# SISCO

Silica Retention in the Scheldt continuum and its Impact on Coastal Eutrophication

*http://www.ulb.ac.be/sciences/dste/ocean/SISCO/frame.html*

# RATIONALE

Industrial & agricultural activities

⇨ increased riverine delivery of N & P

⇨ leading to coastal eutrophication

Change in land-use

⇨ change in the production of dissolved Si unknown

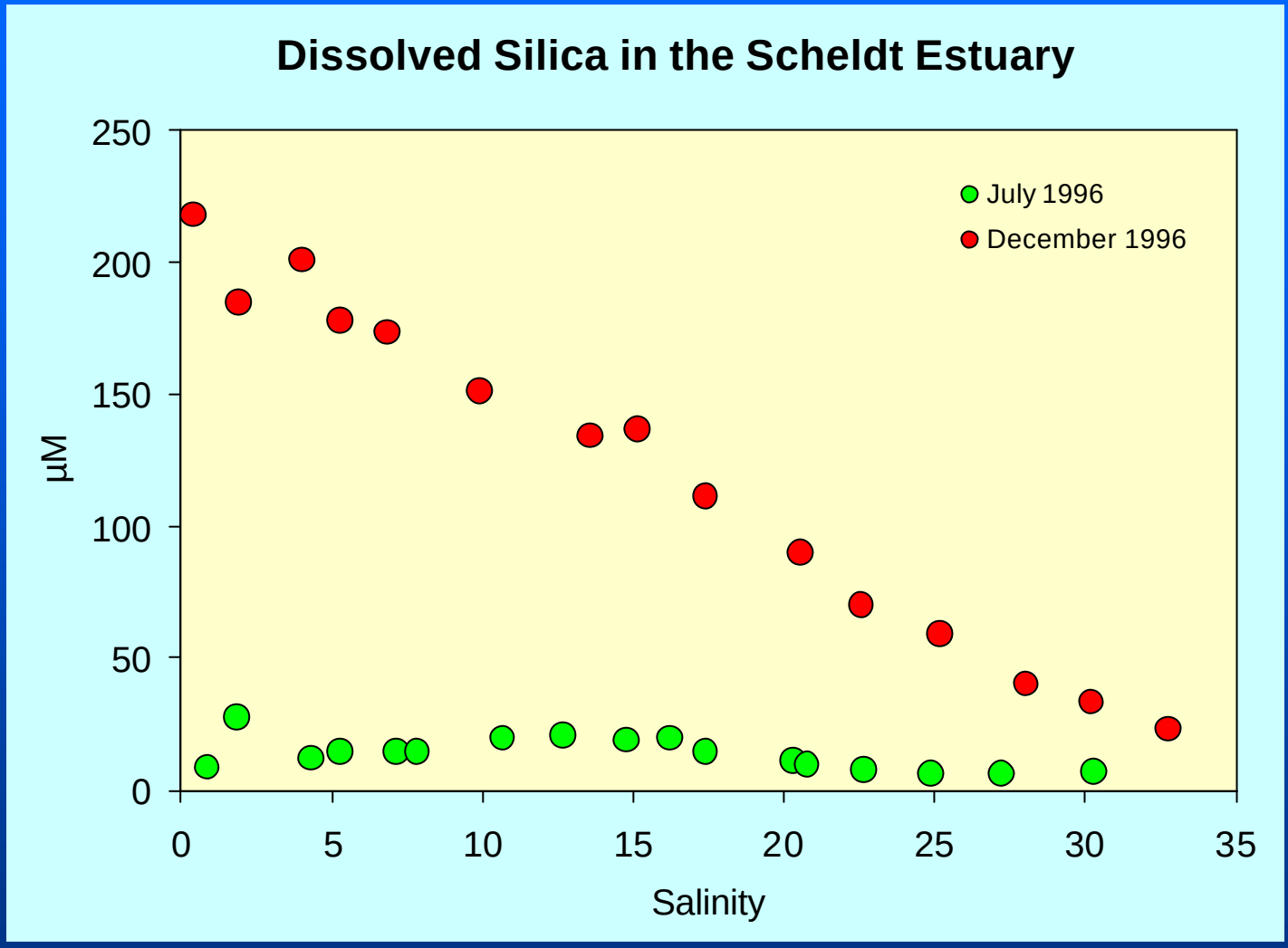
Human interventions of the hydrological cycle

⇨ increased Si retention in the aquatic continuum (lakes/reservoirs/rivers-estuaries-coastal zone-open ocean)

➡ Changes in Si:N:P ratios

➡ Modifications of the phytoplankton succession

➡ Better quantification of the Si fluxes in the Scheldt continuum in order to evaluate its impact on coastal eutrophication and on coastal food web structure


Dissolved Silica in the Scheldt Estuary
250
200
150
100
50
0
µM
0
5
10
15
20
25
30
35
Salinity
July 1996
December 1996

# GENERAL OBJECTIVE

- To elucidate the biogeochemical cycling of Silica and its anthropogenic perturbation in the Scheldt continuum river-estuary-coastal zone

# SPECIFIC OBJECTIVES

- To identify the sources and sinks of Si in the aquatic continuum
- To quantify the major processes controlling the biogeochemical behaviour of Si in the water column
- To evaluate the early diagenesis of Si in order to determine the burial fluxes and internal recycling rates within the sediments
- To develop a Si module within an existing transport-reaction model to assess the Si fluxes carried by the Scheldt to the Southern Bight of the North Sea

# PARTNERS

Lei CHOU (Project Coordinator)
Laboratoire d'Océanographie Chimique et Géochimie des Eaux
UNIVERSITÉ LIBRE DE BRUXELLES (ULB)
*Silicon Biogeochemistry*

Wim VYVERMAN
Protistologie & Aquatische Ecologie
UNIVERSITEIT GENT (RUG)
*Diatom Dynamics*

Pierre REGNIER
Department of Geochemistry, Faculty of Earth Sciences
UTRECHT UNIVERSITY (UU)
*Coupled Hydrodynamic-Biogeochemical Modelling*

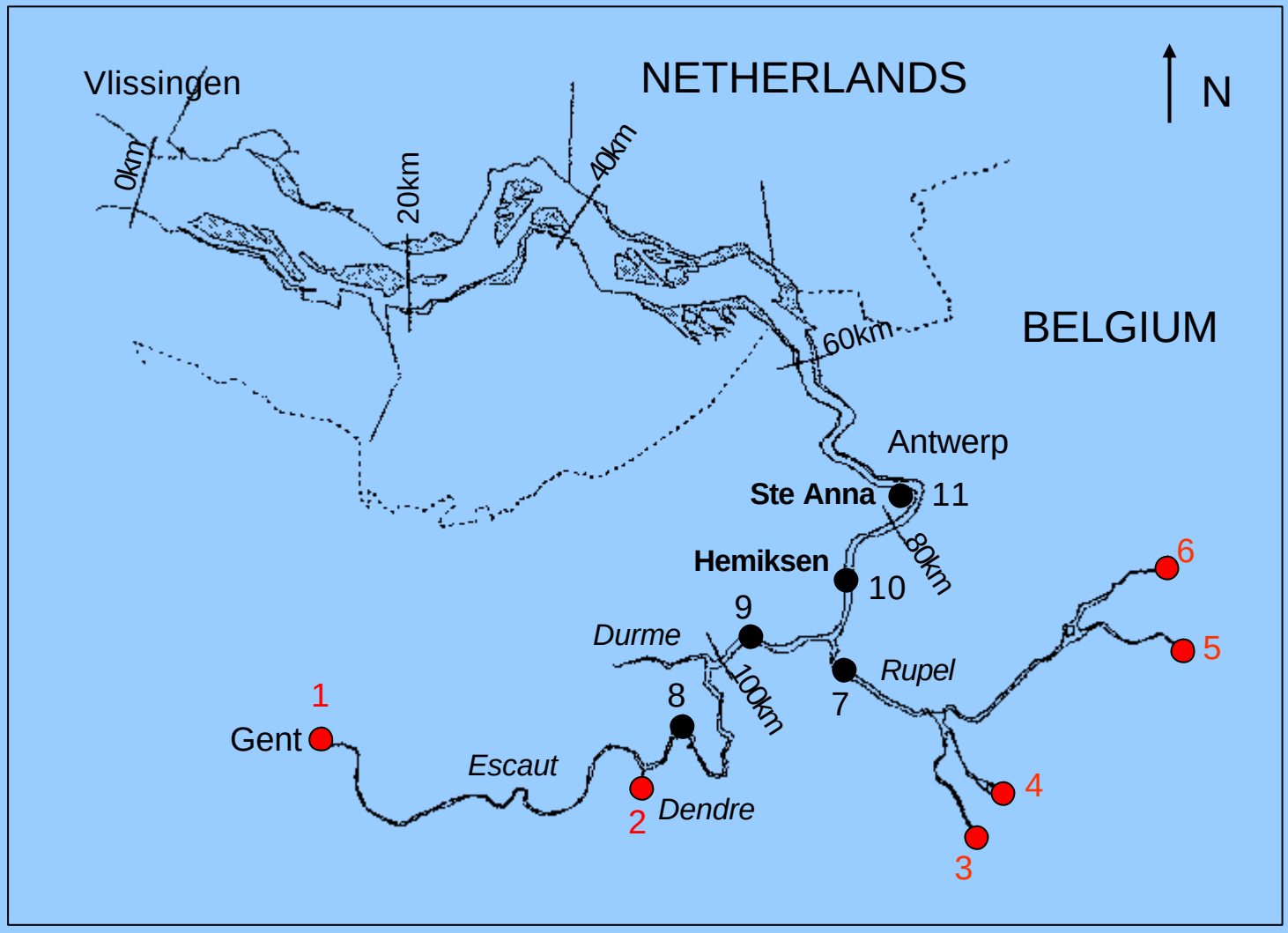
## METHODOLOGIES

Field studies and laboratory experiments will be combined with modelling efforts to achieve the objectives.

1. Collection and analysis of historical data on the Scheldt continuum & those acquired during the project
   *Physico-chemical and biological parameters*

2. Process studies
   *Primary production & diatom production*
   *Retention & regeneration of biogenic silica*
   *Benthic fluxes of dissolved Si across the sediment-water interface*

3. Modelling of Si input, reaction & transport in the continuum
   *Parameterisation of the production and dissolution of biogenic silica*
   *Benthic-Pelagic coupling*




**SISCO sampling area in the Scheldt continuum (*river – estuary - coastal zone*).**

The upper Scheldt will be limited however to areas under the tidal influences as indicated by Stations 1 - 6 where freshwater discharges are measured daily. The coastal zone will be restricted to areas under the influence of the estuarine plume.

# EXPECTED RESULTS

- A comprehensive understanding of the silica biogeochemical cycling in the Scheldt continuum, from the river through the estuary to the coastal zone under the influence of the estuarine plume.
- Parameterisation of rate constants for processes controlling the production, regeneration and retention of silica in the Scheldt continuum.
- A Si diagenetic model for the quantitative assessment of the recycling efficiency, the burial flux and thus the retention of silica in contrasting sediments of the Western Scheldt estuary.

# EXPECTED RESULTS (cont'd)

- An improved transport-reaction model with the implementation of a new Si module including benthic-pelagic coupling, allowing the prediction of the biogeochemical cycling of Si in the Scheldt continuum and Si fluxes delivered to the Southern Bight of the North Sea.
- A database of existing historical data on dissolved silica, other nutrients and related parameters incorporating the results acquired in the present project.

# VALORISATION OF RESULTS

1. Daniel CONLEY

   National Environmental Research Institute, Roskilde, DK

   *Comparison of Si dynamics between various European coastal marine ecosystems: North Sea, Baltic Sea and Black Sea*

2. Josette GARNIER

   UMR Sisyphe, Université Pierre et Marie Curie, Paris, FR

   *Comparison of nutrient dynamics (Si, N, P) in the Scheldt continuum with that of the Seine Continuum (PIREN-Seine, Seine-Aval)*

3. Christoph HUMBORG

   Stockholm University, Stockholm, SE

   *Comparison of Si land-Sea fluxes between anthropogenic perturbed systems with the non-regulated pristine rivers of the Baltic Sea catchment.*

   *Contribution to the ICSU-SCOPE & IGBP-LOICZ on the important role of Si in regulating coastal food webs.*

# VALORISATION OF RESULTS (Cont'd)

4. Jan MEES

   Flanders Marine Institute (VLIZ), Oostende, BE

   *Published results to be incorporated into the VLIZ database*

5. Jack J. MIDDELBURG

   Netherlands Institute of Ecology (NIOO), Yerseke, NL

   *Contribution to the model depvelopement and improvement for biogeochemical cycles in coastal ecosystems currently in progress at NIOO-CEMO*

6. Frank MOSTAERT

   Division Flanders Hydraulics, Borgerhout, BE

   *Contribution to the overall knowledge of the River Scheldt and providing addtional information to support long-term management of the Scheldt*

**SISCO** is clustered with the following two networks:

**AMORE-II**

Advanced modelling and research on eutrophication: linking eutrophication and biological resources (Lancelot)

**CANOPY**

Biogeochemical carbon, nitrogen and phosphorus fluxes in the North Sea (Baeyens)