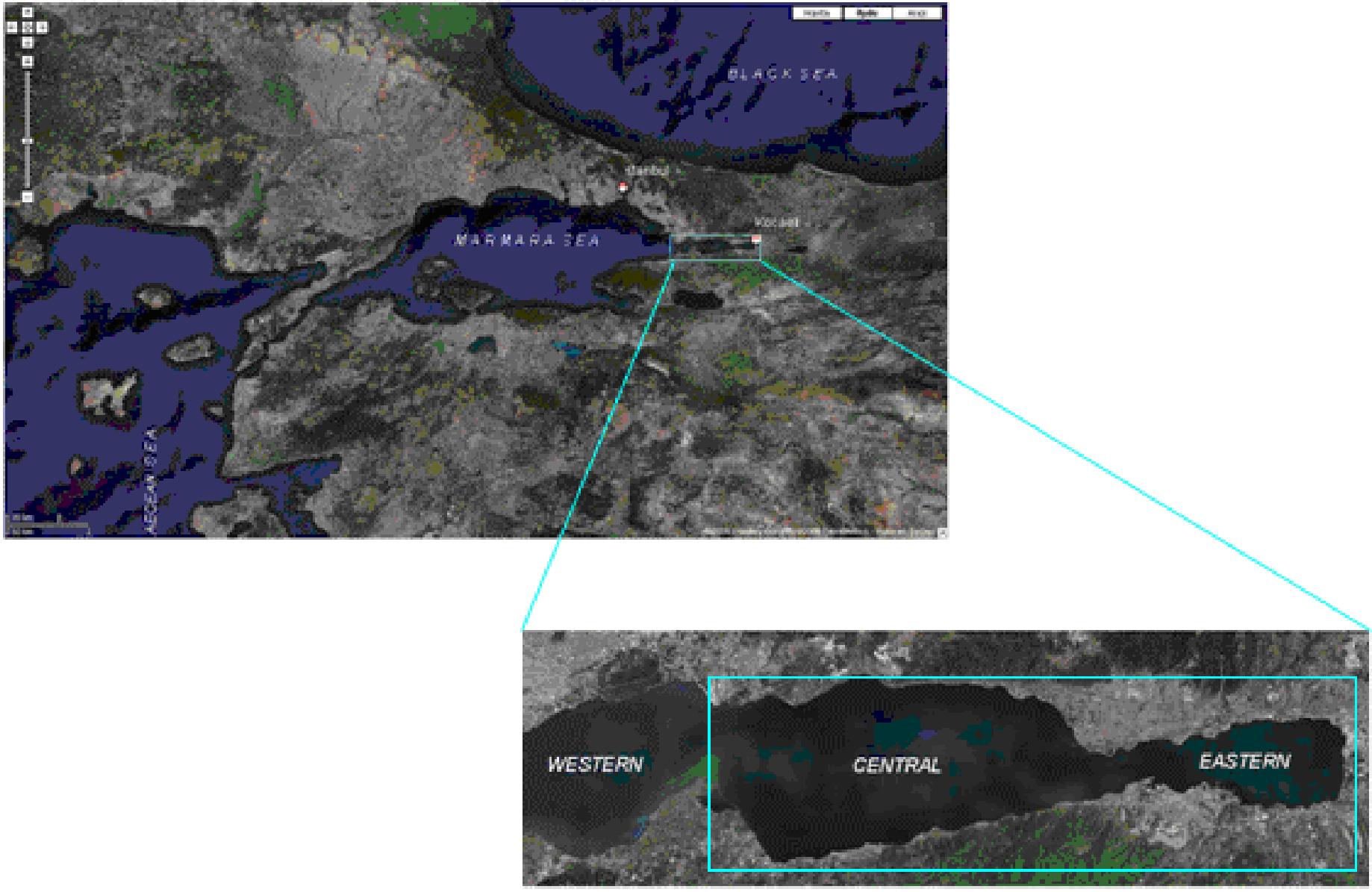
SSA 17- İzmit Bay

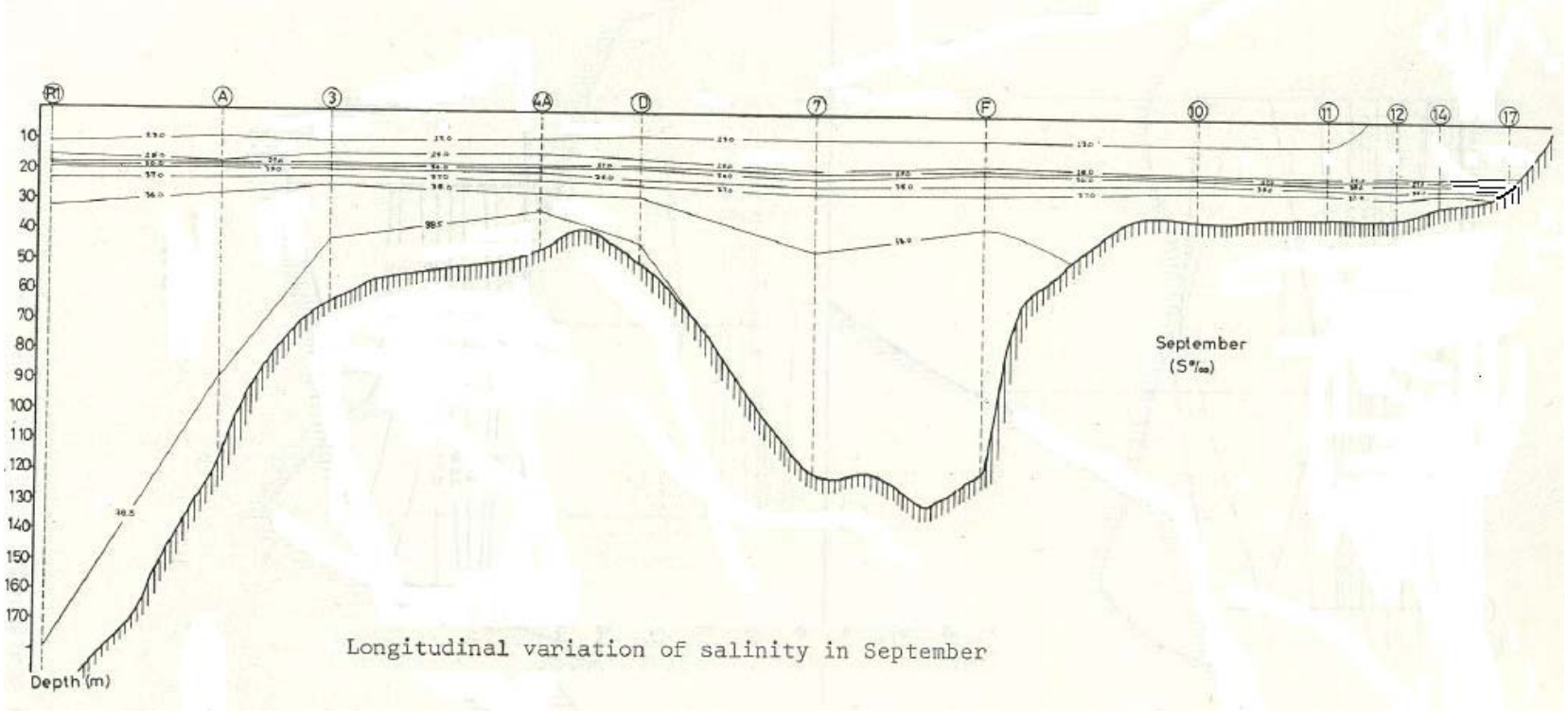
SPICOSA
Cluster Meeting

20nd October 2009

TUBITAK, MRC,
Environment Institute,



Location of of the Izmit Bay



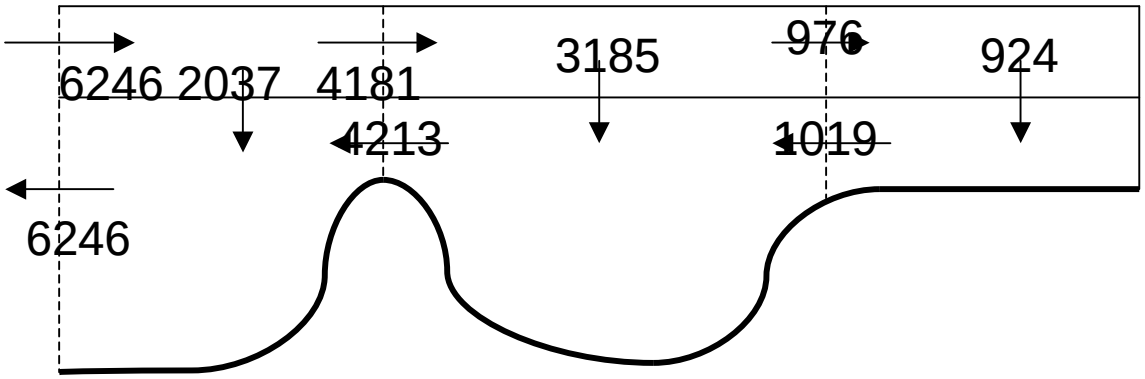
Longitudinal variation of salinity in September

***two- layer water stratification and flow system**
***lower water layer (Mediterranean origin (35-38 %o))**
***upper layer (Black Sea origin (22-28 %o)) 10-15m depth**
*** Oxygen is very limmited in bottom waters and almost zero in the eastern part**

Circulation

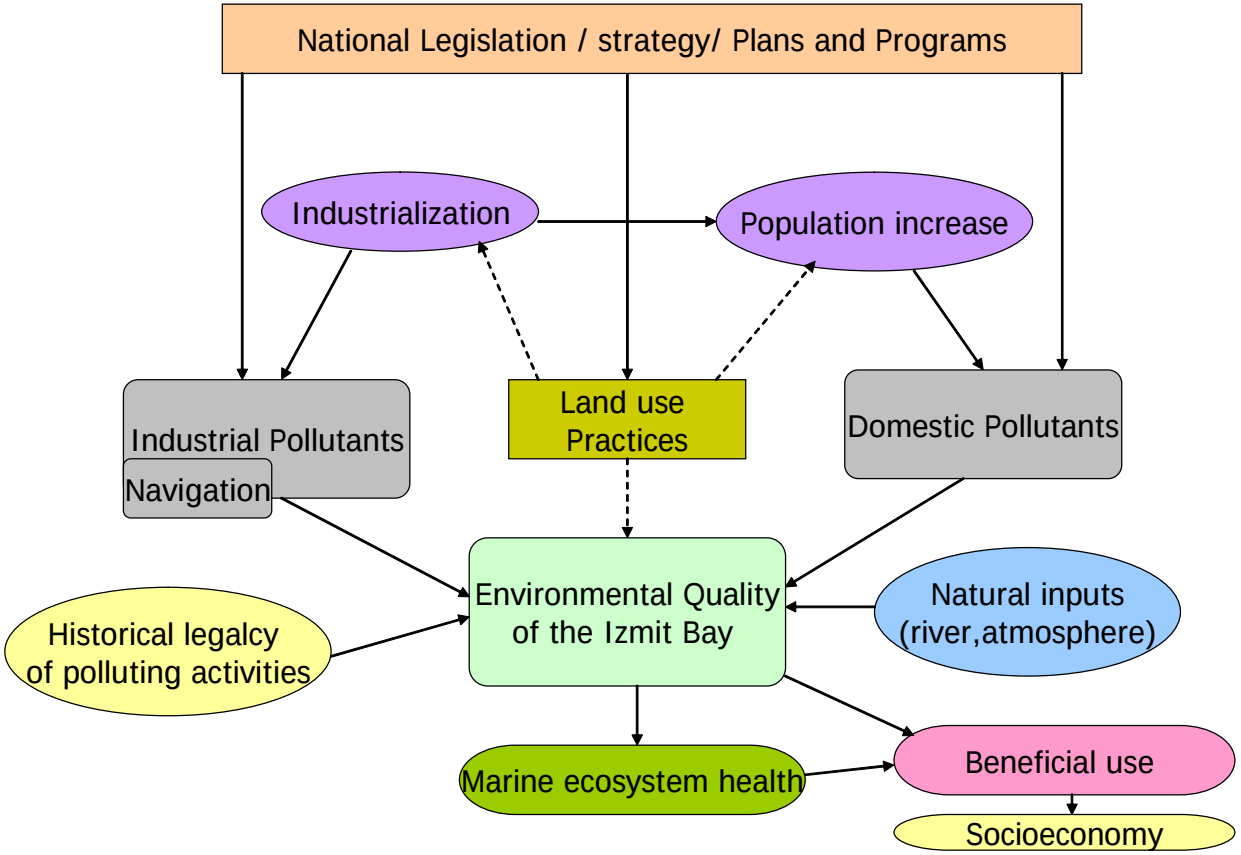
Due to the strong water stratification and two layered flow system in the Bay only upper layer will be considered in the conceptual system.

exchange rate of the surface waters of the Bay with adjacent waters of the Marmara 2000-4000 m3/sec

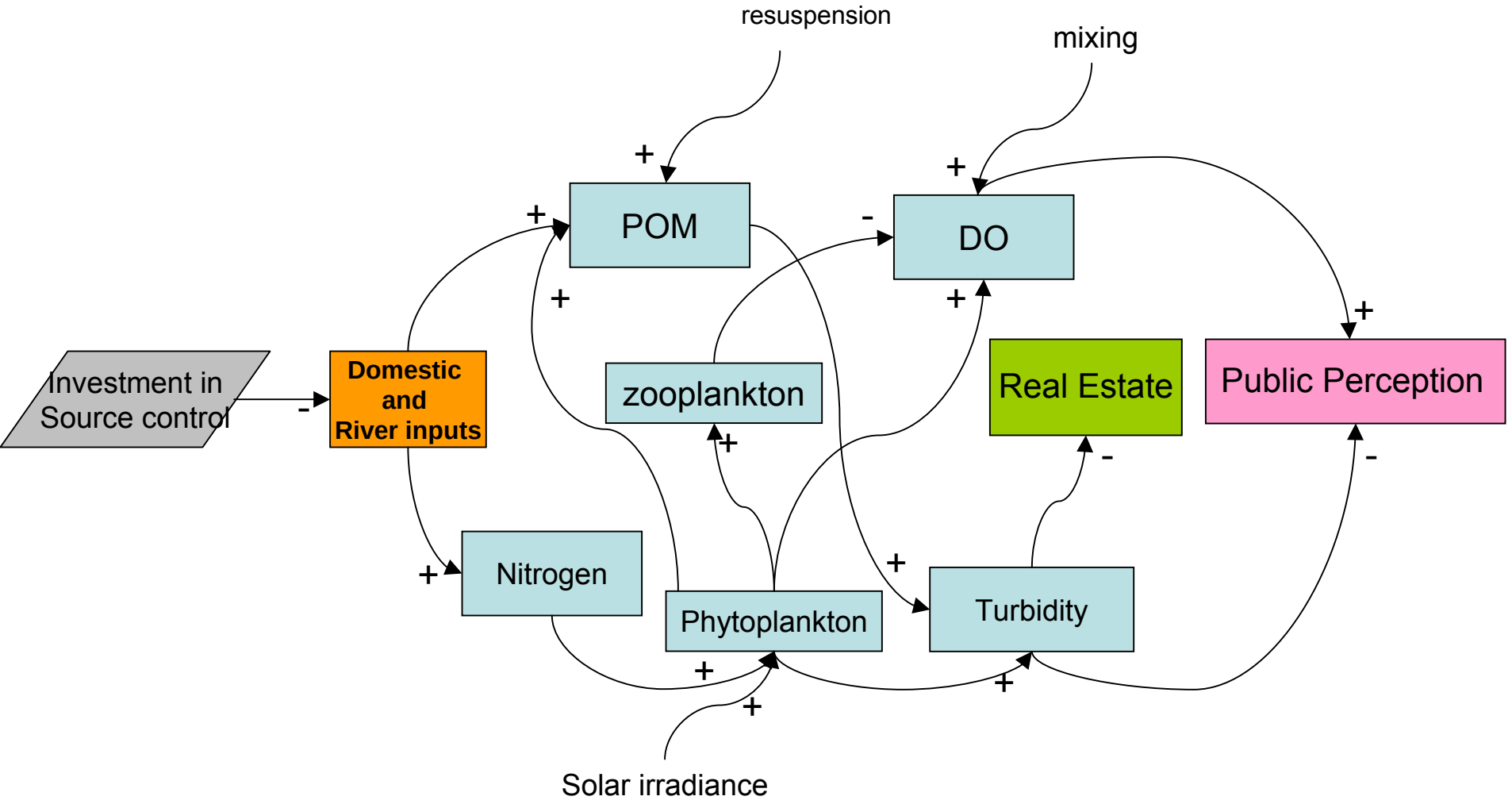


Computed flow rates for summer circulation (ref. Oguz and Sur 1985)

Policy issue: improvement of Izmit Bay water Quality



The main drivers and related pressures on the system are :
1-Urbanization → oxygen deficiency in bottom waters; eutrophication
2-Industrialization → toxicity; harmful substance accumulation in biota and sediments
3-Marine transportation → harmful substance accumulation in biota and sediments



Feed back loop of the Izmit Bay subsystem

Model components

- Natural Component
  -Circulation dynamics
  -Freshwater balance
  -Nitrogen proceses
  -Oxygen proceses
  -Phytoplankton
  -POM
  -SDD

Model components

- Economic Component

  -Cost Benefit Analysis

    *Financial

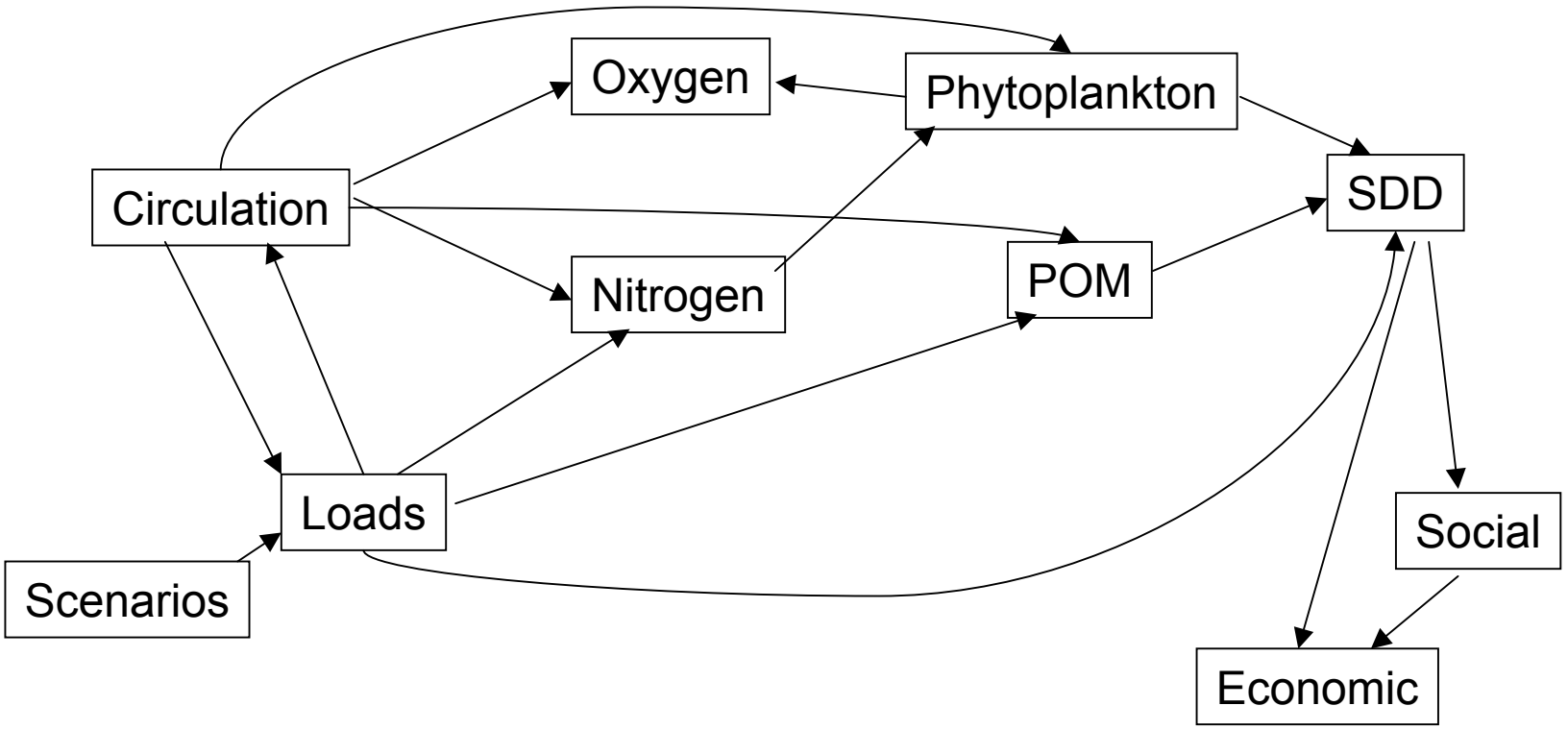
    *Economic

- Social Component

Model components

- LOADS
  -Domestic loads
  -Industrial Loads
  -Runoff Loads

- SCENARIOS
  -Scenario 1
  -Scenario 2



Relationship between model components

Natural Component

•“Conservation of salinity and volume” principal was used for deriving circulation dynamics of the system.

•Water volume exchange of two layered system, advective and diffusive processes were coded in the model blocks.

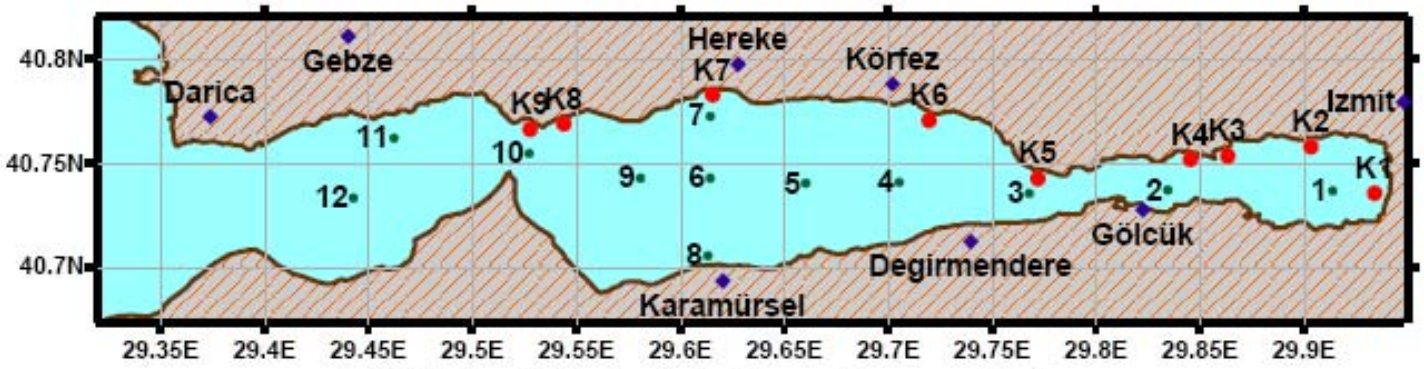
•Salinity measurements have been used for the calibration purpose for the circulation system.

•Nitrogen, POM and DO exchange between the water bodies have been calculated by using these processes.

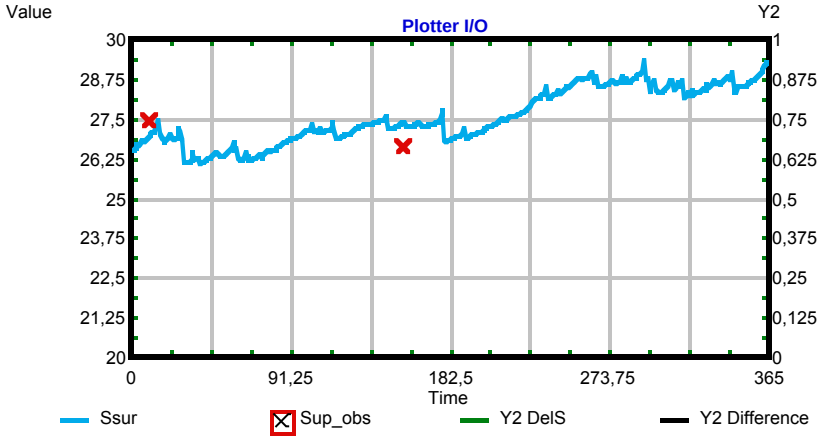
•Primary production was described using two phytoplankton groups which are dinofilegellats and diatoms. The growth process was simulated by using light (Evans and Parslow 1986) and nitrogen limitation (Michael Menten eq.) functions.

•Photosynthetic Active Radiation is calculated by using daily sun radiation measurements, water attenuation coefficient and phytoplankton attenuation coefficient available in the literature.

•SDD was formulated/approximated using the ref. Armengol *et al*. Limnetica 22(1-2): 195-210 (2003).



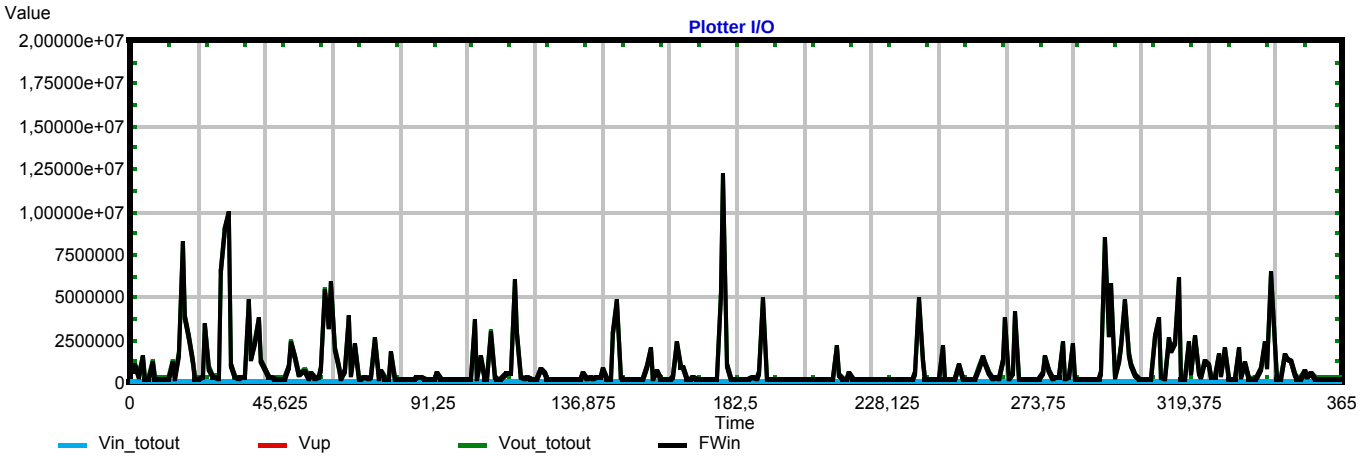
Monitoring stations (2007-2008)



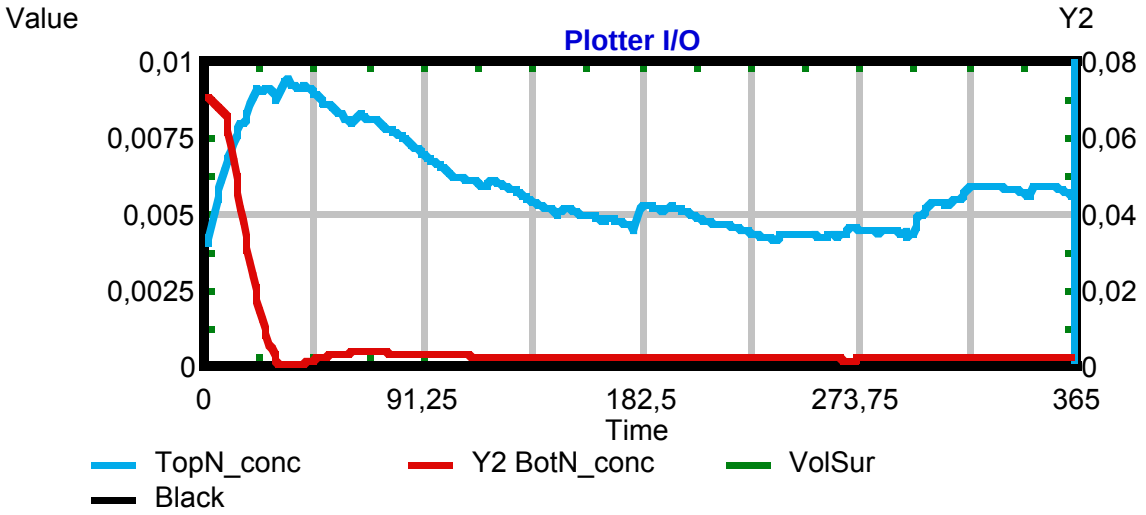
Surface layer Salinity values

Sin was derived from composnit data in west Marmara to determine the seasonal change in the source water and then its mean was adjusted to match obs in east Marmara.

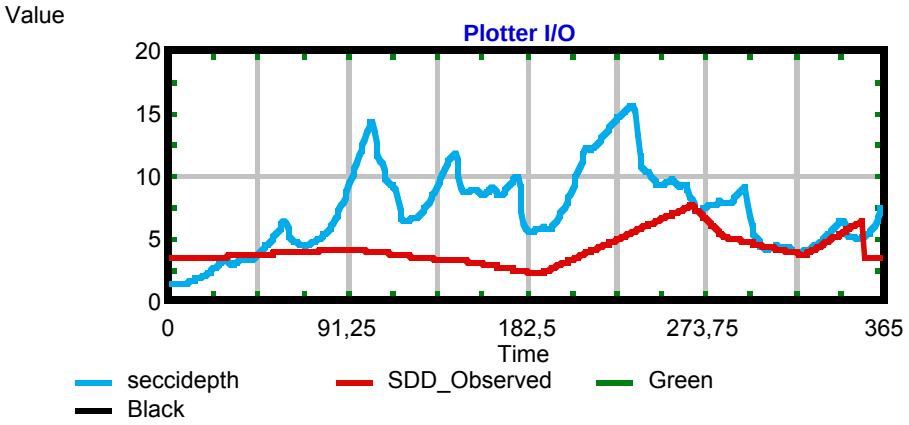
Surface and pycnocline layer calibration data were from Izmit cuises of 2007-8.



Volumes simulated in Circulation block used in Nitrogen and Oxygen blocks



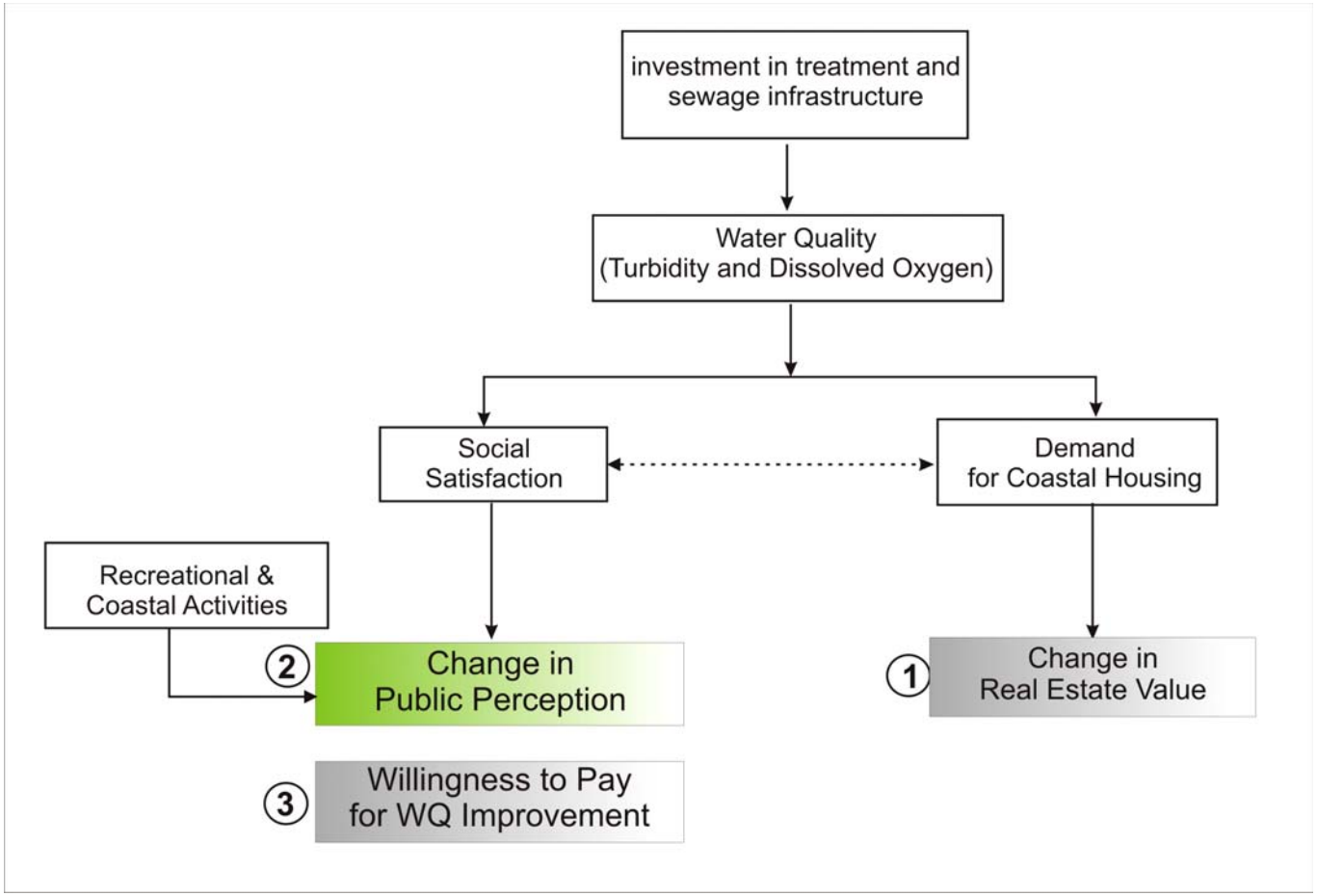
Upper and bottom Nitrogen simulations



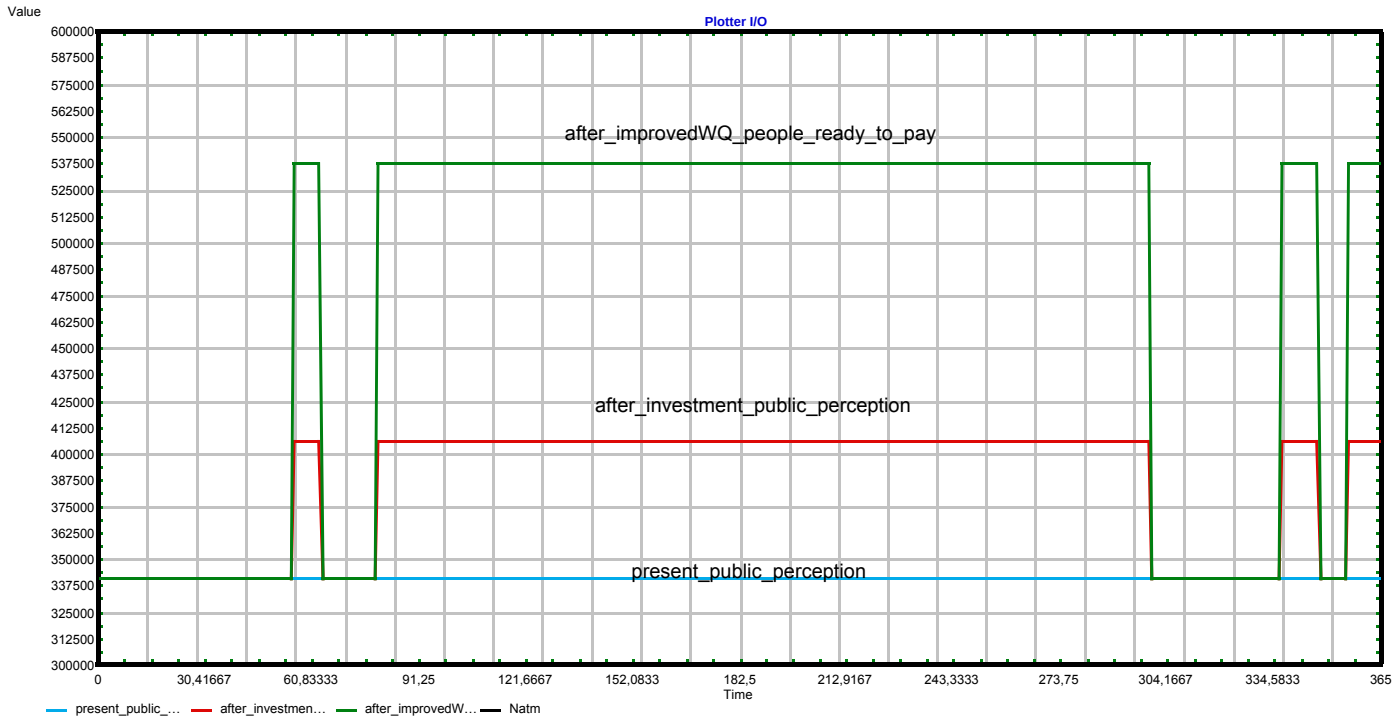
SDD observed and simulated

Social Component

The reduced quality of sea water has impacts both on manufactured capital (value of houses) and social capital (people's preferences and satisfaction). In case of a reduced pollution in the Bay, there will be improvement both in the value of manufactured capital and social capital in terms of increased public satisfaction (more coastal use and more willingness to pay for environmental improvement).
A questionnaire has been prepared for the purpose of drawing a general picture of coastal use and collect information on activities that has both economic and social value. The purpose of the questionnaire was to predict the possible change in those activities if the water in the İzmit Bay is abated. The questionnaire form was distributed to 130 people with different socio-economic profiles and 112 of them have responded.



Socio-economical component



Public perception changes

SDD treshold 5m accepted

Scenarios

Scenarios for the reduction and/or control of the domestic discharges (direct or indirect) to achieve higher visibility developed considering the technical options

The current situation for the domestic wastewater consist a general sewerage system serving urban residential areas and mostly discharged to the central wastewater treatment works.

Location of the WWTP around the Bay

1- Present Situation:

Running the model with the application of present conditions for the bay as a base,
Existing Loads:
Merkez, Korfez and Derince cities: Advanced wastewater Treatment
Golcuk and Karamursel cities: Biological wastewater treatment (no nutrient removal)

İndustrial Loads: Fertilizer Industry

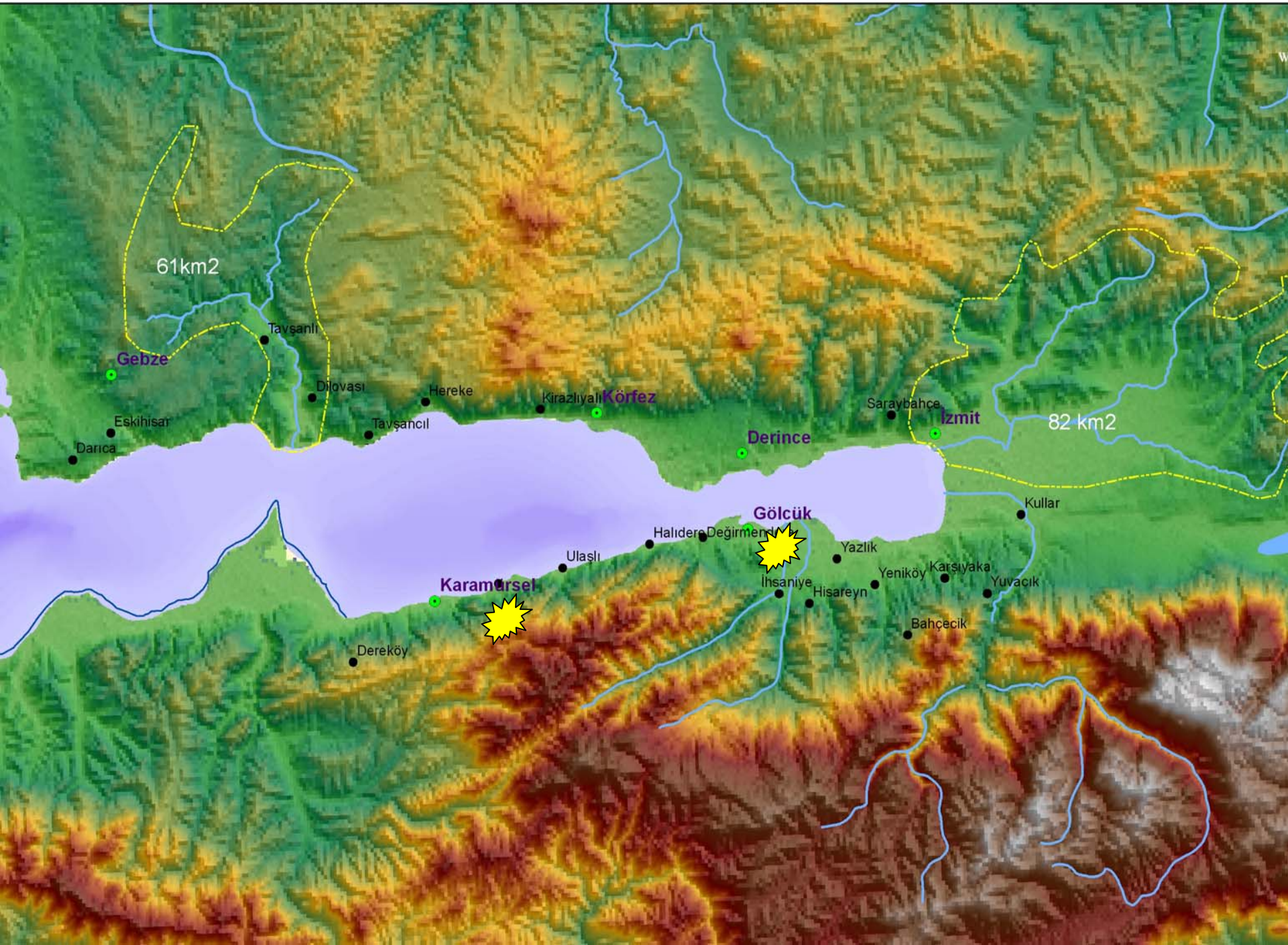
Surface runoffs form the surrounding area

2- Scenario 1:

Running the model with the application of upgrading two WWTPs;
(adition of nutrient removal facilities to the existing WWTPs such as Golcuk and Karmursel cities)

3- Scenario 2:

Running the model with the reduced river loads;
In Stream (Riverine) Treatment in the selected point sources will be applied since some of the rivers such as Dilderesi and Eastern Channel(Sarı River) dischrging to the Bay has high nutrient and TSS loads.


61km2
Tavşanlı
Gebze
Dilovası
Hereke
Kirazlıyalı
Körfez
Eskihisar
Tavşancıl
Darıca
Derince
Saraybahçe
İzmit
82 km2
Kullar
Gölcük
Halıdere
Değirmendere
Yazlık
Ulaşlı
Yeniköy
Karşıyaka
Yuvacık
İhsaniye
Hisareyn
Karamürsel
Bahçecik
Dereköy

Where are we ?

- Process models have been constructed and validated with the best available data for the natural component. We have recently obtained Marmara Sea data for 2005-2006 yeras so we will use it for calibration/hindcast purpose.
- Ballpark models of the NC were completed. Their dynamic links with other components were established. Different time scales problem solved (Economic and Natural components).
- Cost Benefit Analysis was completed.
- POM and SDD relationship added.
- The linkages between the Anthropogenic Inputs and the model (in the various scenarios) was established (Scenarios component).
- The ESE models need further tuning

What we will do…

- Better calibration can be done with 2005 – 2006 Marmara Sea data
- Hindcast simulation can be done with 2005-2009
- One more layer will be added in the natural component
- Sensitivity analysis will be carried out
- Meeting with stakeholders and give information about the final situation of the model and scenarios
- Second scenario will be connected and run.