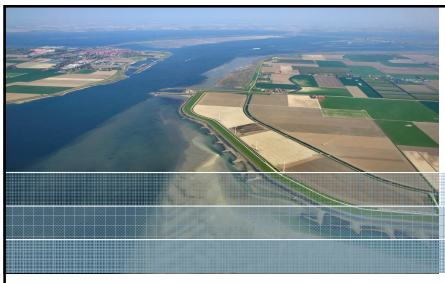


Deltares
Enabling Delta Life

Effect of geological uncertainties on the salinisation of surface water systems in deltaic areas

Marta Faneca

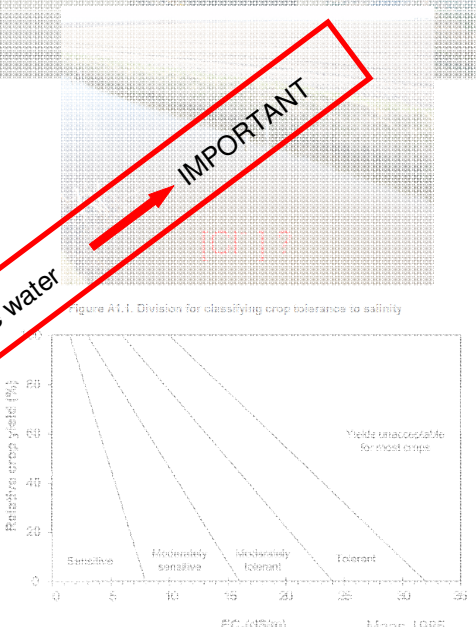
26 april 2012

Reasons of this study

- Surface water from ditches often used for crop irrigation
- Not all crops are equally salt tolerant
  - Strawberry 171mg/l
  - Potato 202mg/l
  - Brocoli 388mg/l
  - Sugar cane 1288mg/l
- Salt load from groundwater into surface water can be significant deltas

Quantification of salt load into surface water

IMPORTANT



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Goal and methods

- GOAL
  - > Quantify salt load from groundwater into surface water
  - > Quantify the range of salt load related to the uncertainty of the geology
- METHODS
  - > Density dependent groundwater model
  - > Use of different geologies for the area

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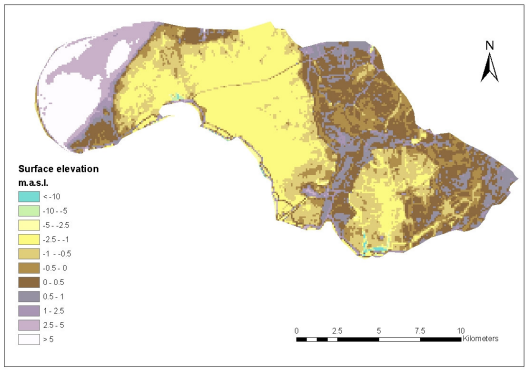
Location



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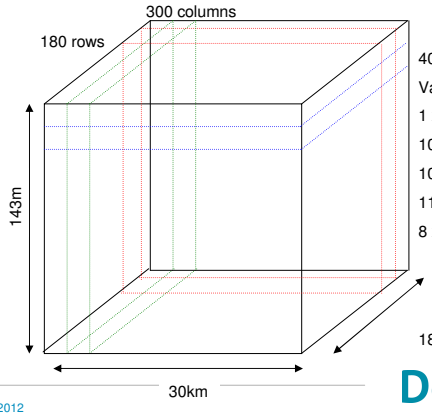
Model

- 3D density dependent groundwater model (MOCDENS3D)
- Model cells 100*100m2
- 40 model layers
- calibration with measured head corrected to freshwater heads
- Steady state: winter and summer



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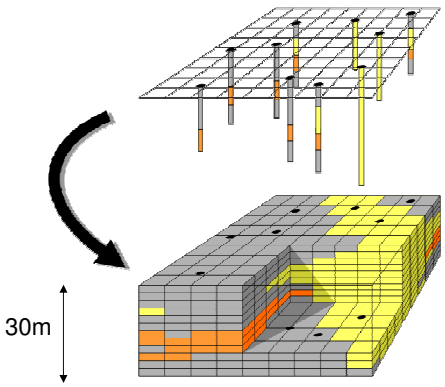
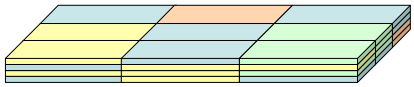
GEOLOGICAL SURVEY OF THE NETHERLANDS (TNO)



GEOTOP model

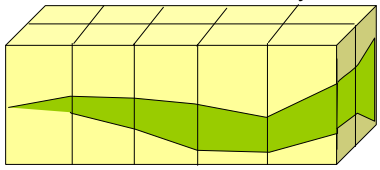
Chance to lithology and lithofacies

GeoTOP 100 x 100 x 0.5 m



+

REGIS II.1 100 x 100x layer thickness



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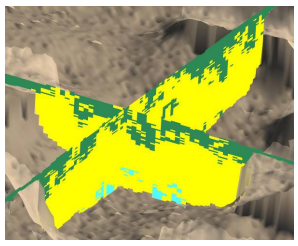
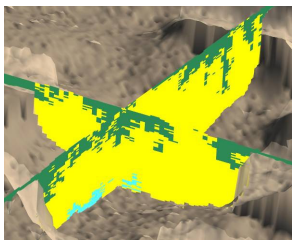
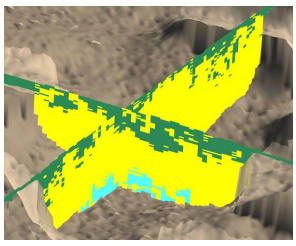
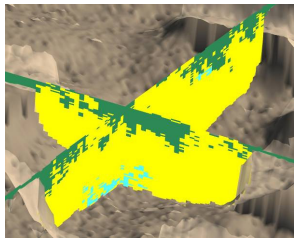
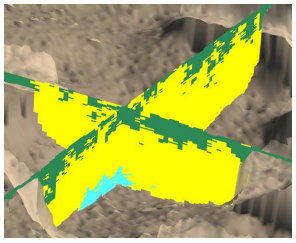
Lithofacies modelling (3D)

50 GEOLOGICAL SCENARIOS with equal probability

- Clay
- Sand'
- Shell-rich deposits

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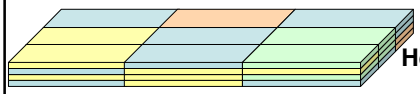
Parametrisation of the hydraulic conductivity

MCODENS3D

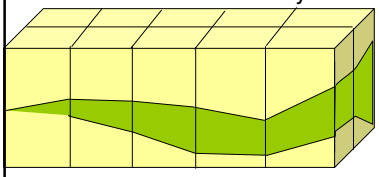
GeoTOP 100 x 100 x 0.5 m



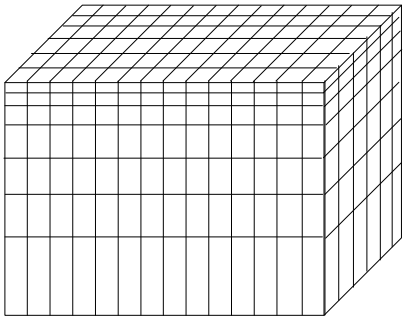
Holocen

+

REGIS II.1 100 x 100x layer thickness



Pleistocen



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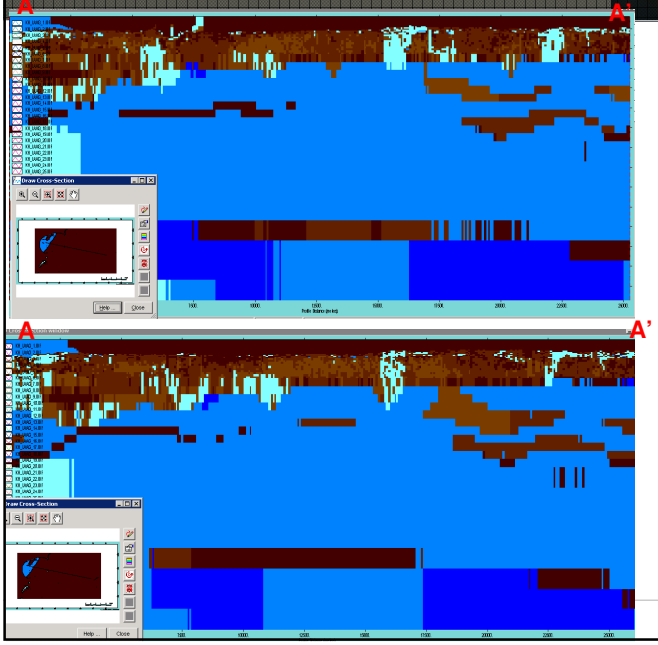
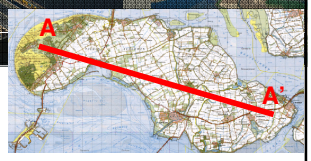
Geology 2 different realizations





Horizontal Hydraulic conductivity (m/d)

- 200-500
- 50-200
- 25-50
- 10-25
- 1-10
- 0.1-1
- 0.01-0.1
- 0-0.01

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50 different geologies

↓

50 hydrogeological models

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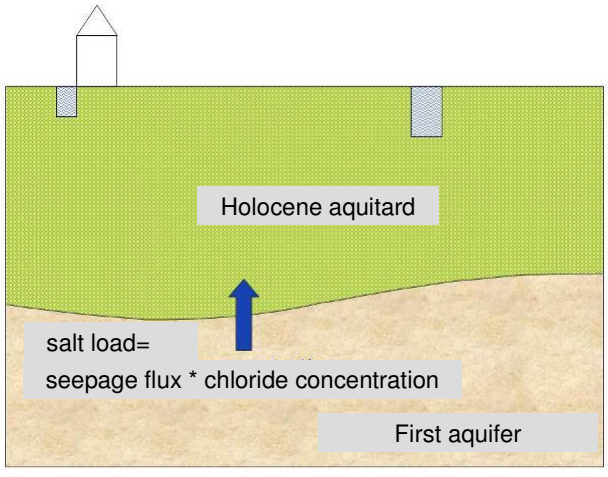
Calculation salt load to surface water system



Salt load in kg/ha/year or ton Cl-/year

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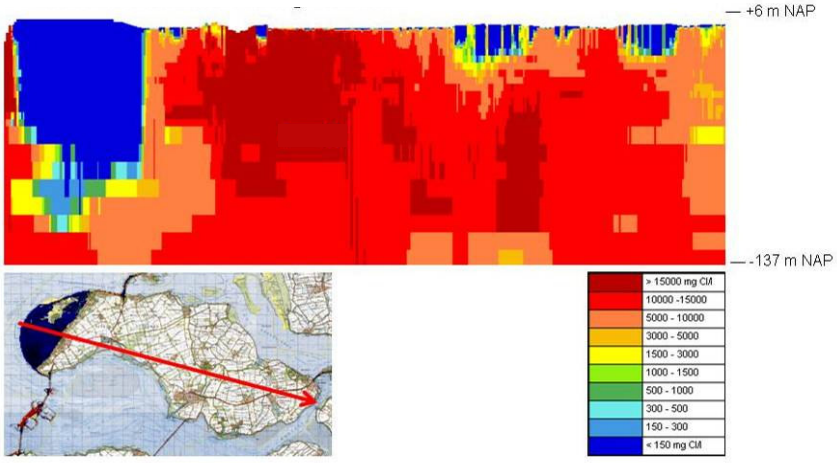
Model Results - Concentration

Profile Chloride concentration



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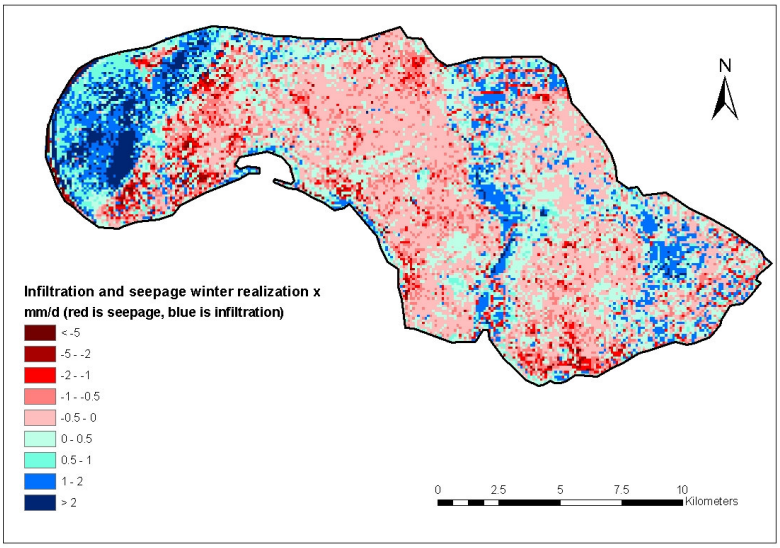
Model Results – Infiltration and seepage



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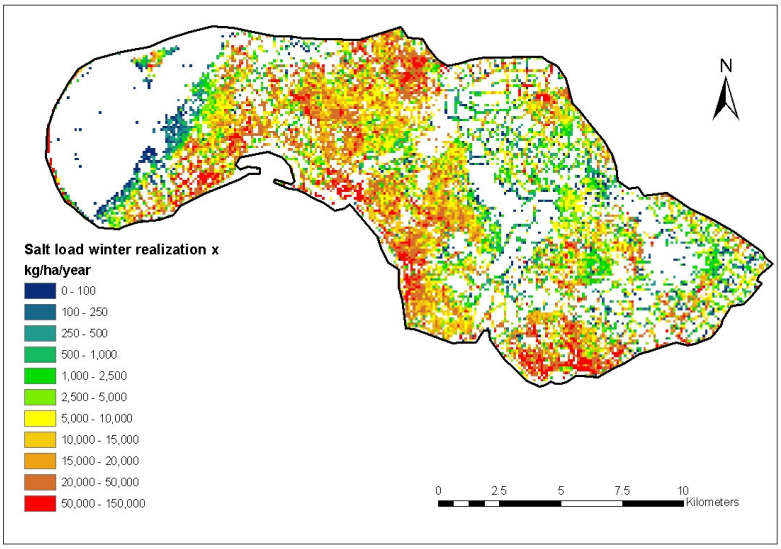
Model Results - Salt load



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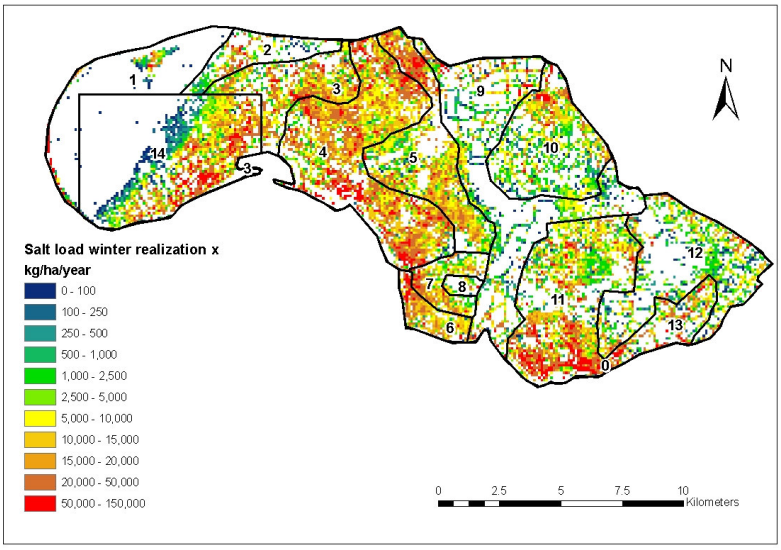
Model Results - Salt load



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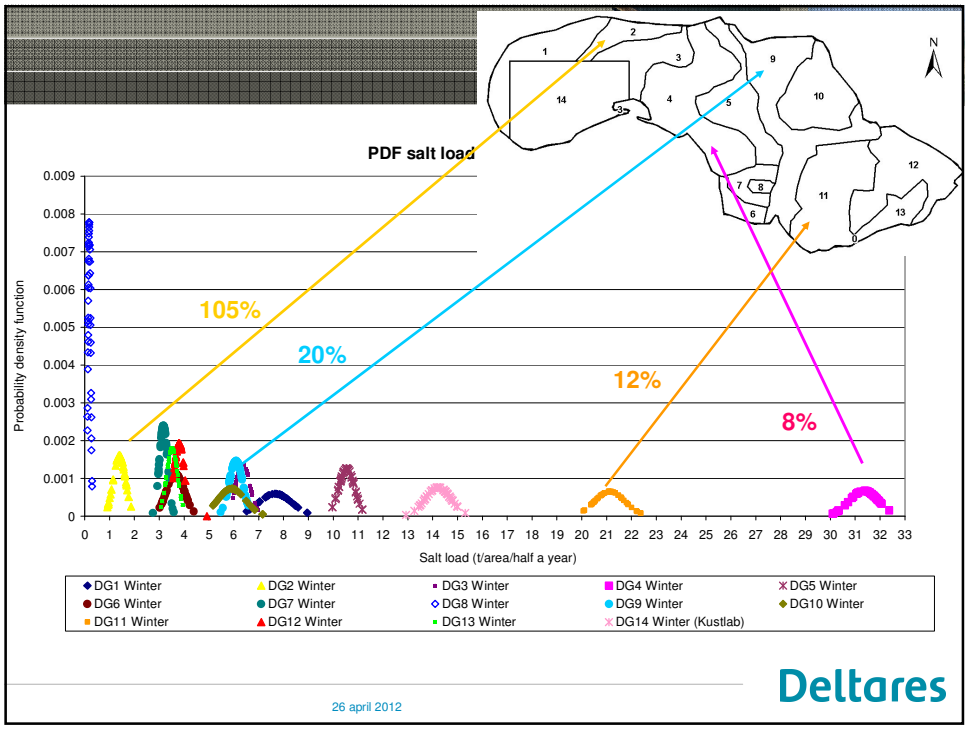
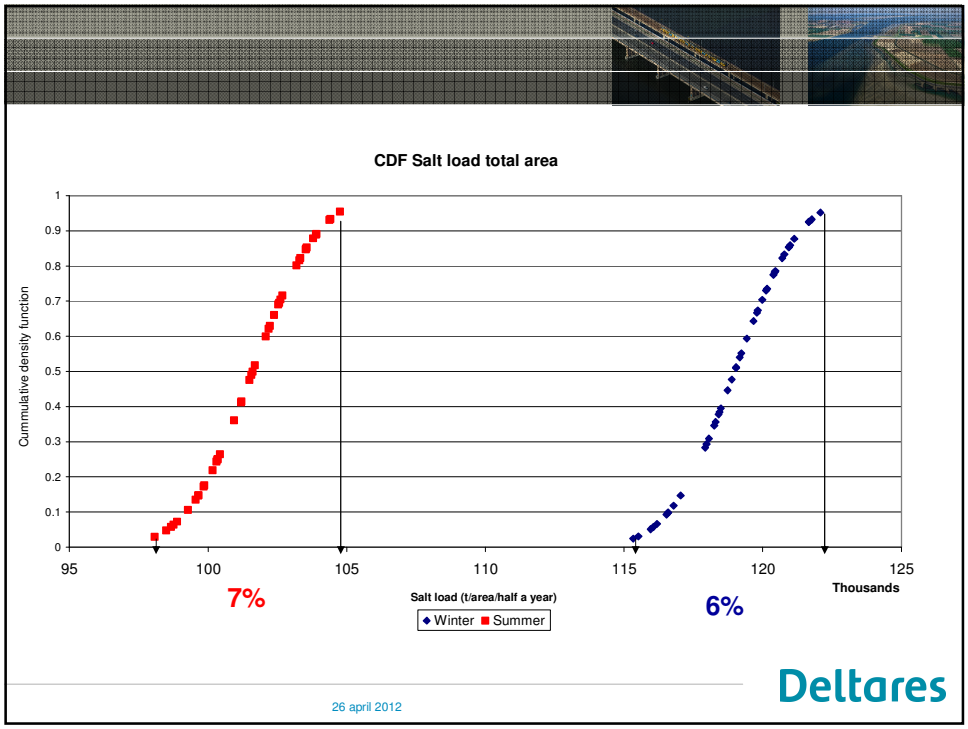

PDF salt load
Probability density function
Salt load (t/area/half a year)
105%
20%
12%
8%
DG1 Winter
DG2 Winter
DG3 Winter
DG4 Winter
DG5 Winter
DG6 Winter
DG7 Winter
DG8 Winter
DG9 Winter
DG10 Winter
DG11 Winter
DG12 Winter
DG13 Winter
DG14 Winter (Kustlab)
N
26 april 2012
Deltares


CDF Salt load total area
Cummulative density function
Salt load (t/area/half a year)
Thousands
7%
6%
Winter
Summer
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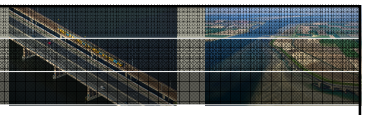
Conclusions



- The uncertainties in geology are translated to the salt load model results
- Salt load variation related to geological uncertainties up to 105% but in average 20%
- The variation depends on the size and type of the study area
  - > Low amount of boreholes = high geological uncertainty and high salt load variation
  - > Transition infiltration-seepage or dunes-polers where the continuity of aquifers and aquitards is uncertain, can give a great variability in salt load results.

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