Delft3D – Water Quality Model

preliminary scenario results

M. Zalewski, Z. Witek & M. Wielgat
Sea Fisheries Institute, Gdynia, POLAND

Scenarios used to Delft3D – Water Quality Model calculations

Scenario_s0:

- conditions from year 2000 without any changes

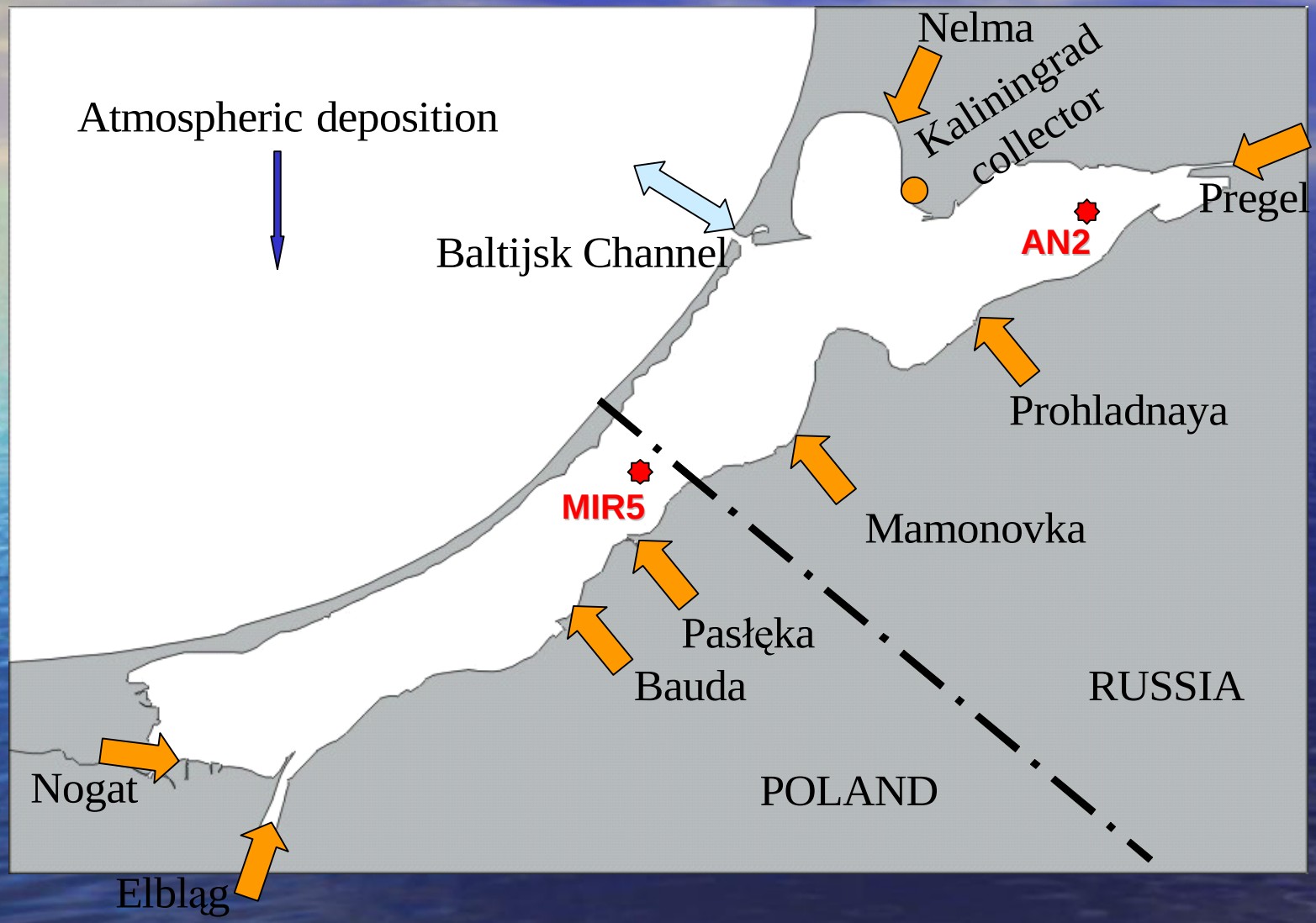
Scenario_s2:

- immediate increase of nitrogen loads by 24%
- immediate reduction of phosphorus loads by 24%

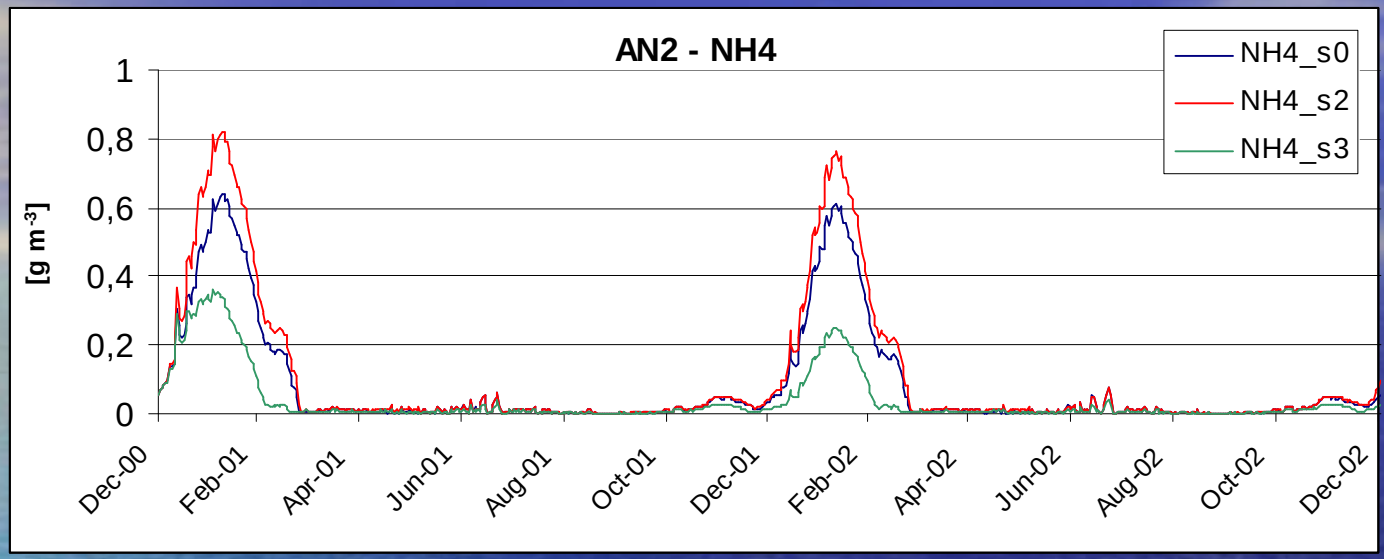
Scenario_s3:

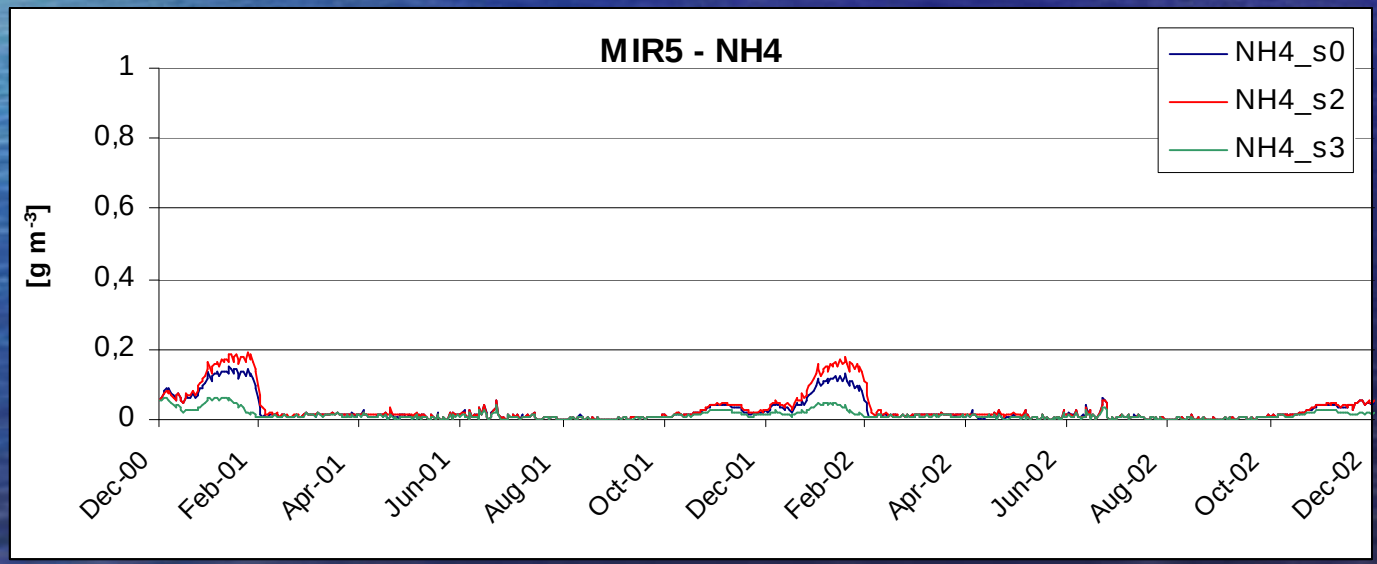
- immediate reduction of nitrogen loads by 57.25%
- immediate reduction of phosphorus loads by 67.75%

Localization of stations AN2 and MIR5

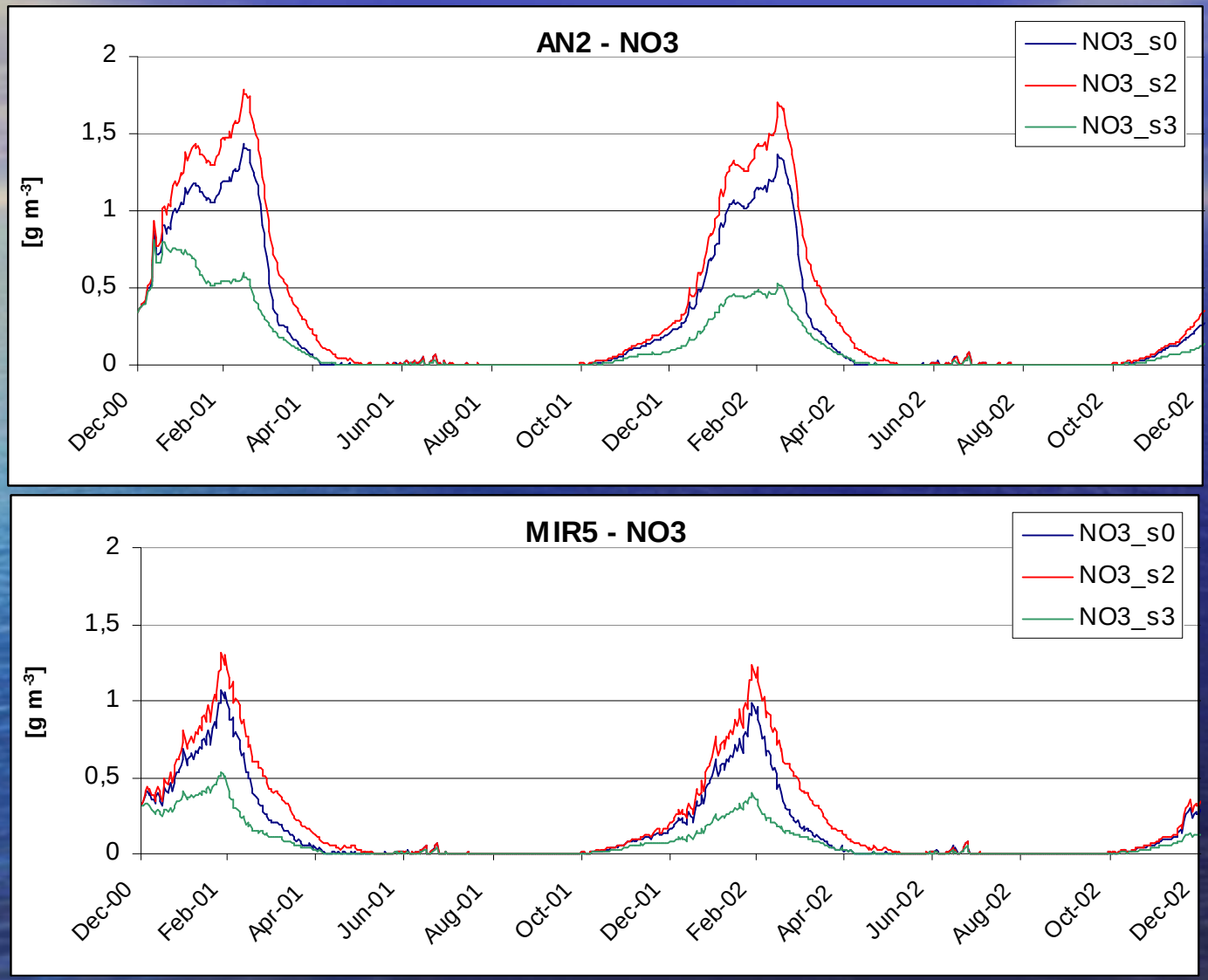


Model – predicted NH4 concentrations in first two years after nutrient loads modification



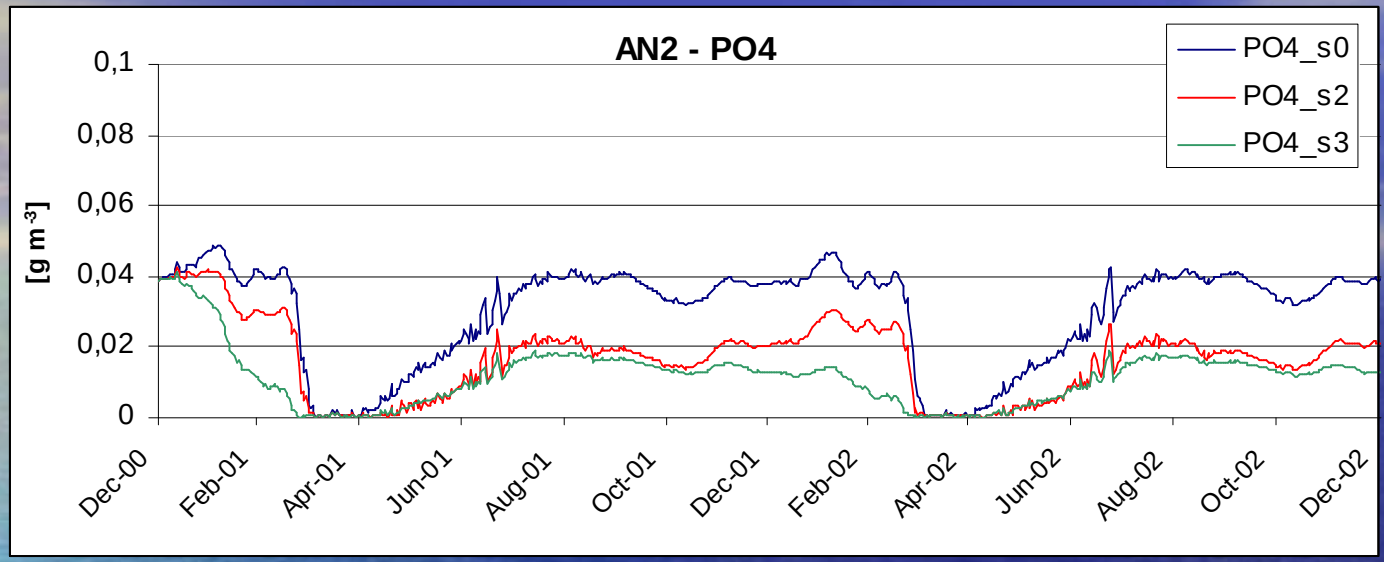


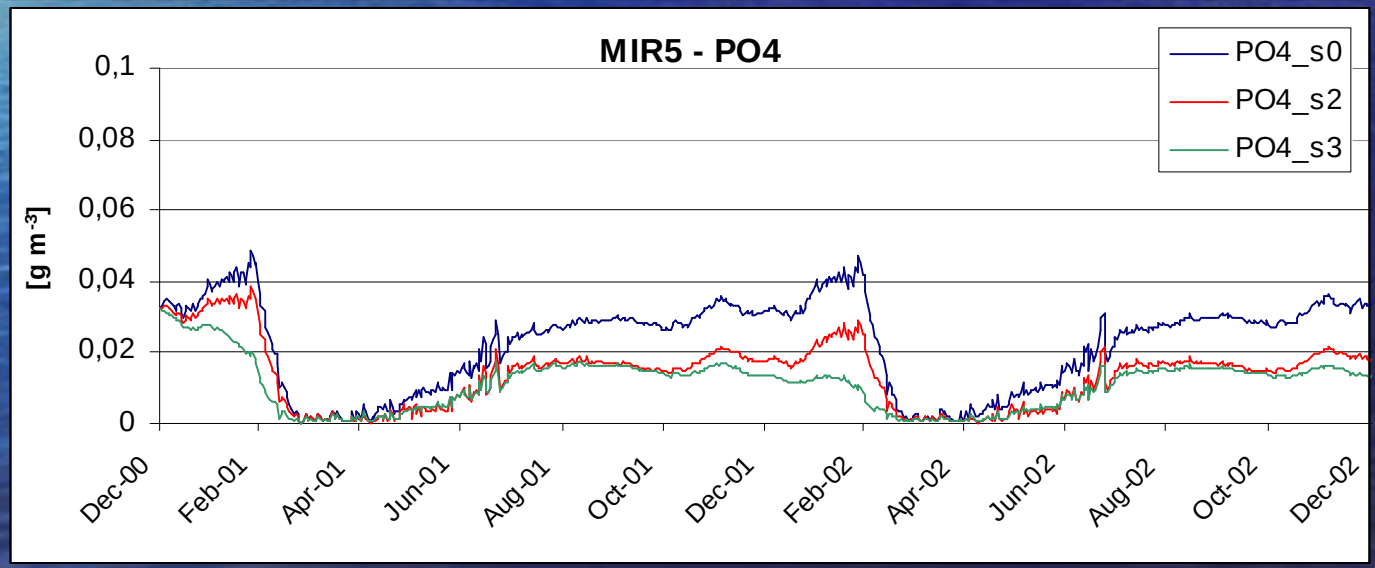
Model – predicted NO3 concentrations in first two years after nutrient loads modification



MANTRA - East - Vistula Lagoon
December 2003

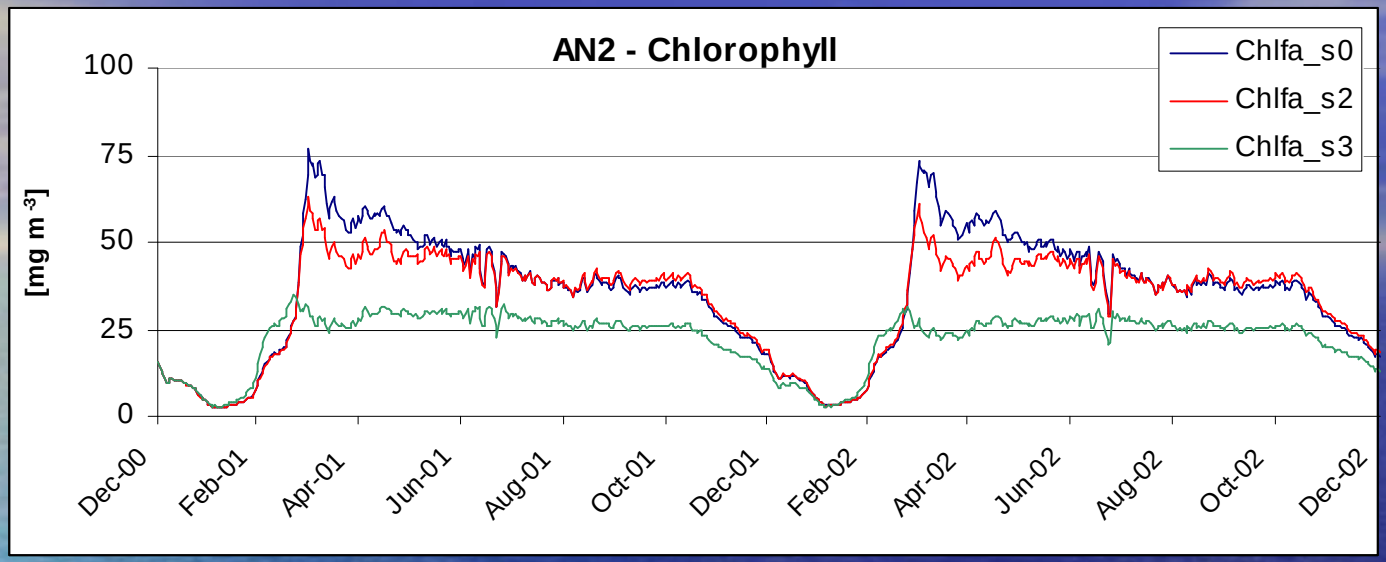
Model – predicted PO4 concentrations in first two years after nutrient loads modification

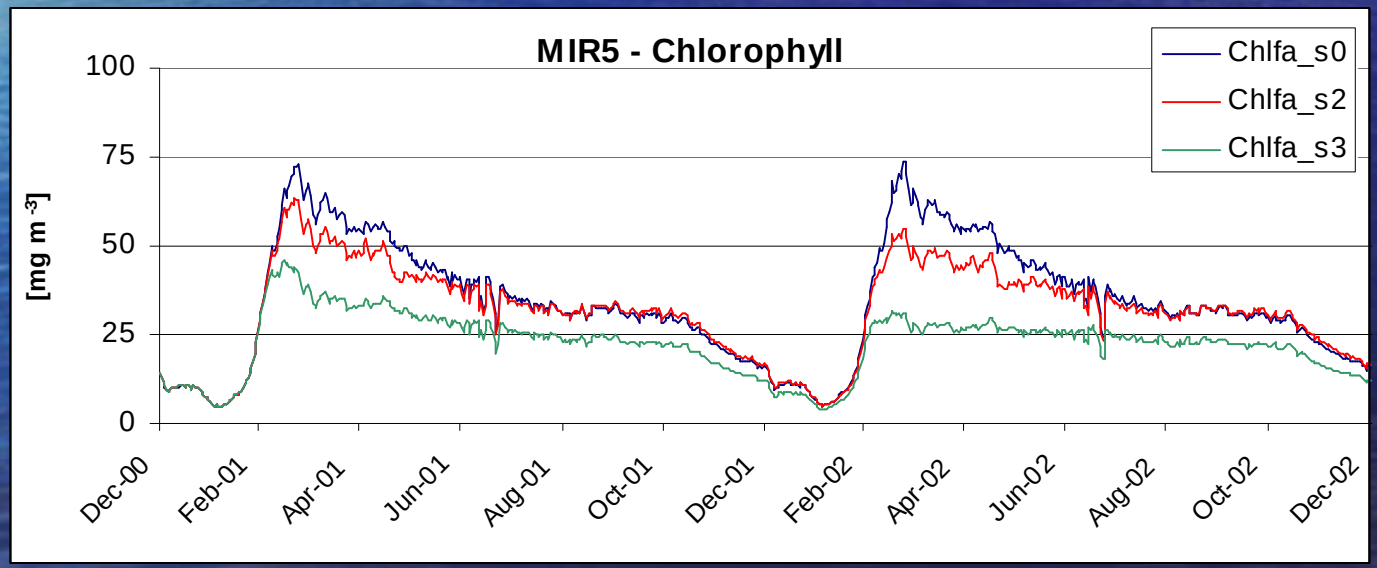




MANTRA - East - Vistula Lagoon
December 2003

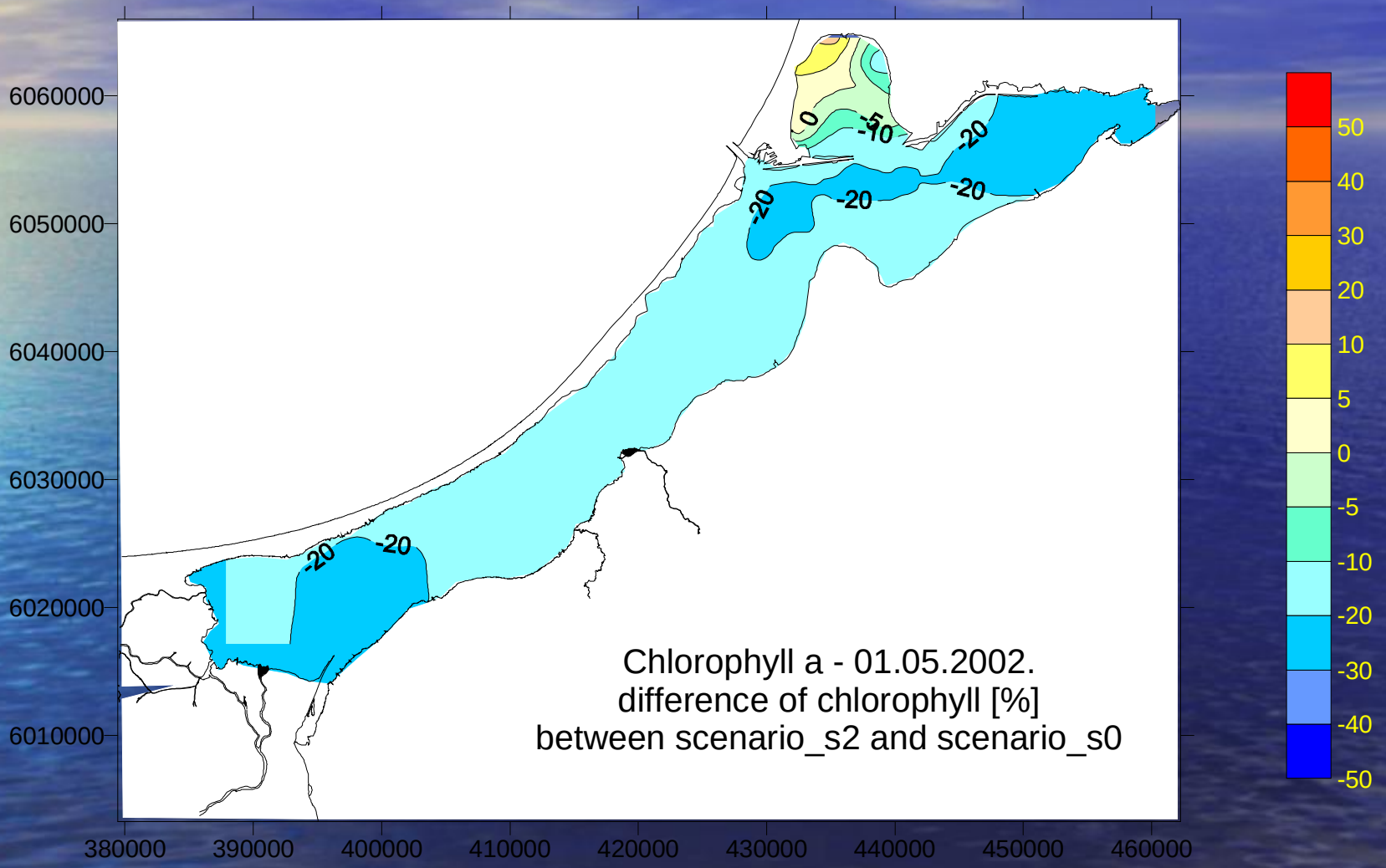
Model – predicted chlorophyll concentrations in first two years after nutrient loads modification





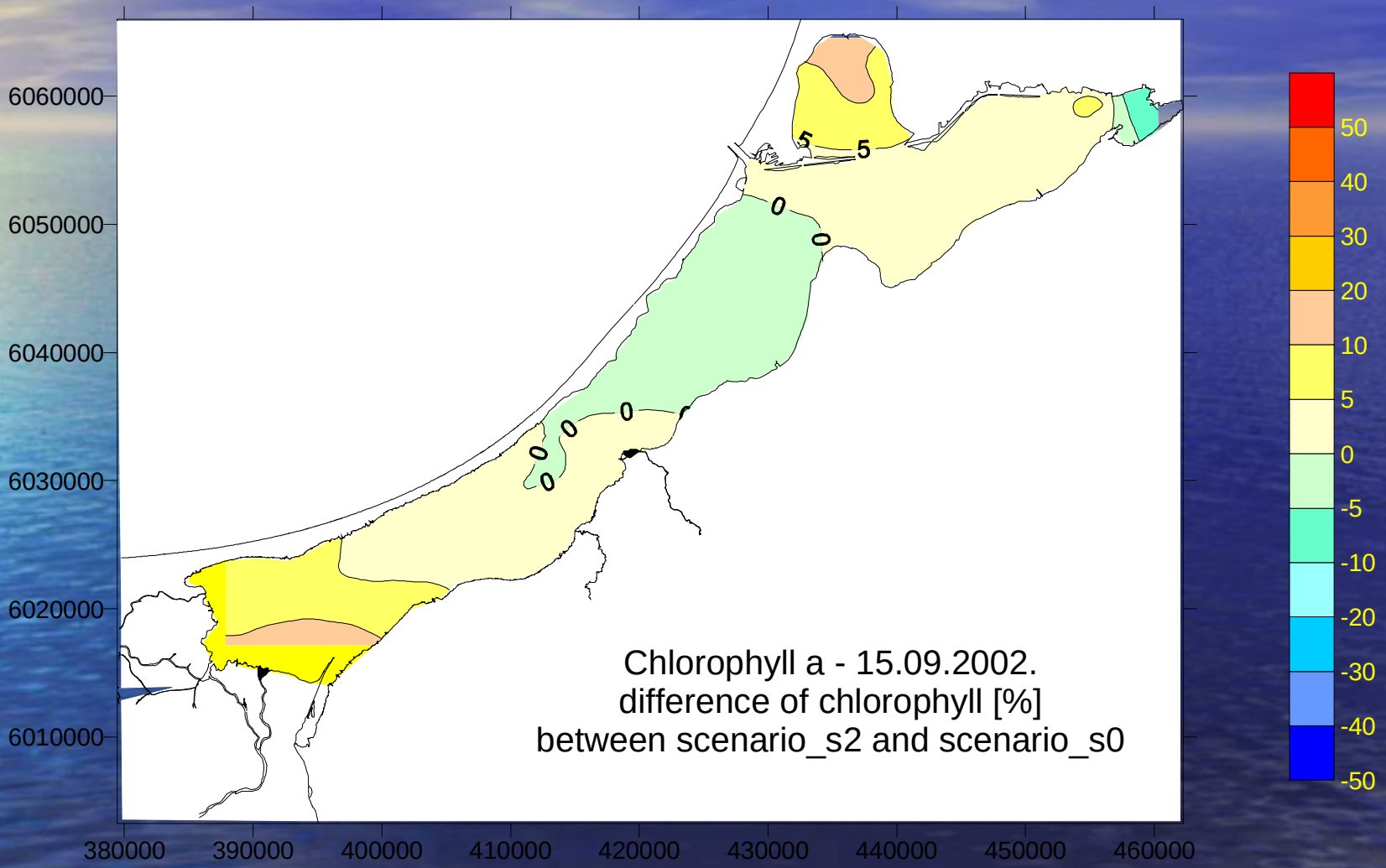
MANTRA - East - Vistula Lagoon
December 2003

Predicted changes in chlorophyll concentrations in spring.
Percent difference between scenario_s2 and scenario_s0



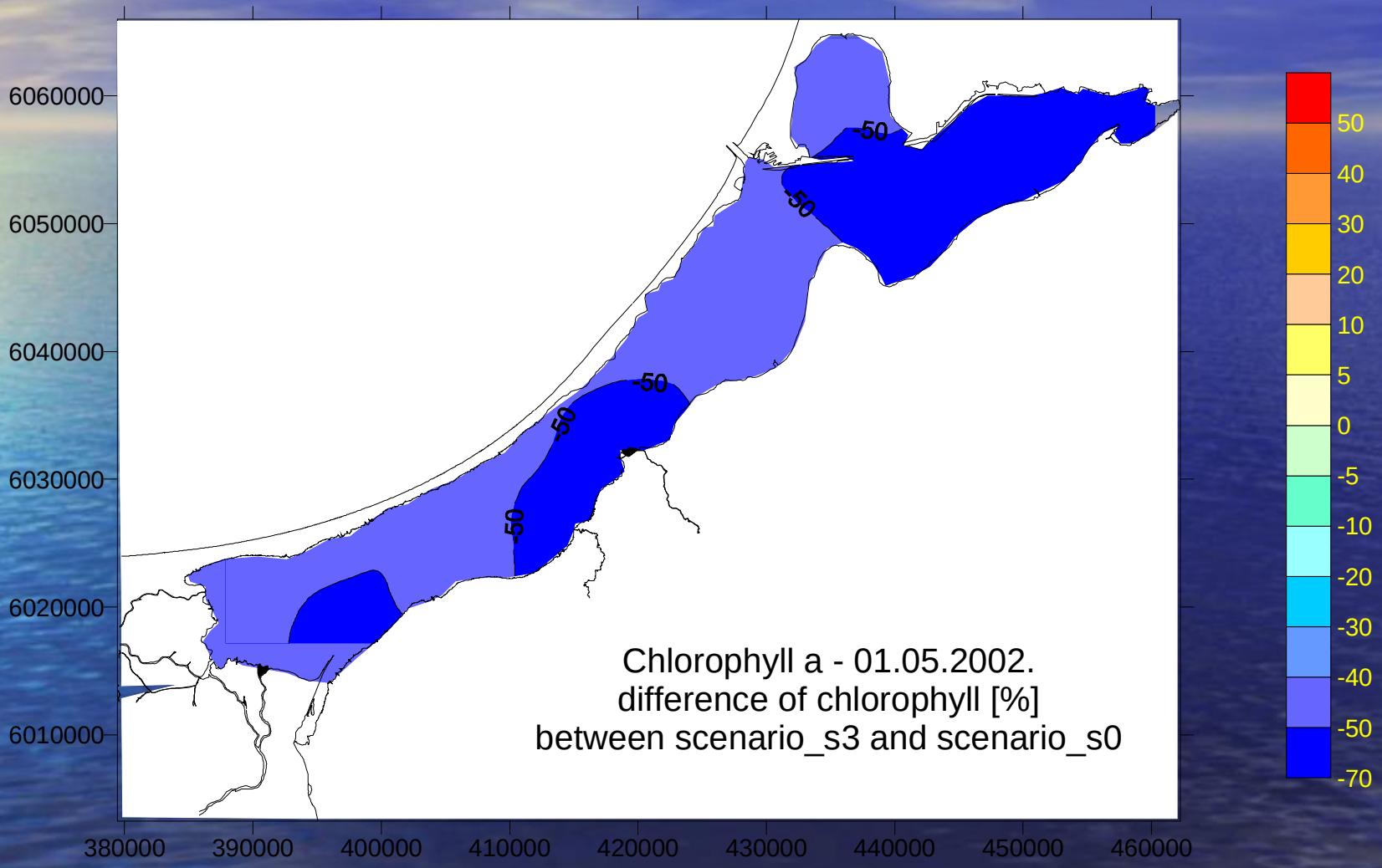
MANTRA - East - Vistula Lagoon
December 2003

Predicted changes in chlorophyll concentrations in late summer.
Percent difference between scenario_s2 and scenario_s0



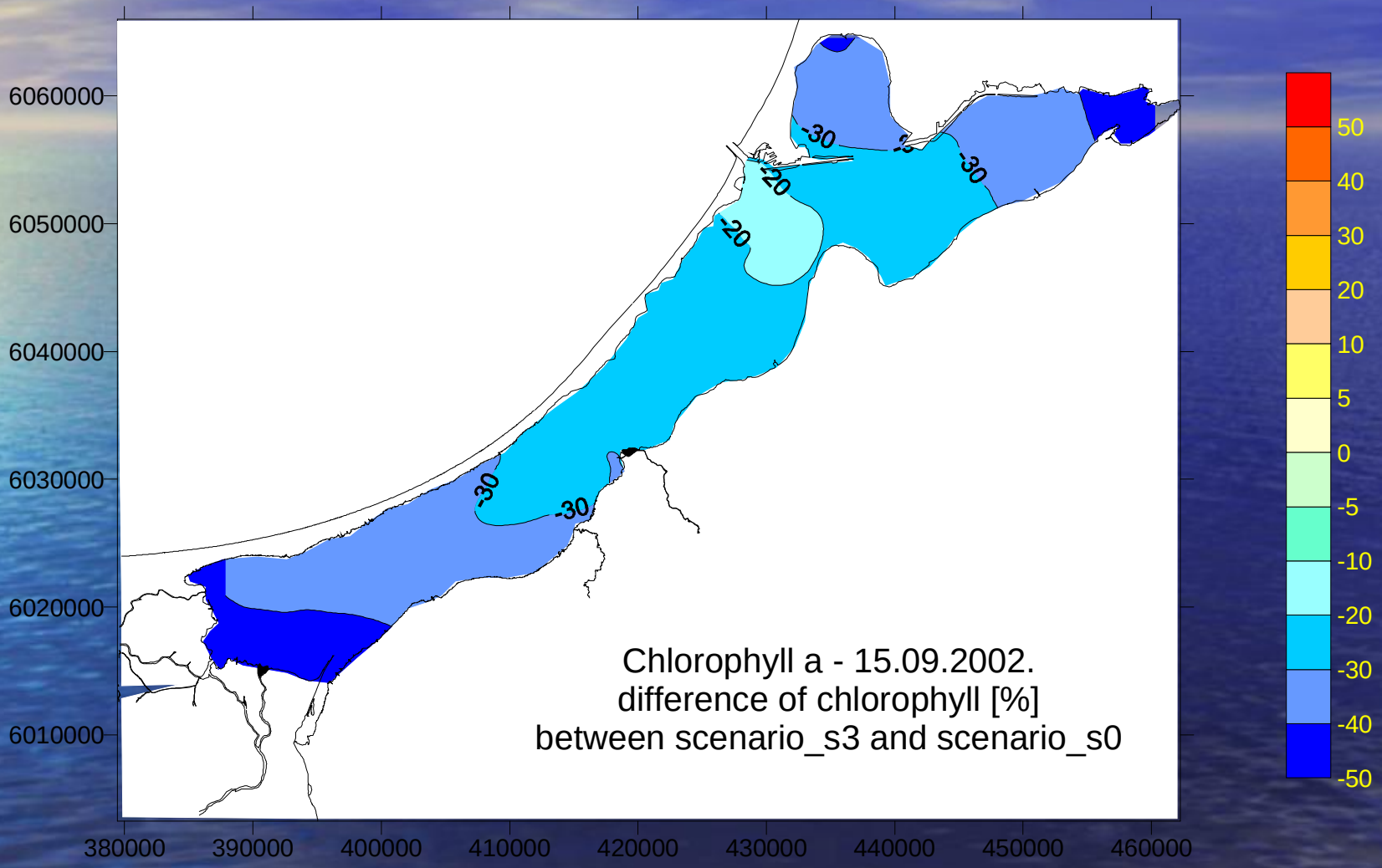
MANTRA - East - Vistula Lagoon
December 2003

Predicted changes in chlorophyll concentrations in spring.
Percent difference between scenario_s3 and scenario_s0



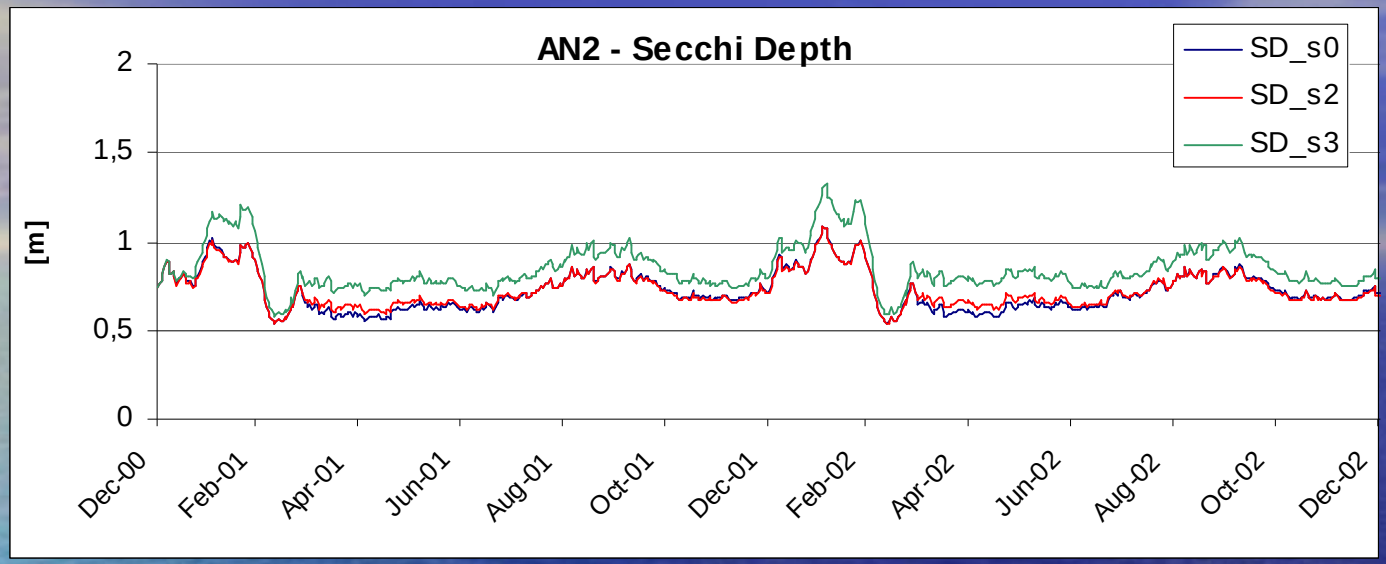
MANTRA - East - Vistula Lagoon
December 2003

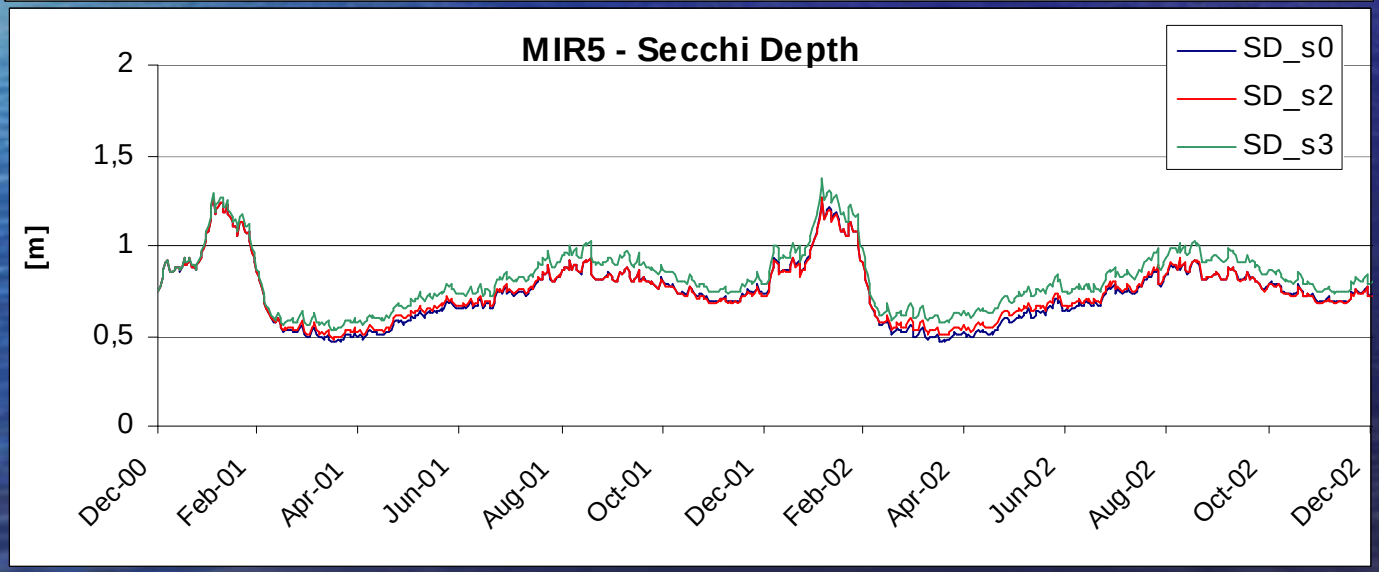
Predicted changes in chlorophyll concentrations in late summer.
Percent difference between scenario_s3 and scenario_s0



MANTRA - East - Vistula Lagoon
December 2003

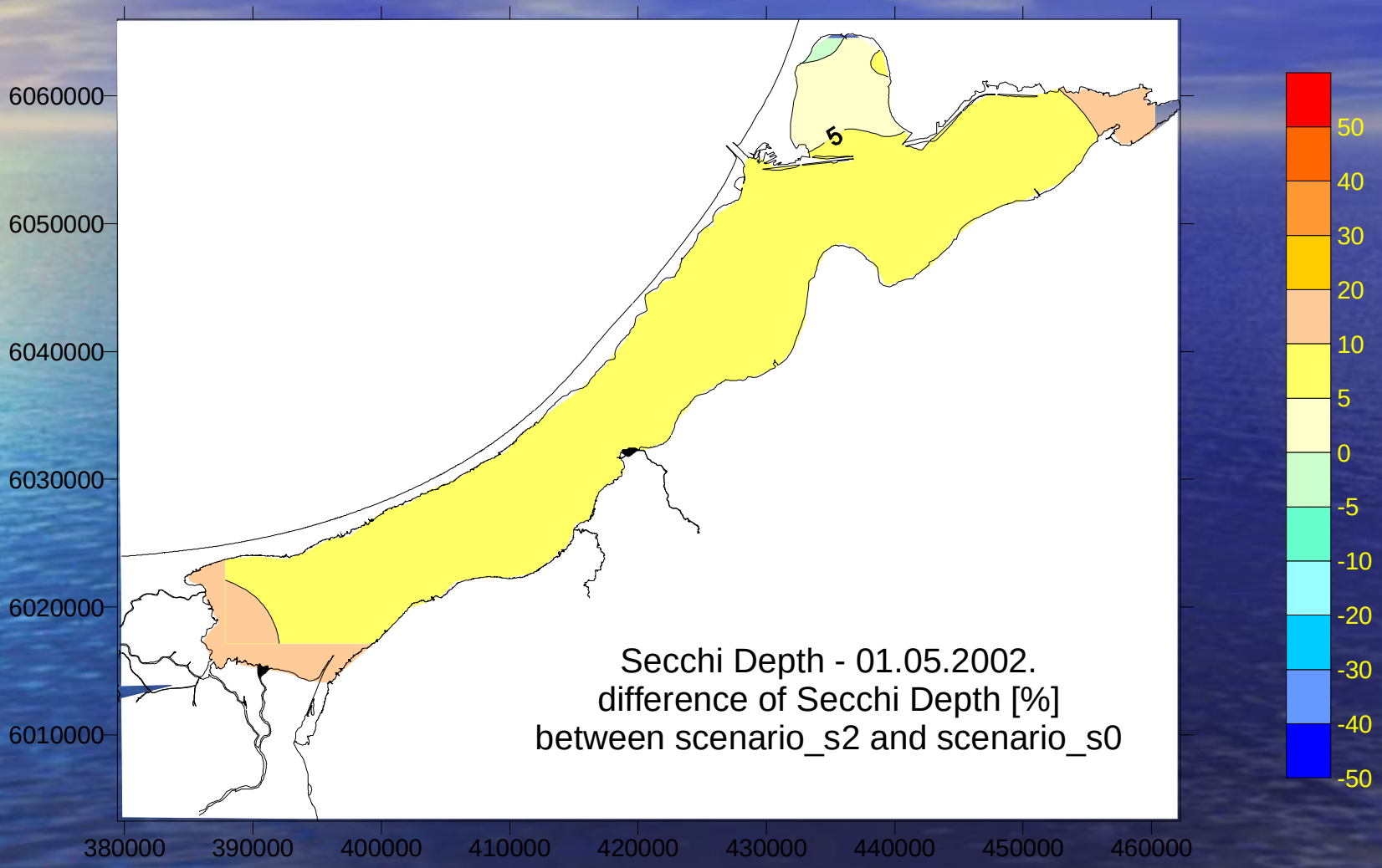
Model – predicted Secchi Depth in first two years after nutrient loads modification





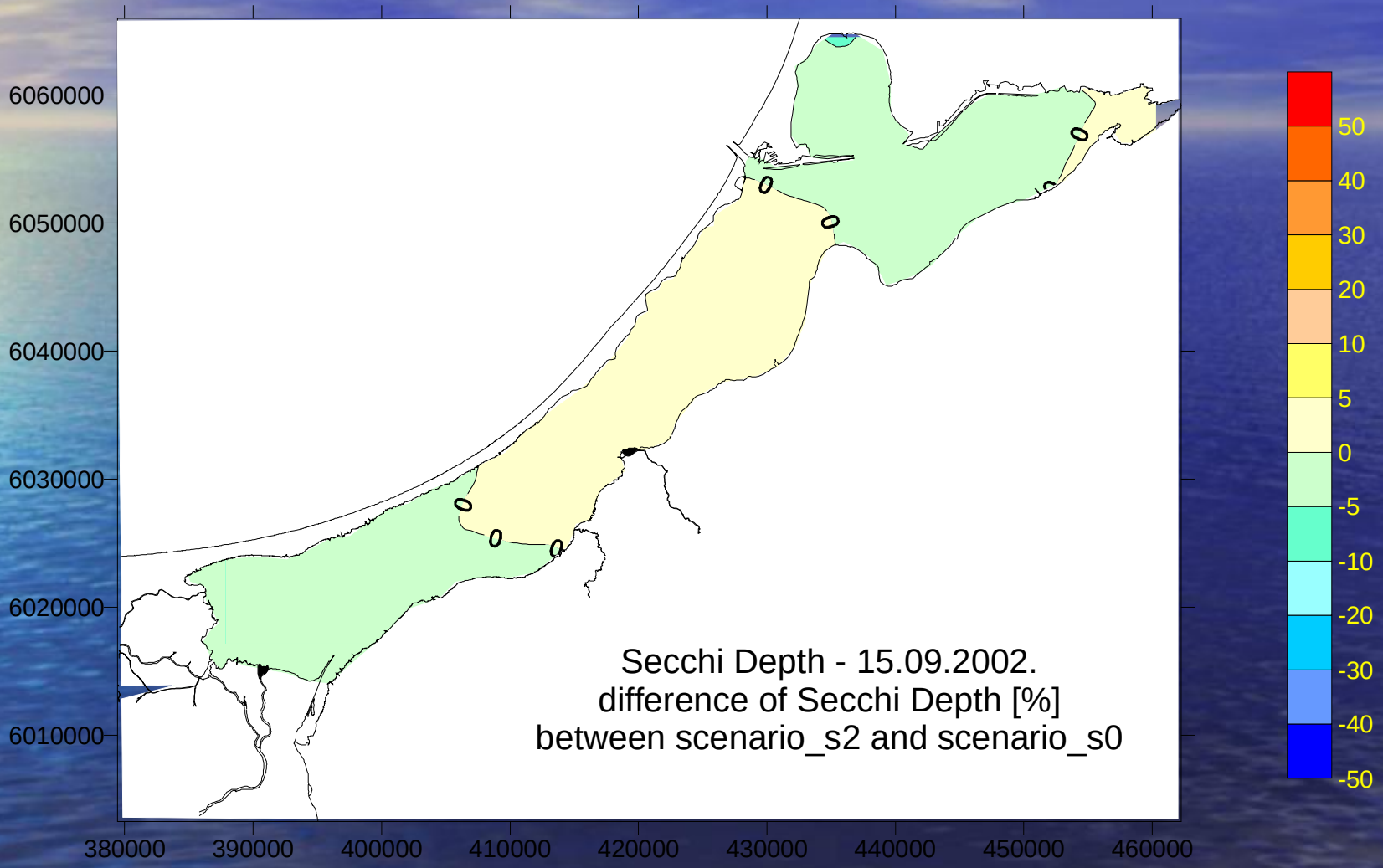
MANTRA - East - Vistula Lagoon
December 2003

Predicted changes in Secchi Depth in spring.
Percent difference between scenario_s2 and scenario_s0



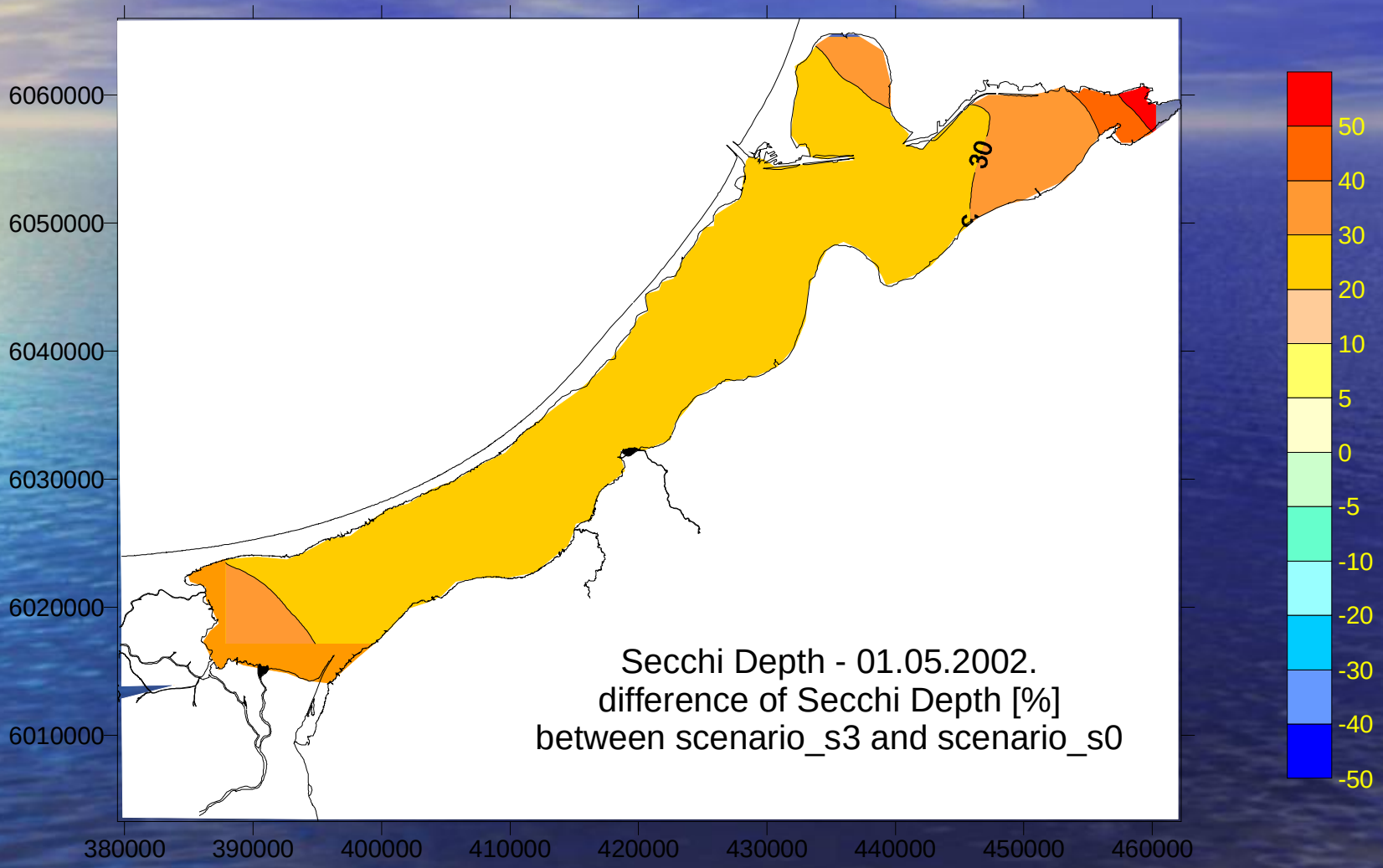
MANTRA - East - Vistula Lagoon
December 2003

Predicted changes in Secchi Depth in late summer.
Percent difference between scenario_s2 and scenario_s0



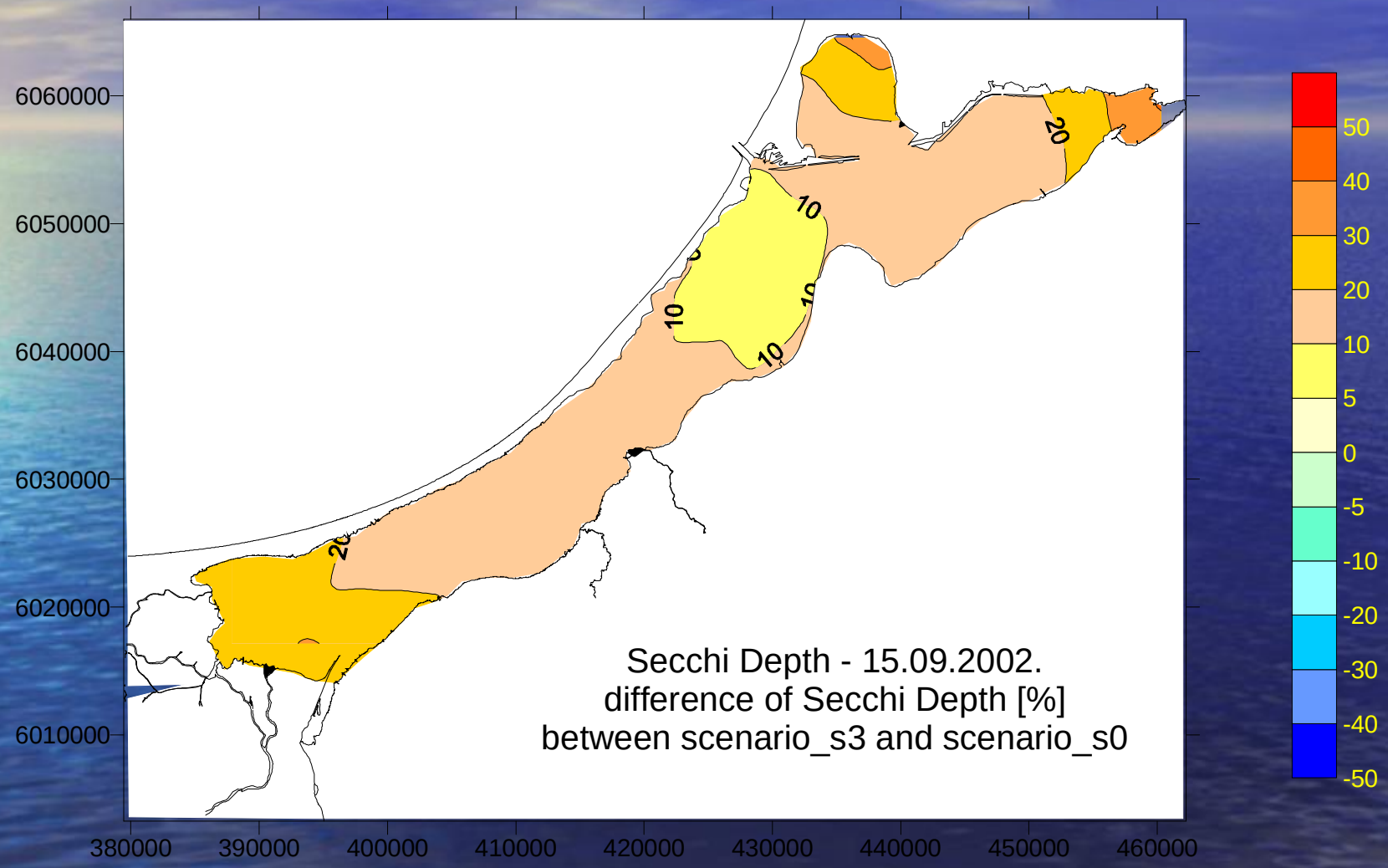
MANTRA - East - Vistula Lagoon
December 2003

Predicted changes in Secchi Depth in spring.
Percent difference between scenario_s3 and scenario_s0



MANTRA - East - Vistula Lagoon
December 2003

Predicted changes in Secchi Depth in late summer.
Percent difference between scenario_s3 and scenario_s0



MANTRA - East - Vistula Lagoon
December 2003

Conclusions

- Due to short freshwater residence time (ca. 7 months) the Vistula Lagoon ecosystem may quickly react to changes in nutrient loads. According to the model, the pelagic system may stabilize at new levels within 2 years. However, at the present state of model development, the reaction of bottom sediments cannot be reliably predicted.
- With scenarios 02 and 03 noticeable changes in nitrogen concentrations in the lagoon may be expected only in cold season. Changes in phosphorus concentrations may be observed over a longer part of the year.
- According to the model, changes of phosphorus loads first of all may influence the spring phytoplankton bloom, while changes of nitrogen loads will affect phytoplankton biomass in summer season.

Conclusions

- Despite the increase of nitrogen loads in scenario 02, the phytoplankton biomass may decrease in spring season, as a result of reduced phosphorus concentrations. In the second half of growth period, when phosphorus ceases to be a limiting factor, phytoplankton biomass may slightly increase.
- With scenario 03 substantial reduction of phytoplankton biomass may be expected over the most part of the year.
- Due to the dominant influence of resuspended matter on the light extinction in the water, only moderate changes in water transparency may be expected as a result of nutrient loads reduction.
- The effects of load reductions will be most pronounced in the river mouth areas.