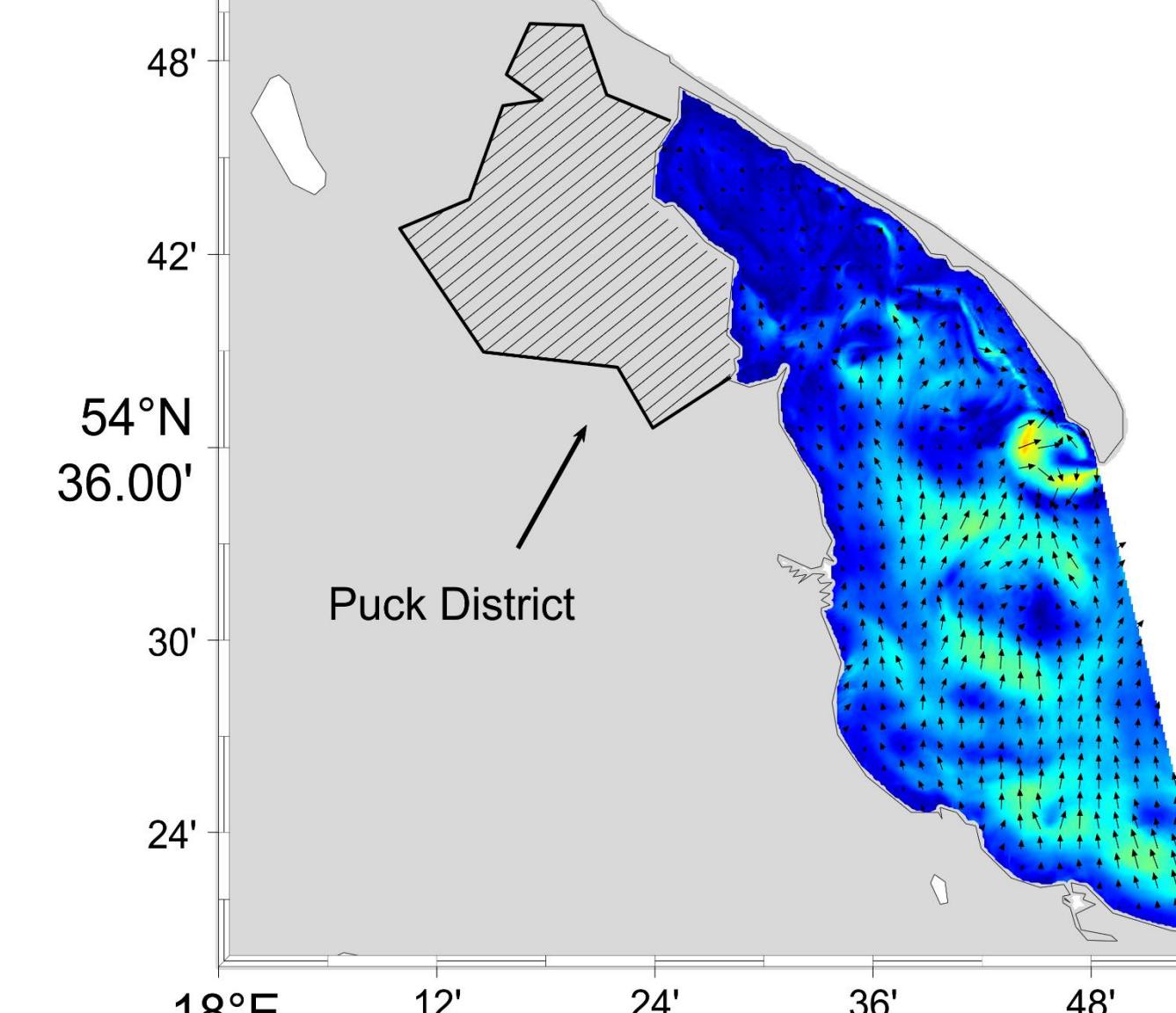
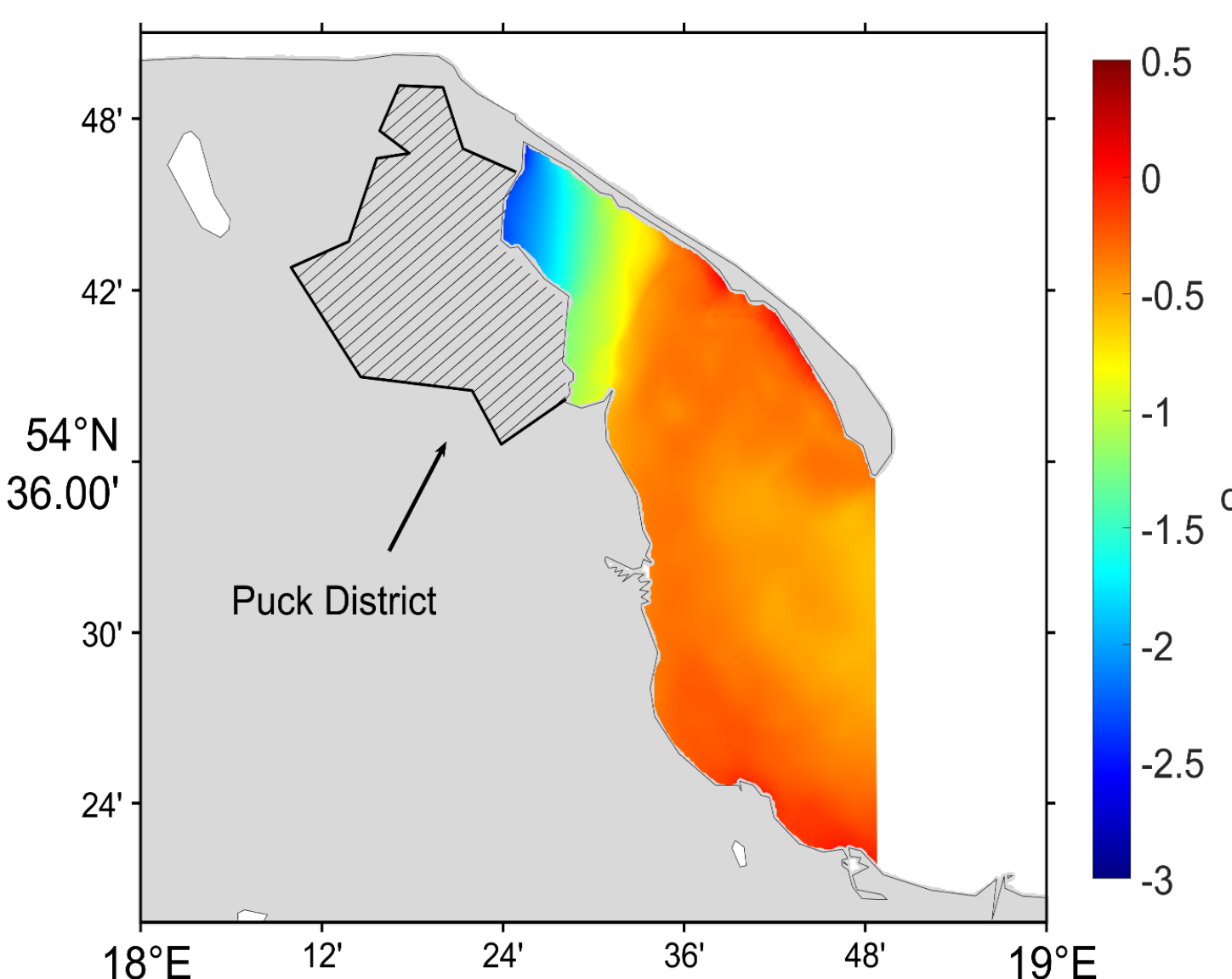
	T7	T10	T11	T12	T14	OM1	T16	T6a	ZG
surface layer	0.989	0.992	0.988	0.960	0.984	0.966	0.990	0.990	0.938
bottom layer	-	-	0.959	0.803	0.957	0.683	0.991	-	0.801



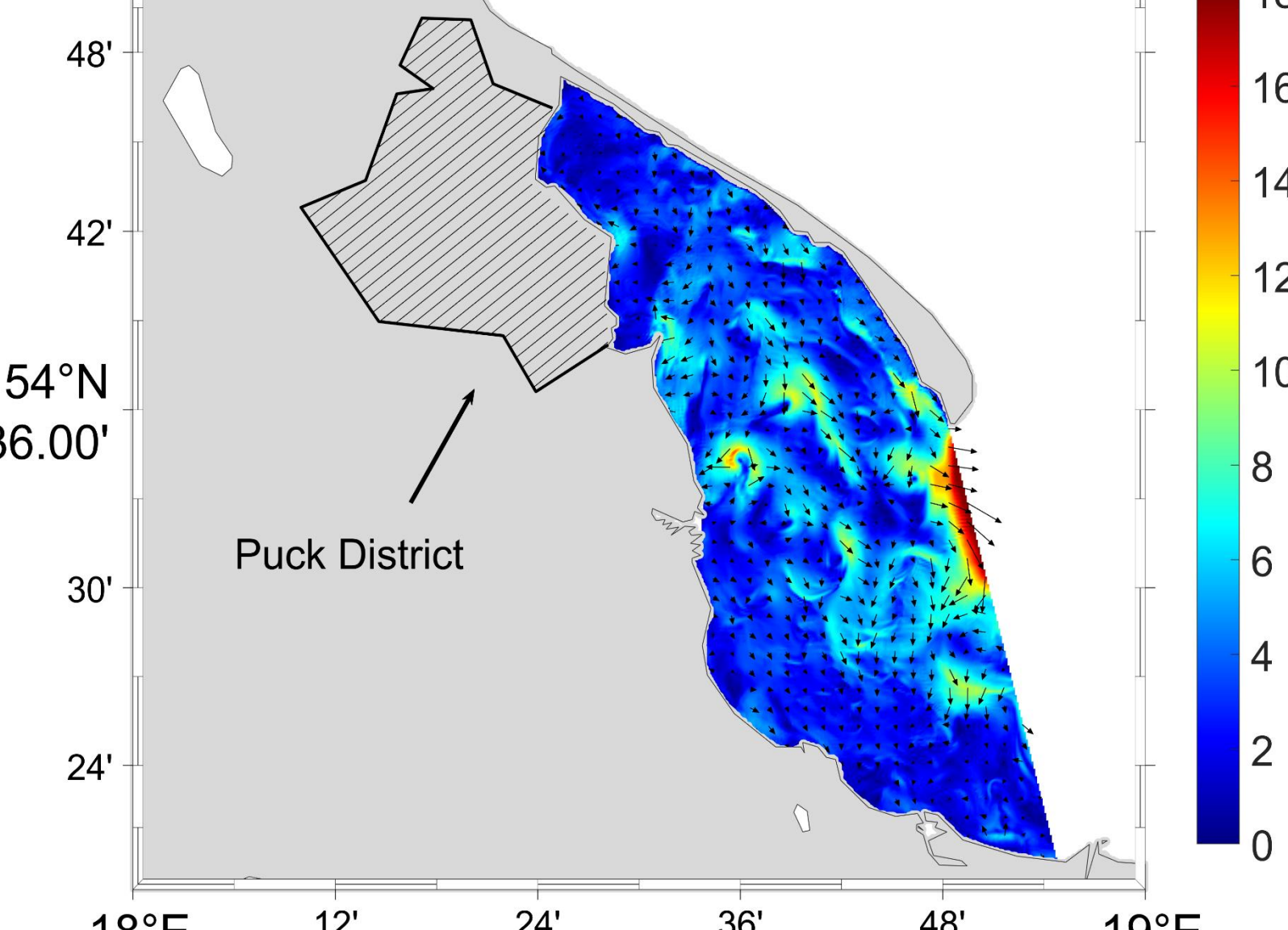
Model domain with bathymetry and locations of measurement stations



Salinity and sea height distribution in the surface layer in Bay of Puck in May, 2015 (3D EcoPuckBay).



Temperature and currents distribution in the surface layer in Bay of Puck in May and October, 2015 (3D EcoPuckBay).



www.waterpuck.pl

Project Leader – (dzierzb@iopan.pl)
prof. Lidia Dzierzbicka-Glowacka

This work was supported by the National Centre for Research and Development within the BIOSTRATEG III program No. BIOSTRATEG3/343927/3/NCBR/2017.