

Vandskifte med Limfjorden - slusens og dæmningens betydning

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Formål

- At tilvejebringe et vidensgrundlag for at afgøre hvorvidt dæmningen og slusen over Virksund gør, at Hjarbæk Fjord må klassificeres som et stærkt modificeret vandområde, samt om en sådan klassificering af Hjarbæk Fjord kan ændres

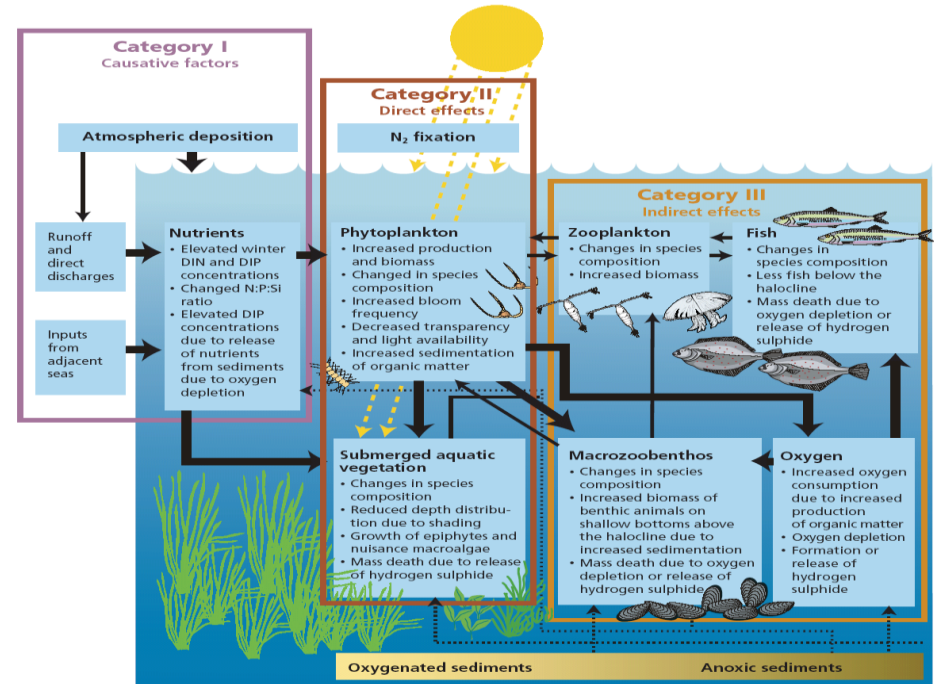
Metode

- Benytte mekanistiske modeller – udviklet som del af 2. generations vandområdeplaner – til vurdering af effekterne af dæmningen/slusen

Modellerne og sammenhæng med målinger

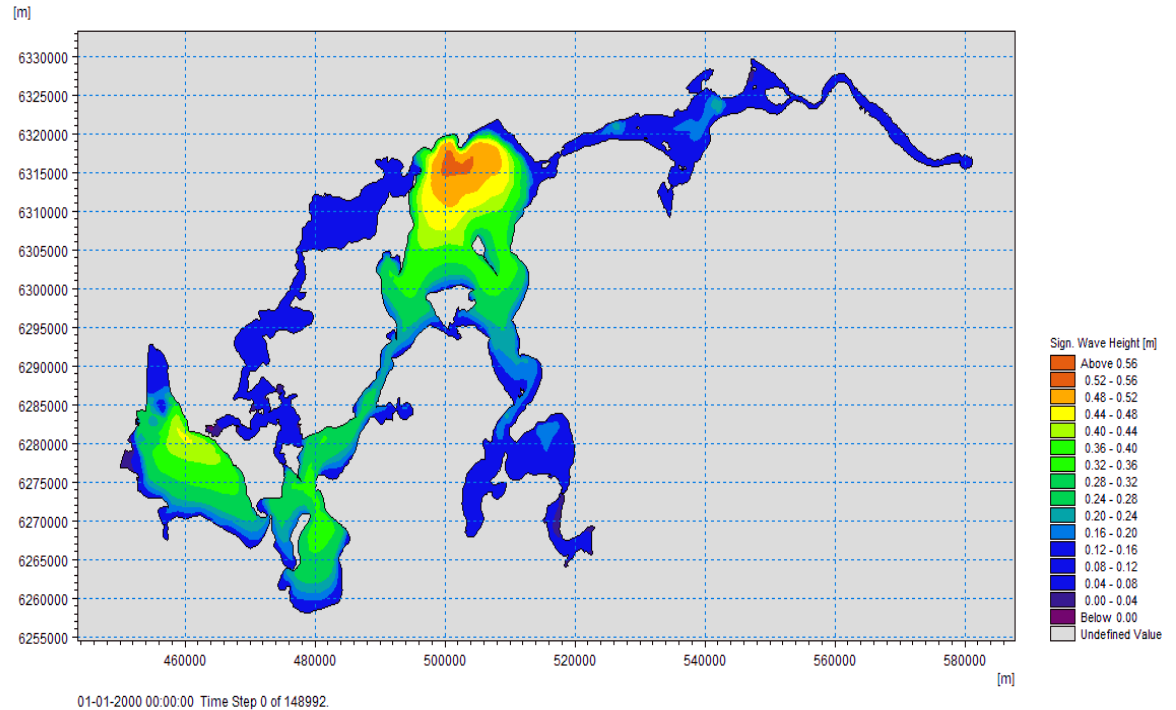
- **Mekanistiske modeller:**

- Årsagssammenhænge (differentiale ligninger)
- Biologisk og fysisk viden for et givent omr (målinger indgår indirekte som del af formelapparatet)
- Høj spatial- og temporal opløsning
- Validering af modellerne (målinger)



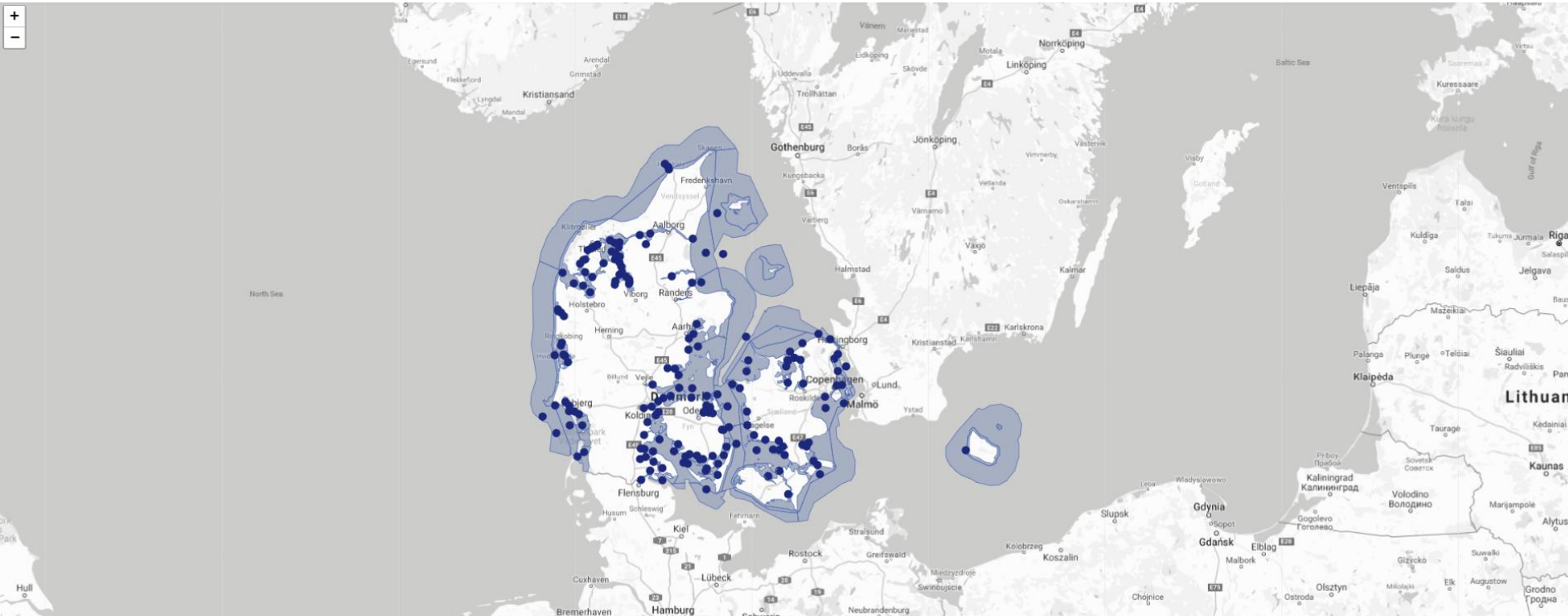
Bølgemodellering: Signifikant bølgehøjde

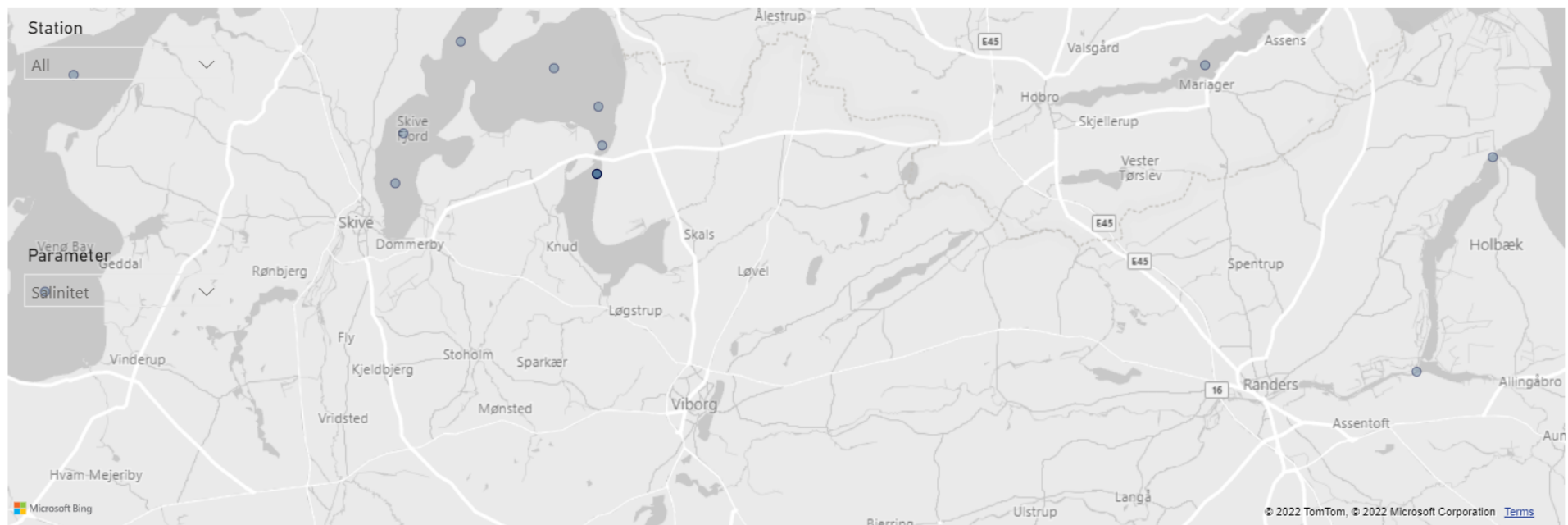
- Modelresultater:
 - Signifikant bølgehøjde
 - Periode
 - Bølgeretning



Præsentation af modelresultater

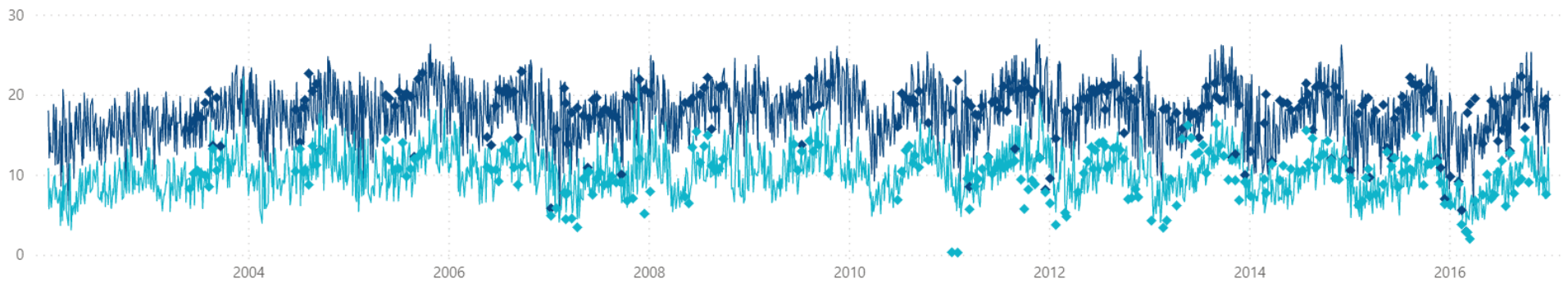
<http://rbmp2021-2027.dhigroup.com>



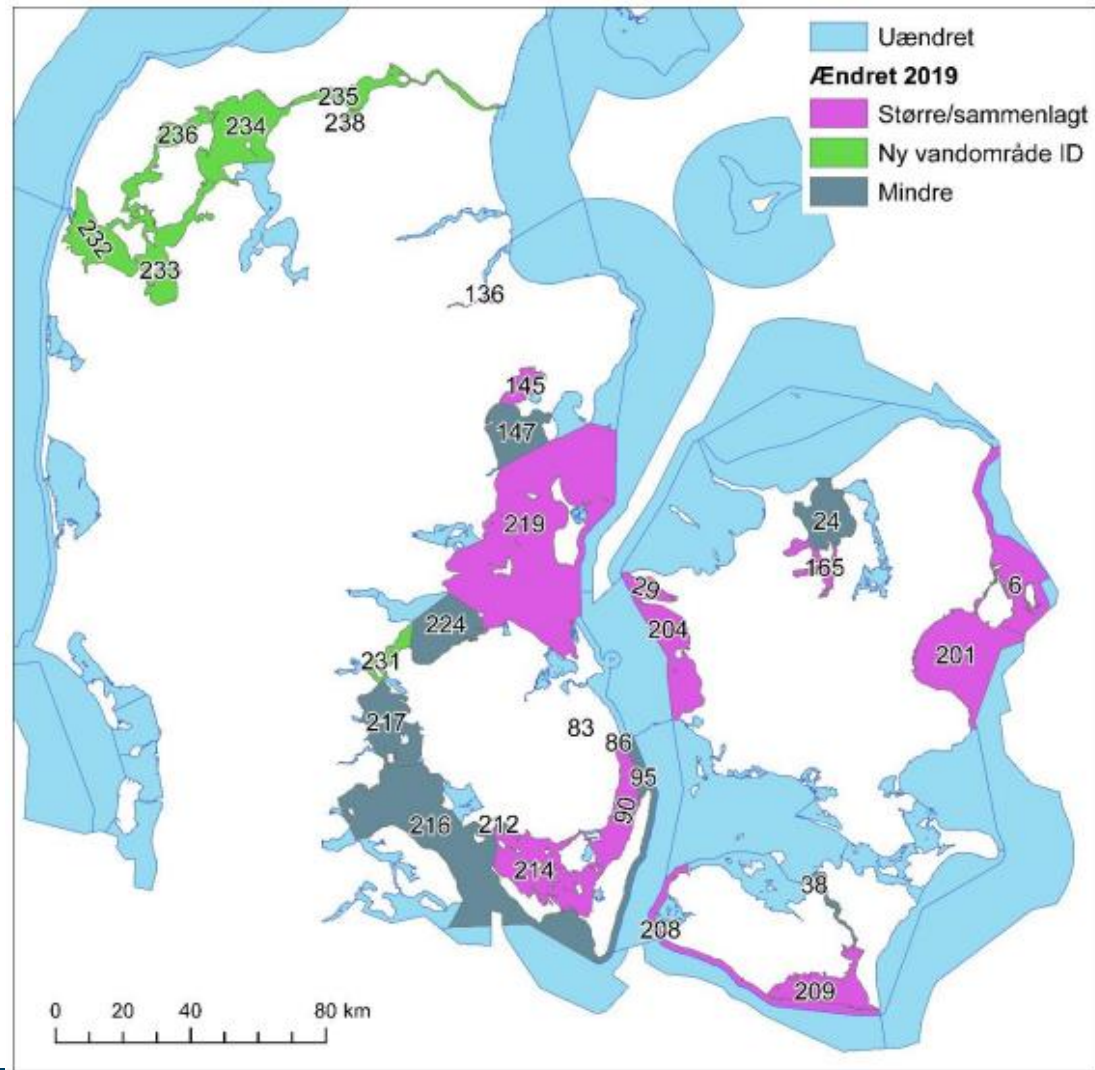


Salinitet

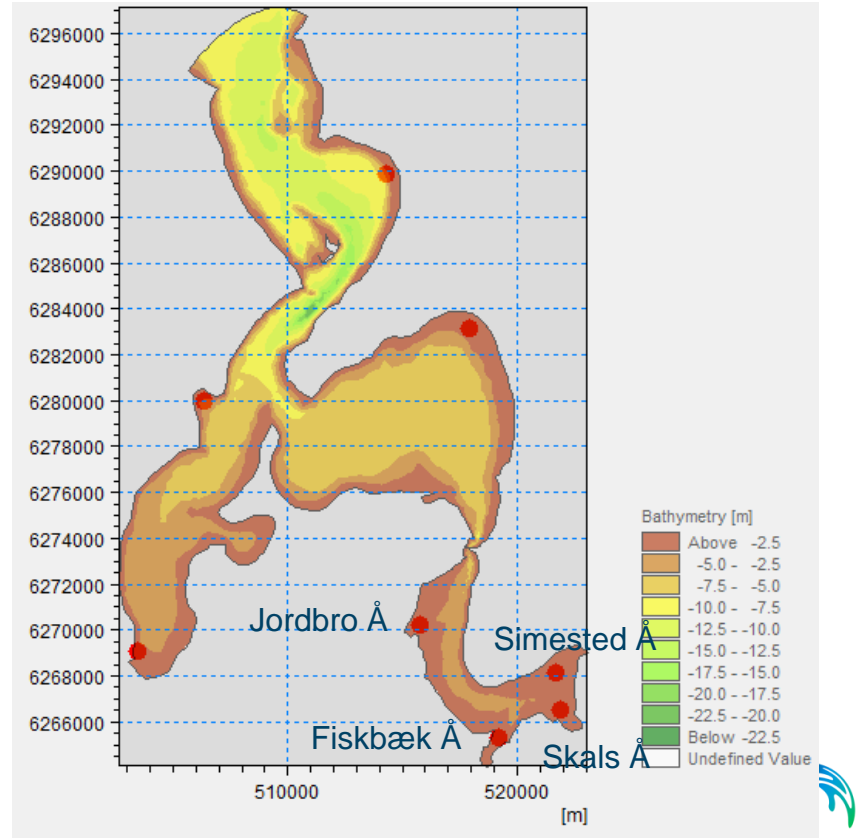
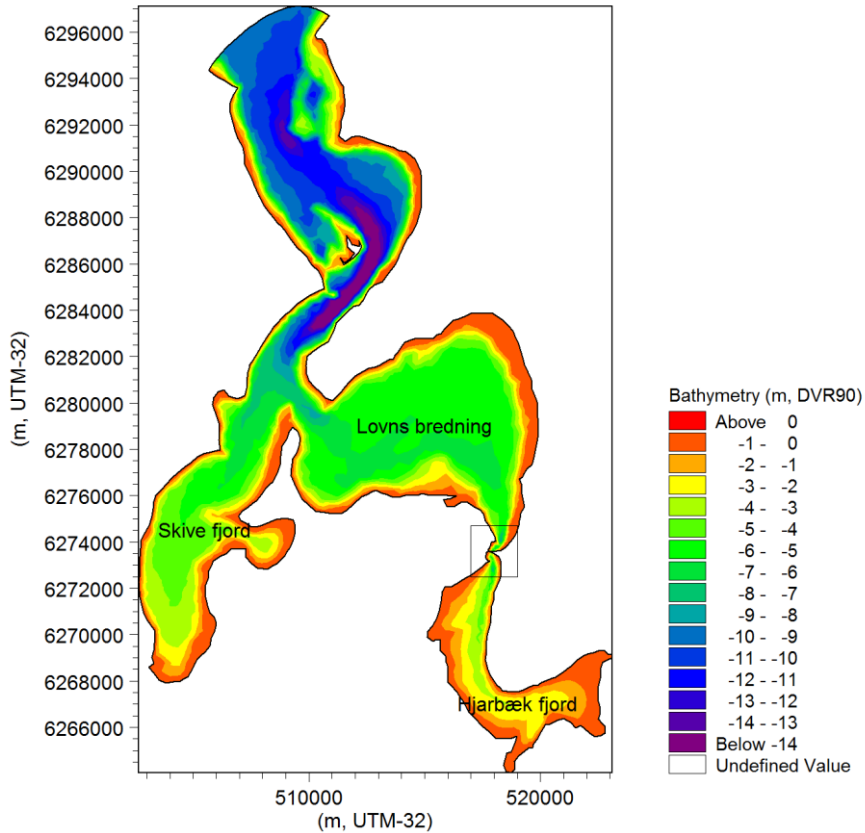
◆ Målinger, bund ◆ Målinger, overflade — Model, bund — Model, overflade

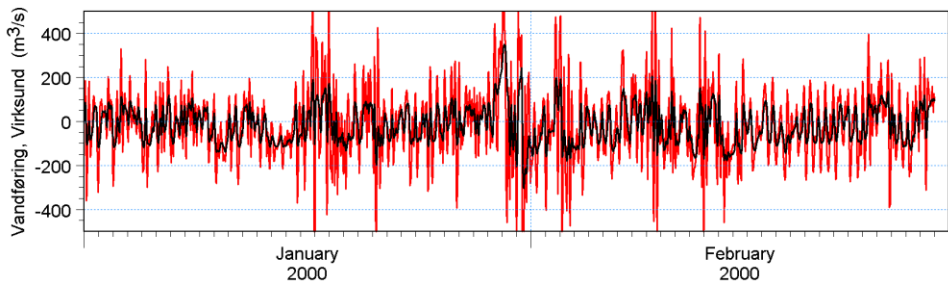
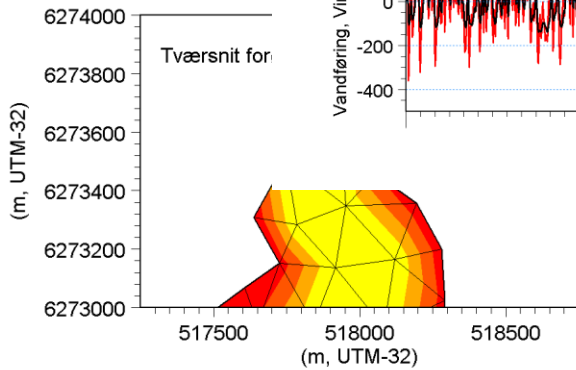
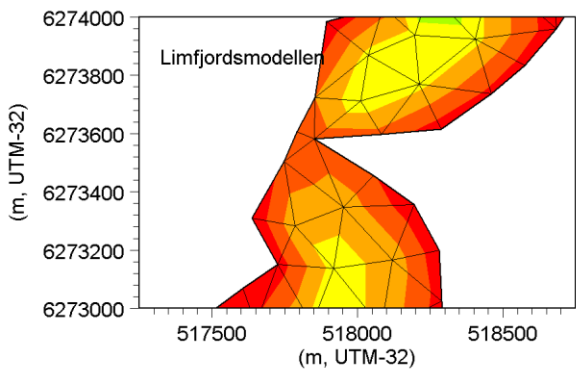
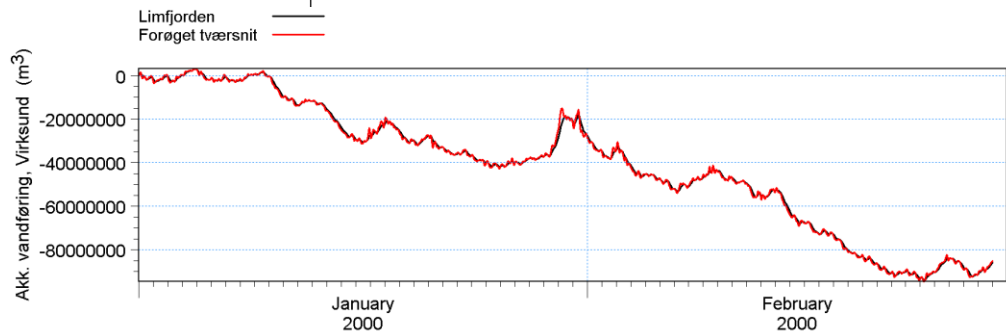
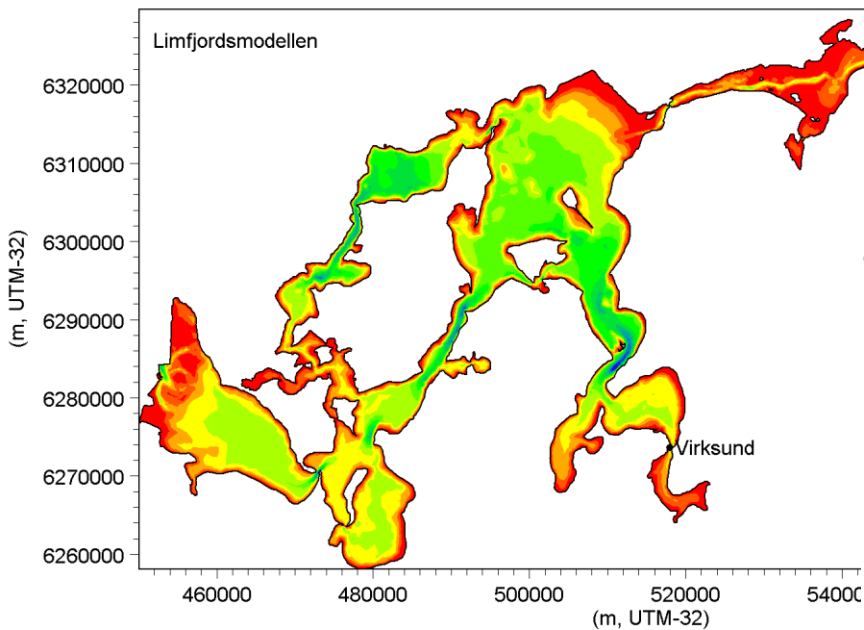


Afgrænsning



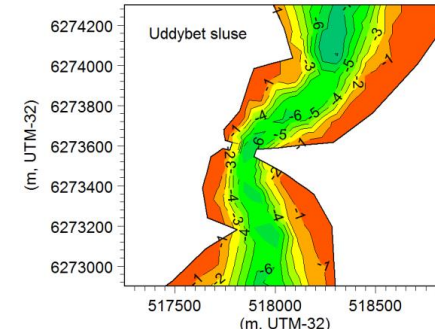
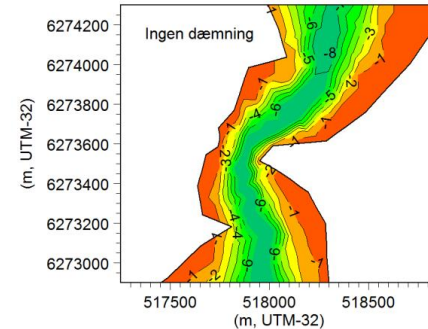
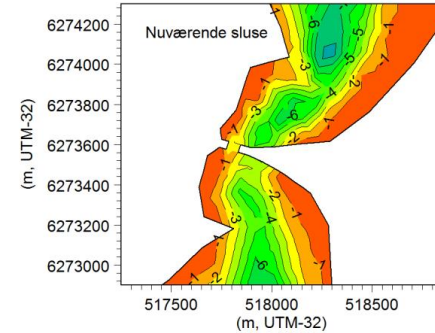
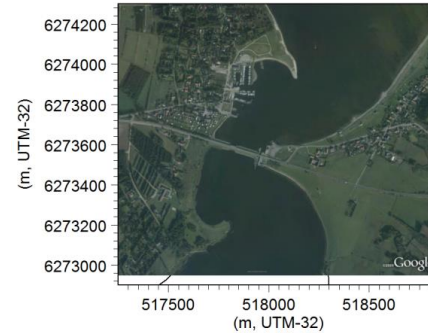
Modelanalyse af Virkesunddømmningen

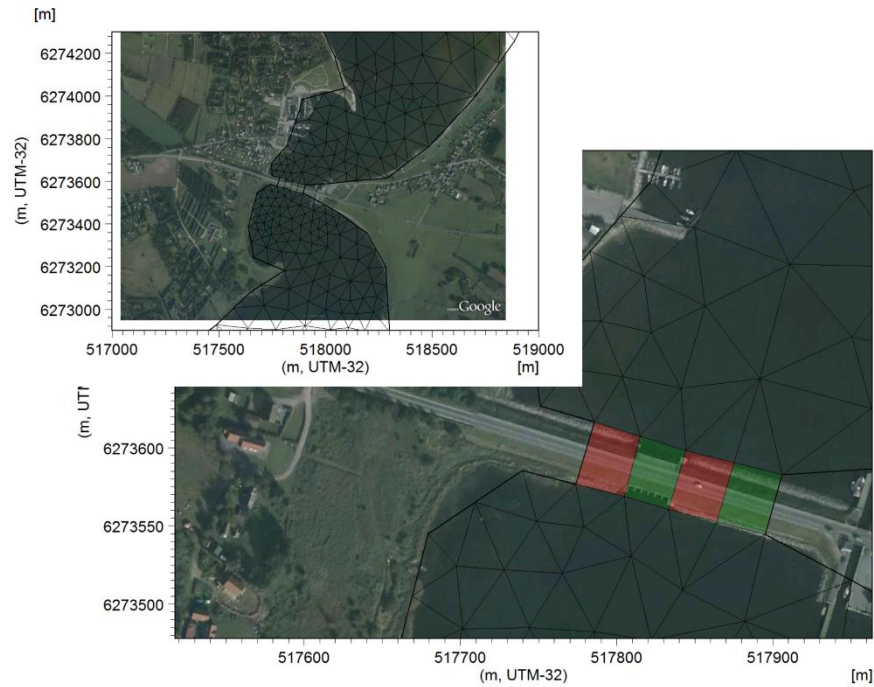
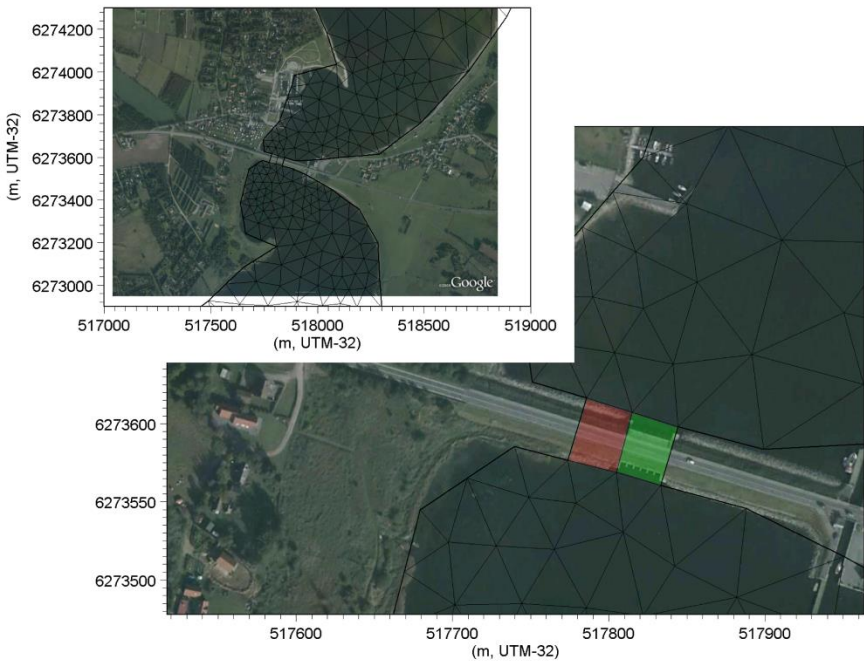


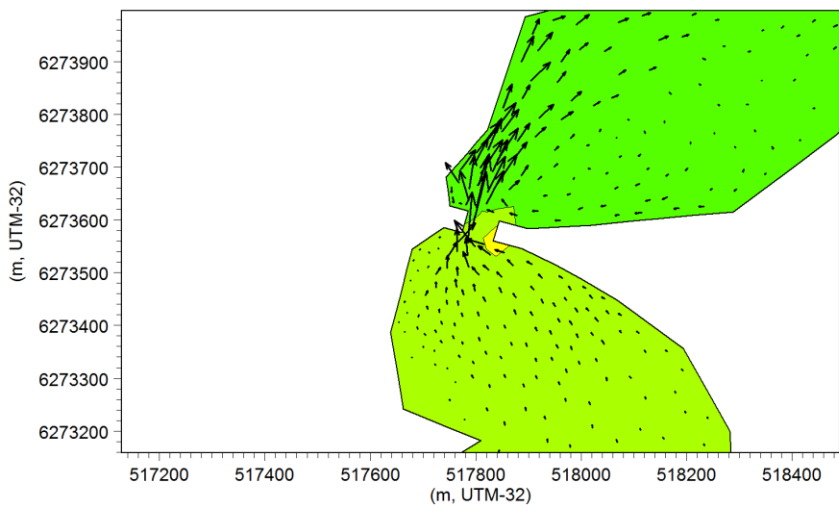
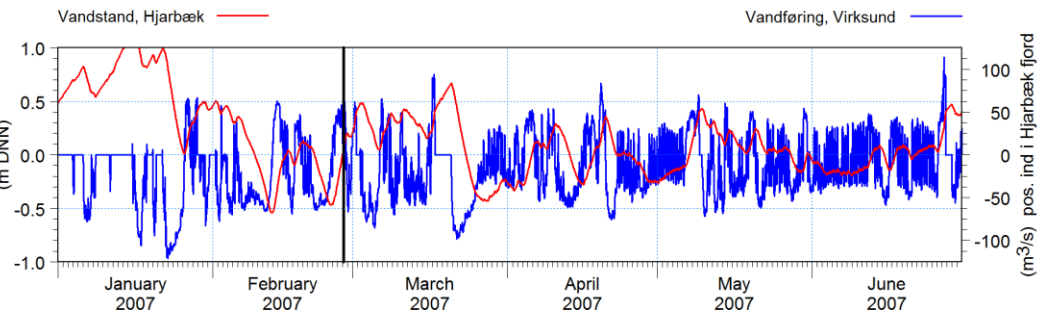
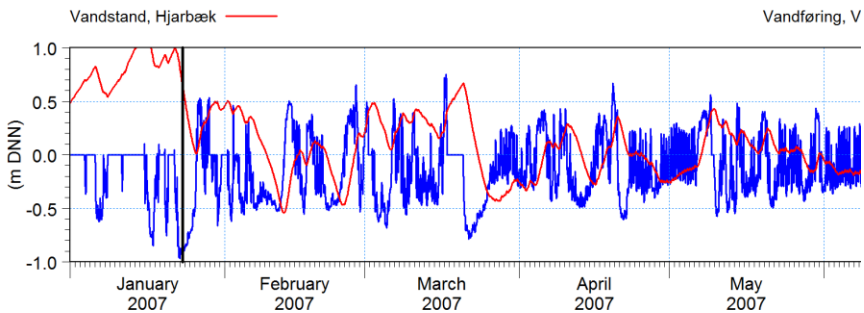


Scenarier

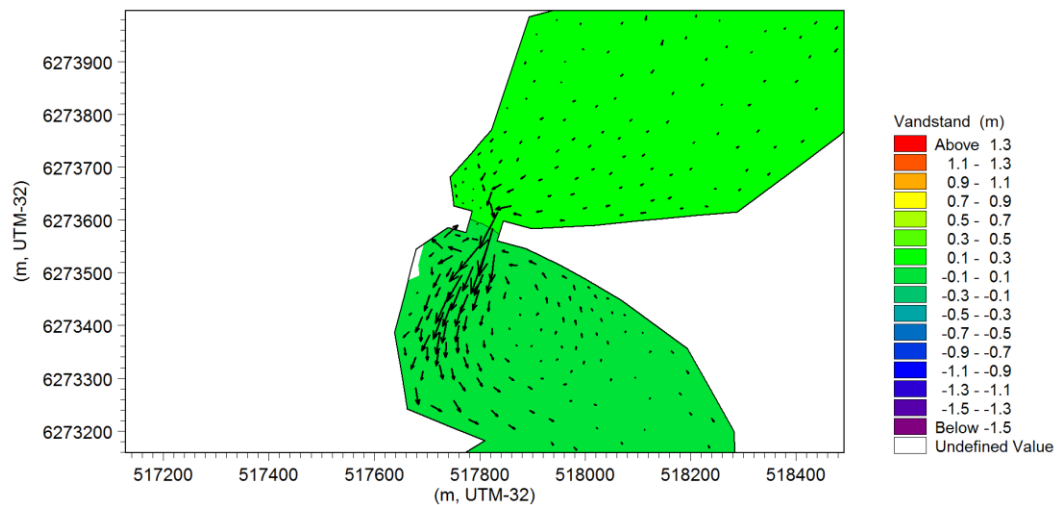
- Modelperiode: 2007-2011
- Modelscenarier:
 - Eksisterende situation (slusebund i -2m DVR90)
 - Scenarie med nuværende afvandings-sluse samt ny dybvandssluse (slusebund i -6m DVR90 og bredde på 35m (5x7m))
 - Scenarie uden dæmning og sluse (bundkote i -7 m)







23-01-2007 14:00:00

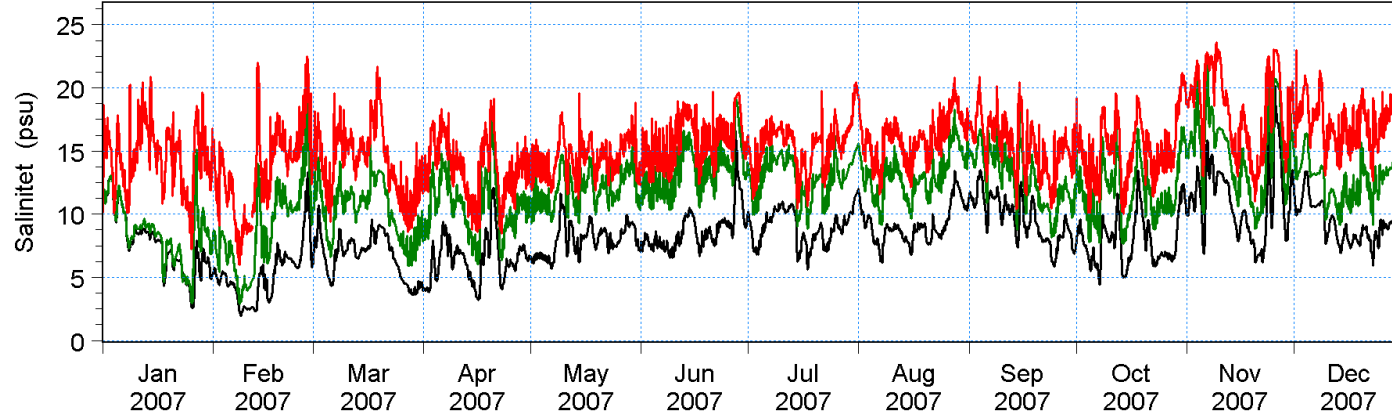


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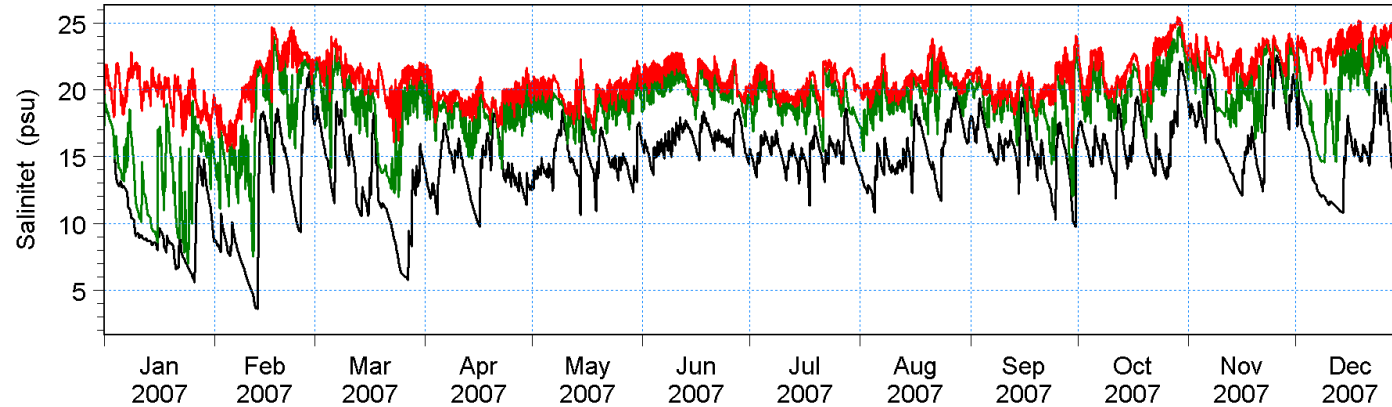
Modelresultater

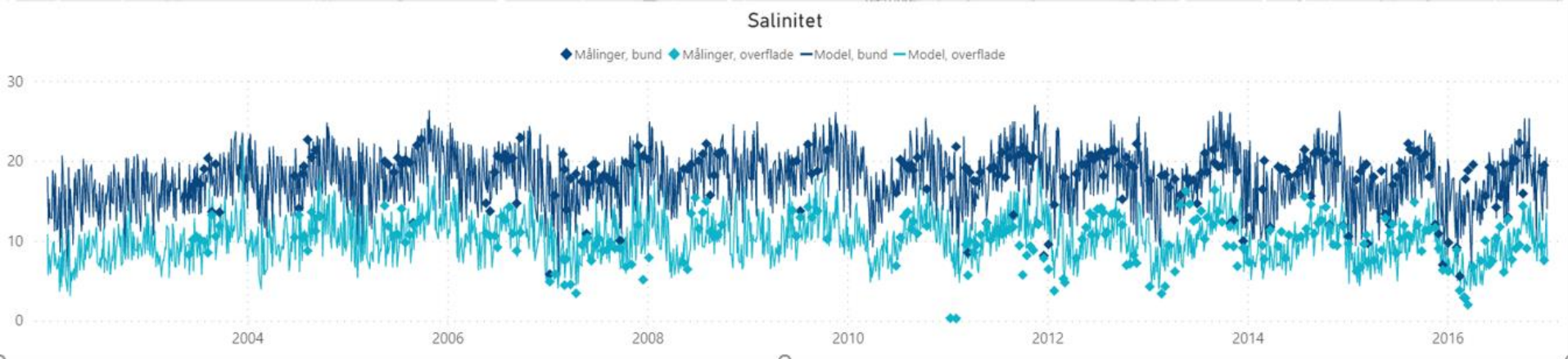
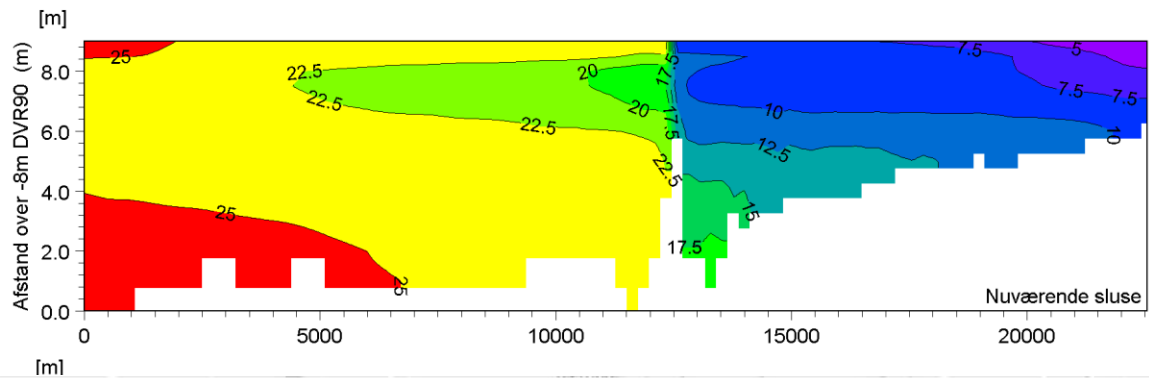
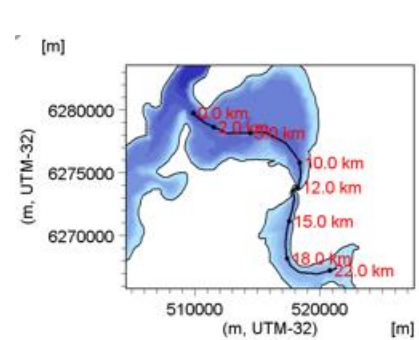
Nuværende situation [PSU] —
Ny dybvandssluse ned til -6m DVR90 [PSU] —
Reference [PSU] —

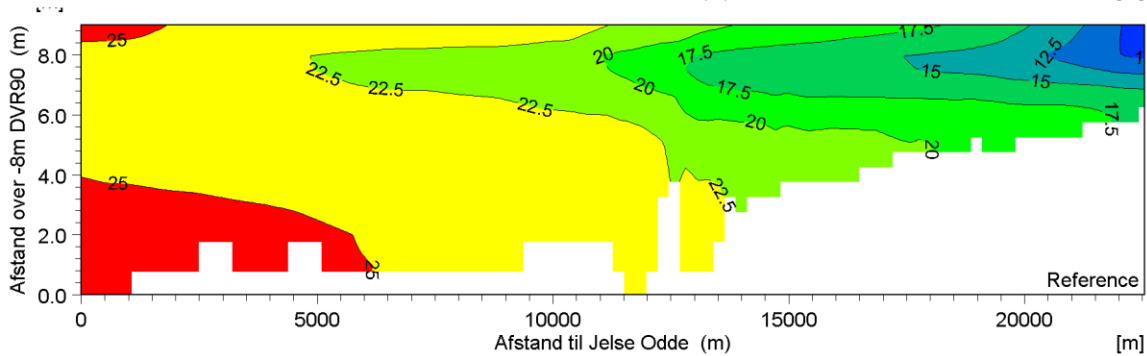
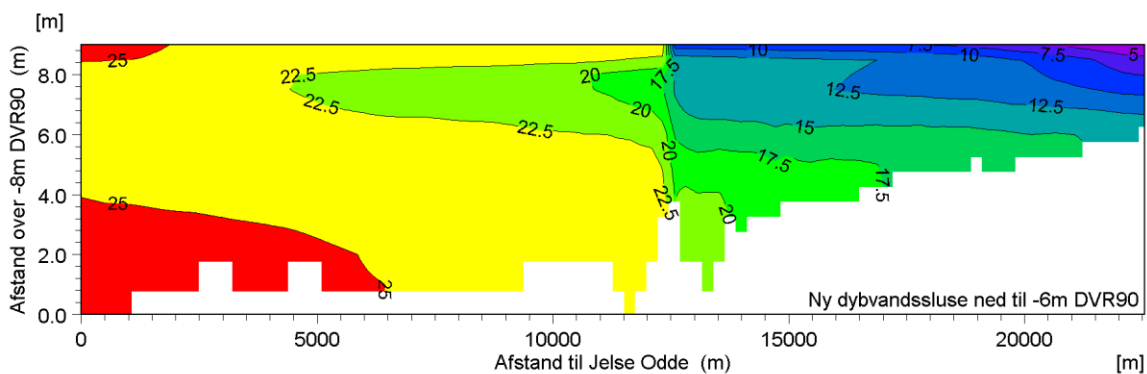
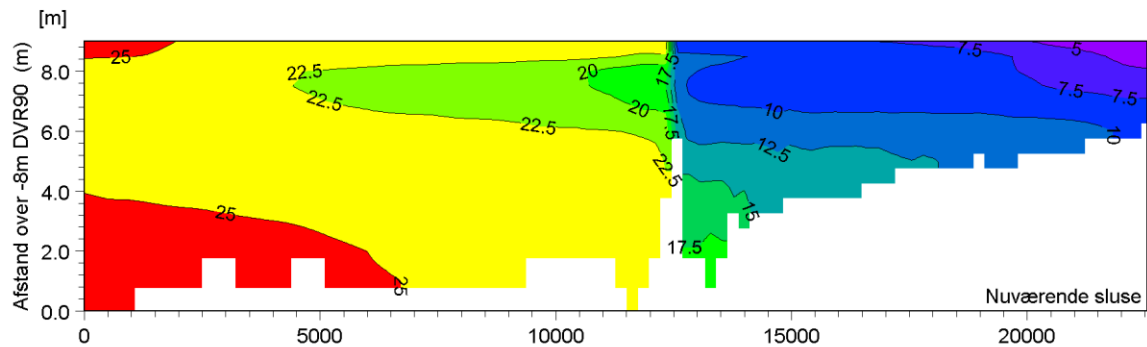
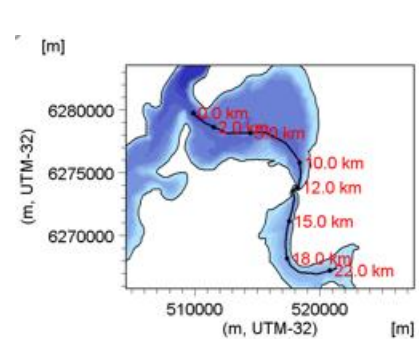
Overflade

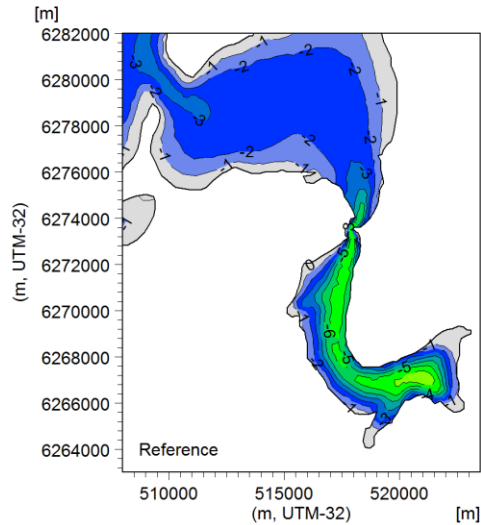
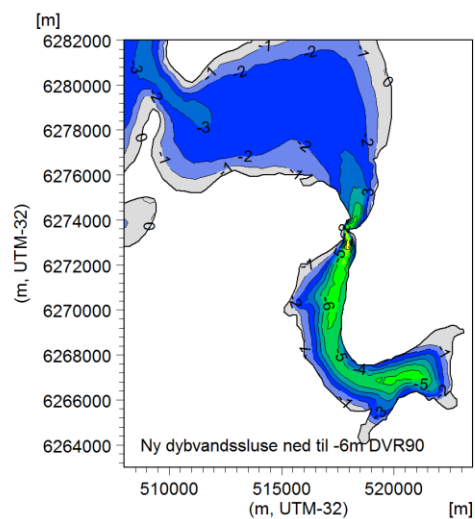
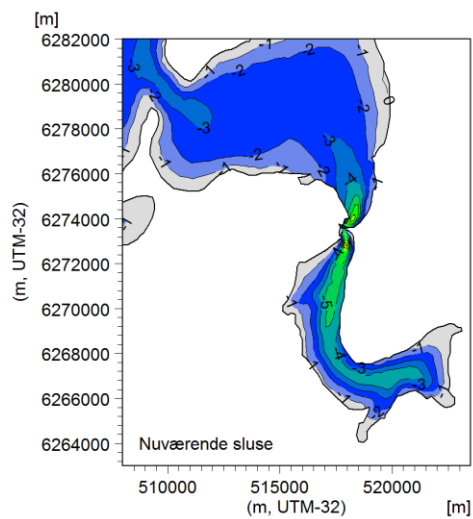


Bund

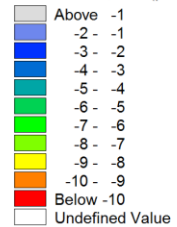




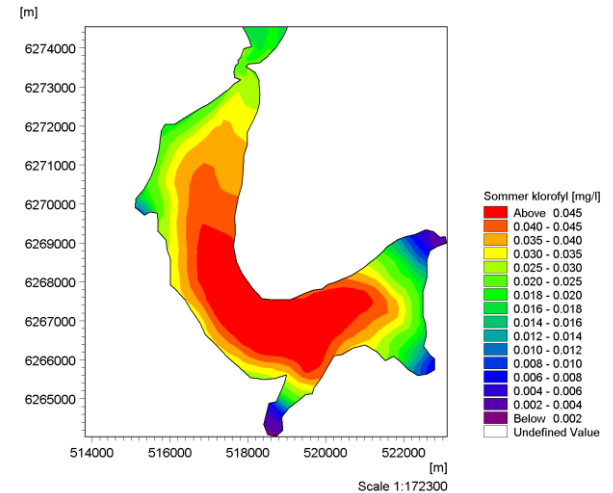
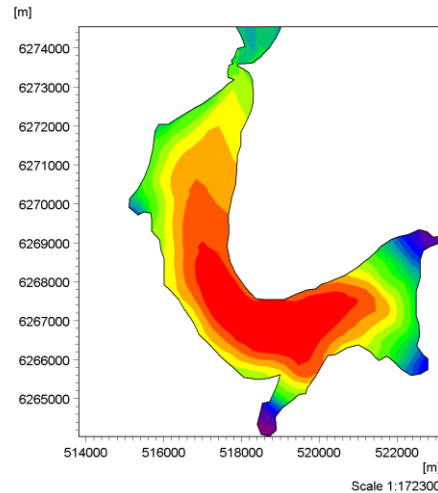
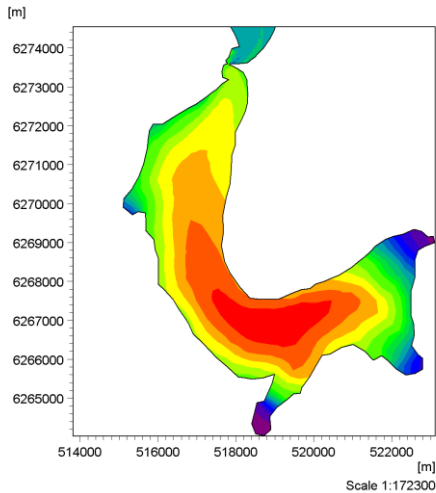




Middelforskel, salt (psu)



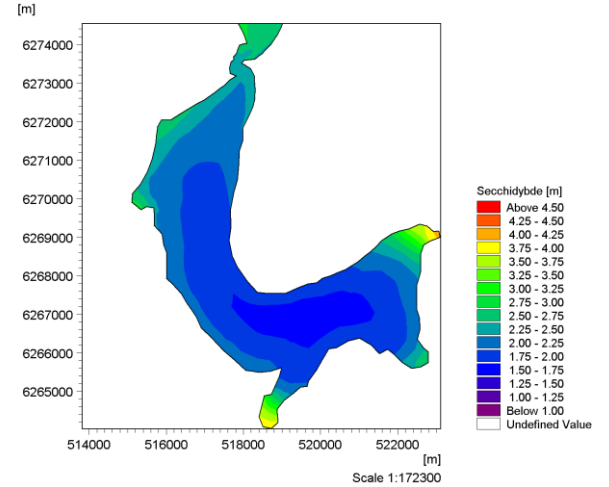
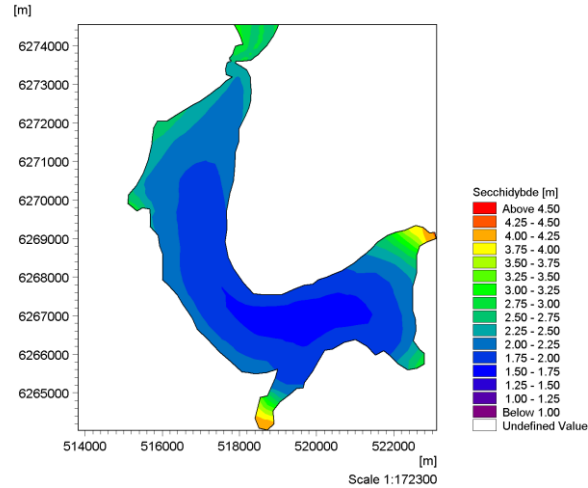
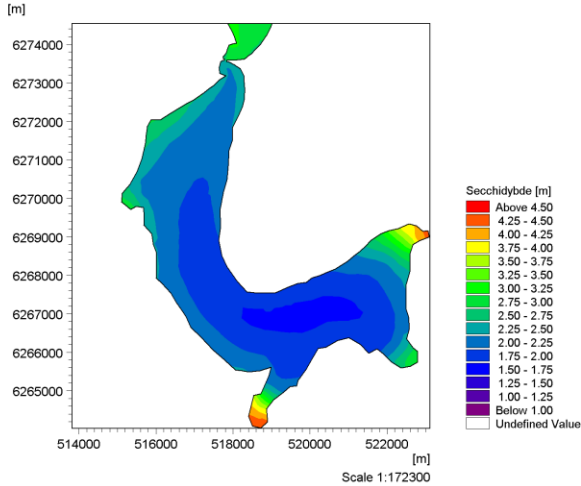
Klorofyl-a



Tabel 7-2 Sommermiddelt koncentration af klorofyl-a i Hjarbæk Fjord. Bemærk at enheden er $\mu\text{g/l}$.

	<i>Nutid</i>	<i>Uddybet sluse</i>	<i>Reference situation</i>
Koncentration	30 $\mu\text{g/l}$	32 $\mu\text{g/l}$	33 $\mu\text{g/l}$

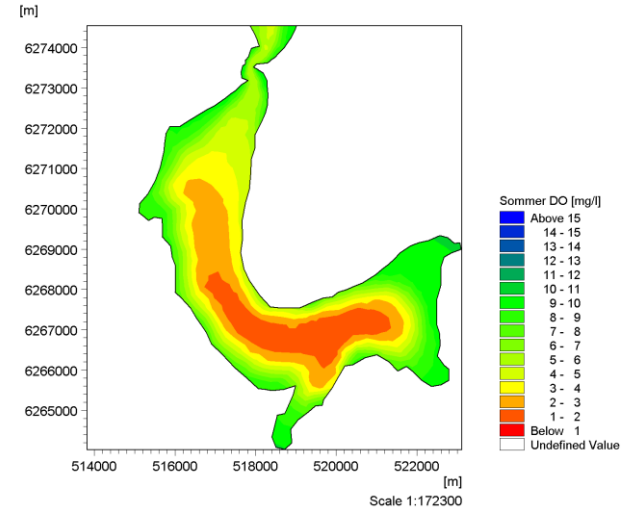
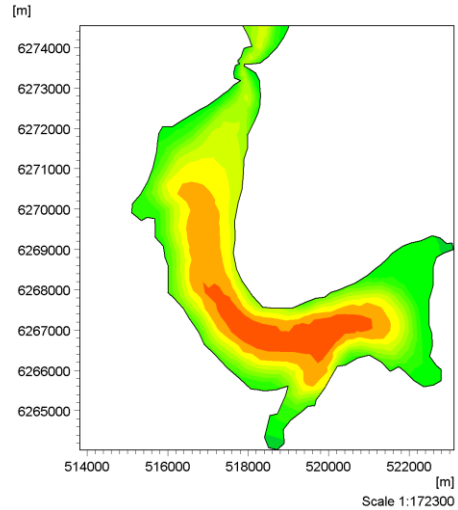
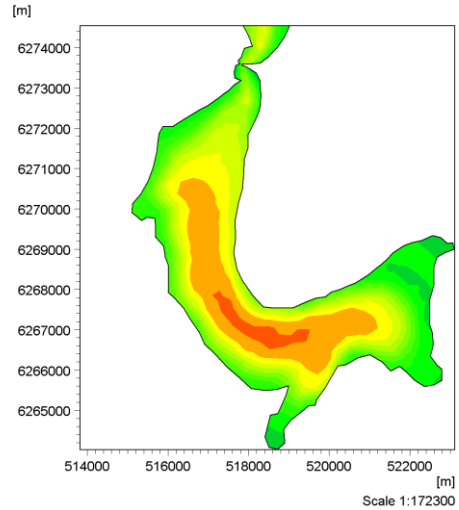
Sigtdybde



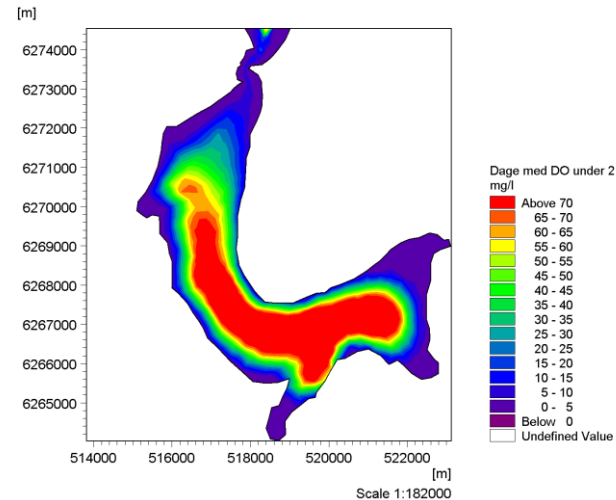
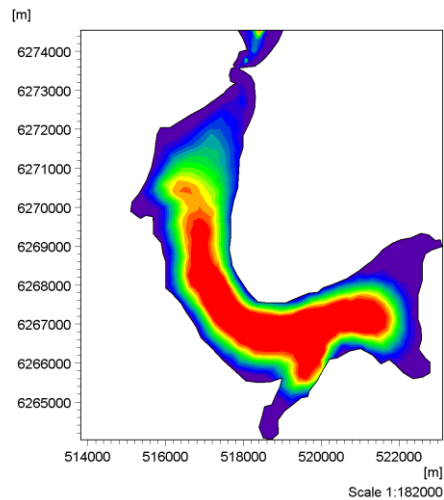
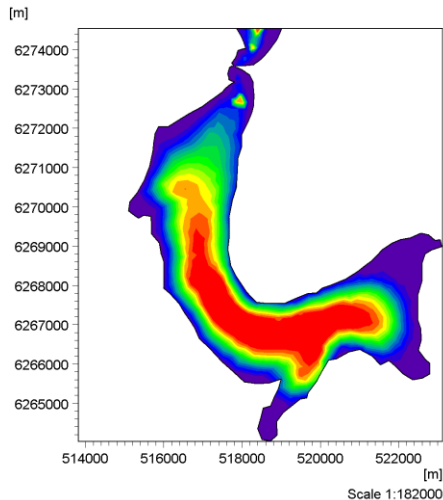
Tabel 7-3 Middel sigtdybden i vækstperioden i Hjarbæk Fjord.

	<i>Nutid</i>	<i>Uddybet sluse</i>	<i>Reference situation</i>
Sigtdybde	2,2 m	2,1 m	2,1 m

Ilt (oxygen)



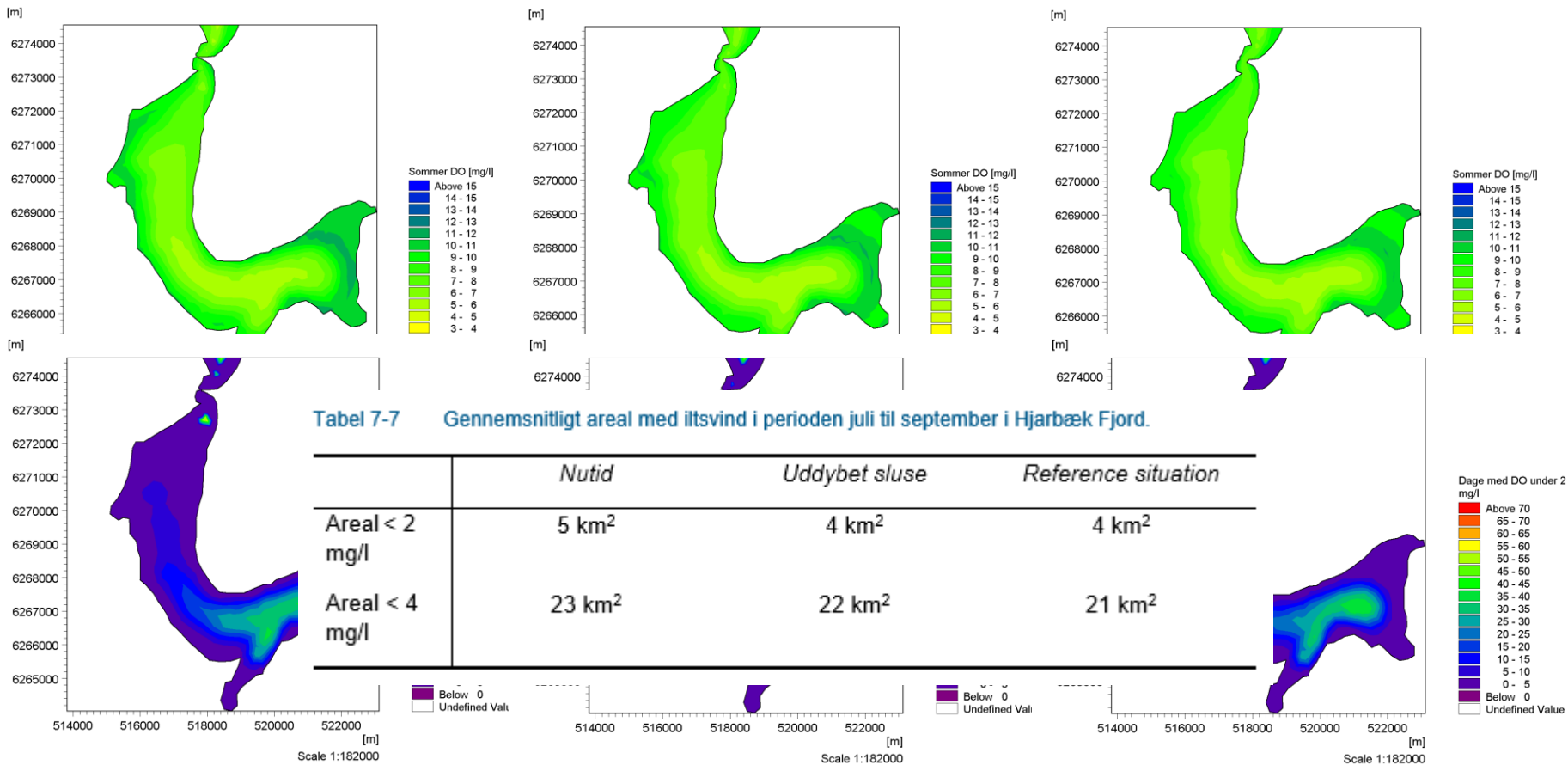
Iltsvind



Tabel 7-4 Gennemsnitligt areal med iltsvind i perioden juli til september i Hjarbæk Fjord.

	<i>Nutid</i>	<i>Uddybet sluse</i>	<i>Reference situation</i>
Areal < 2 mg/l	24 km ²	23 km ²	22 km ²
Areal < 4 mg/l	61 km ²	61 km ²	60 km ²

Ilt i reference-situation



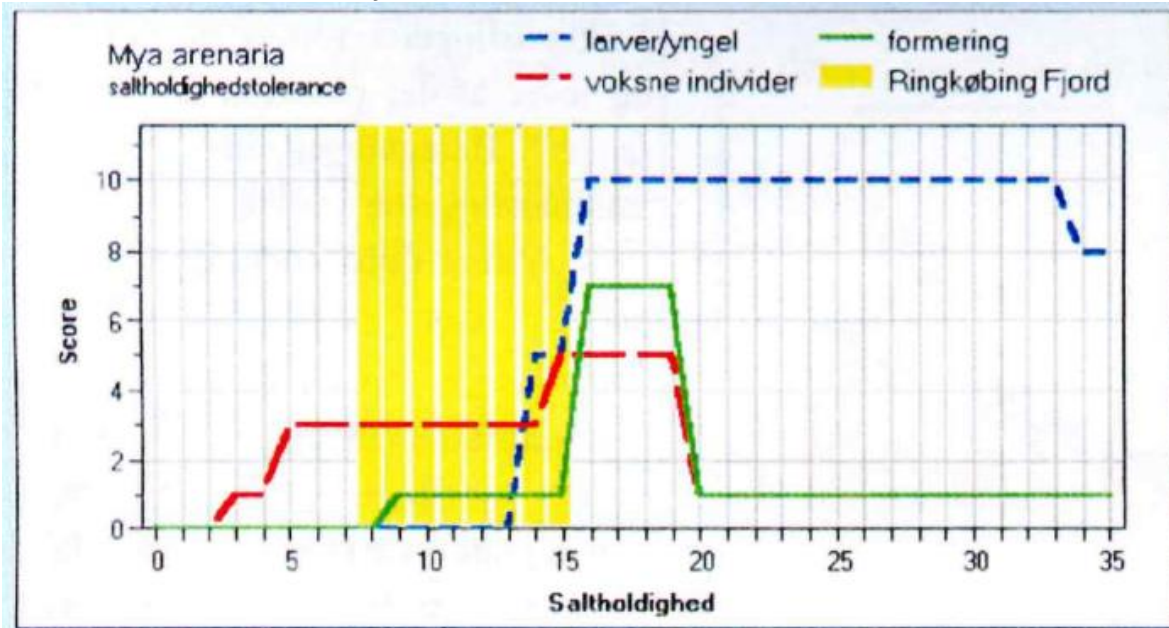
Etablering af bestande af sand- og/eller blåmuslinger i Hjarbæk Fjord



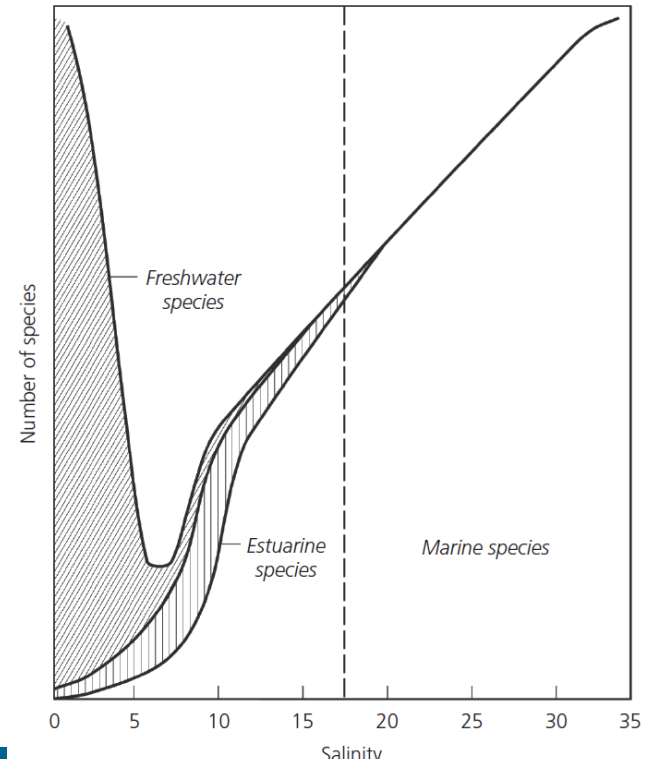
Salinitet & Biodiversitet

Mya Arenaria

- $15 < \text{PSU} < 20$ Optimale vækstbetingelser og reproduction
- $\text{PSU} < 13$ Larver settler ikke
- $\text{PSU} < 8$ Stop for larveproduktion
- $\text{PSU} < 2$ Mya forsvinder

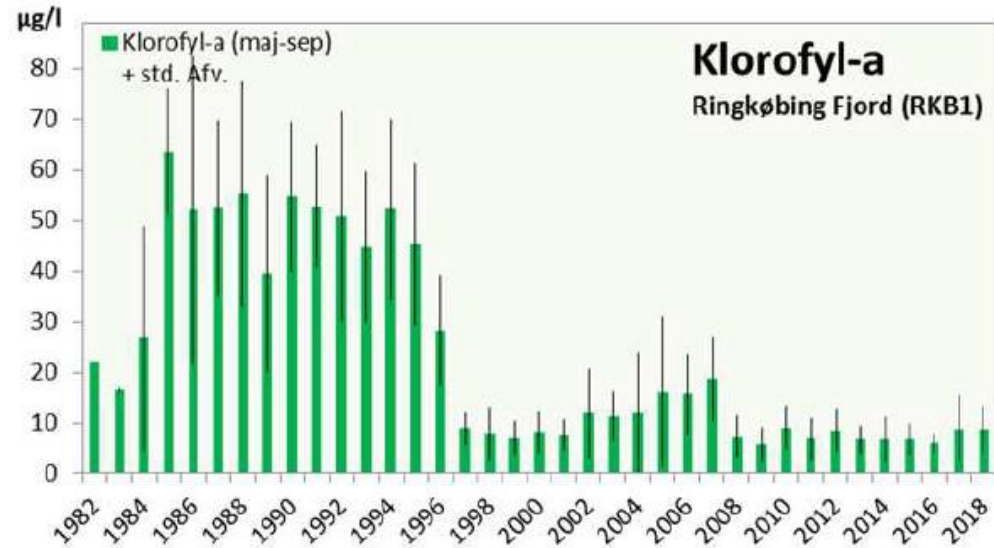
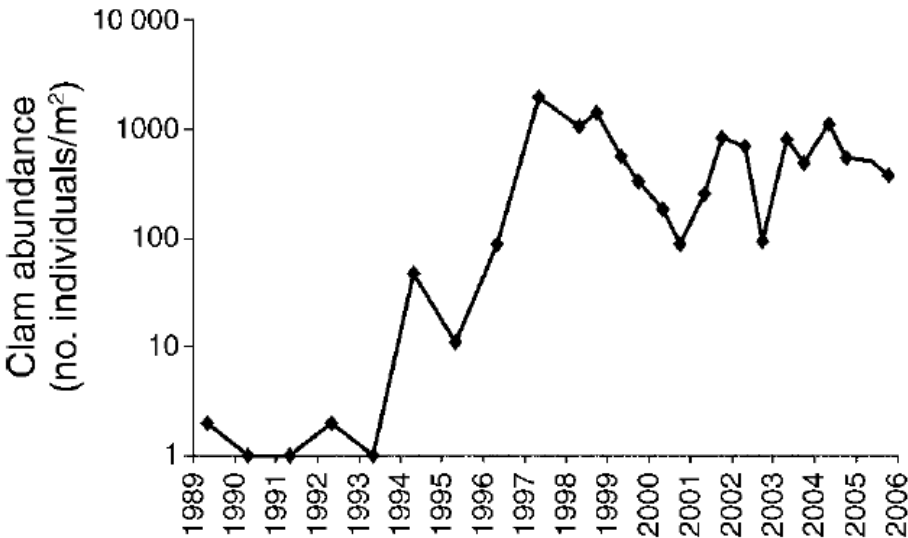


- Biodiversitet: PSU & variation I PSU



Ringkøbing historie

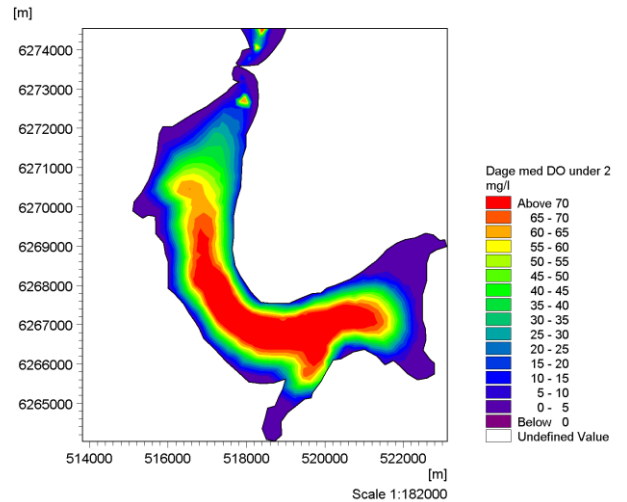
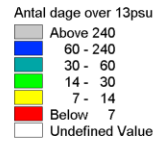
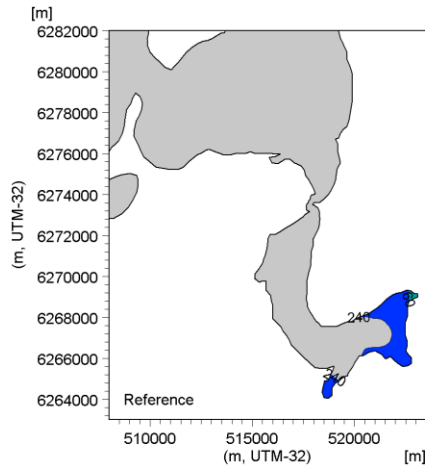
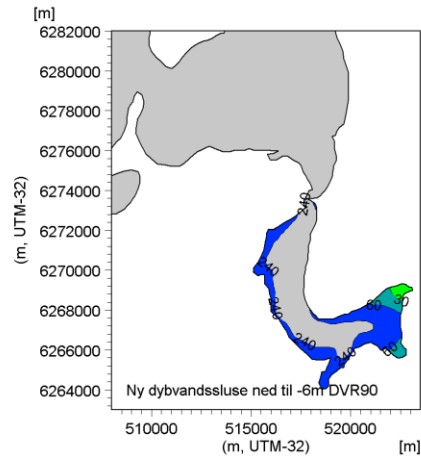
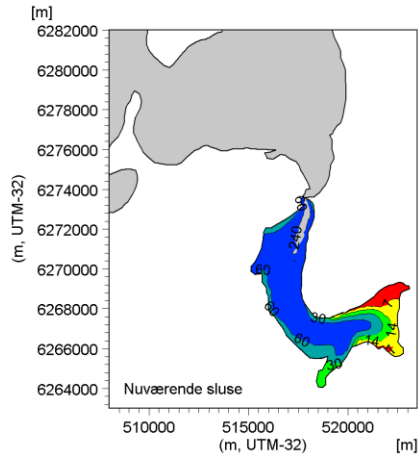
- 1996-1998 Masiv invasion af sandmuslinger (*Mya arenaria*) → reduction i klorofyl-a koncentrationer pga filtrering



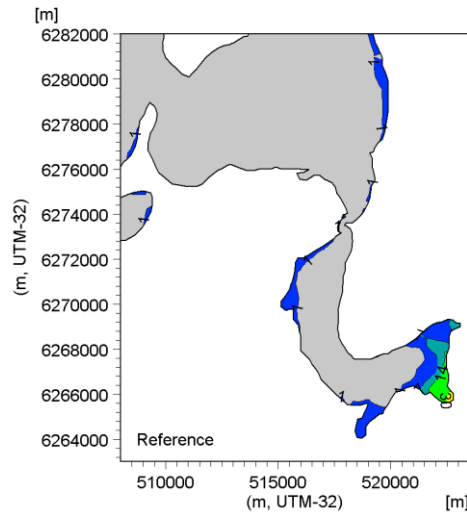
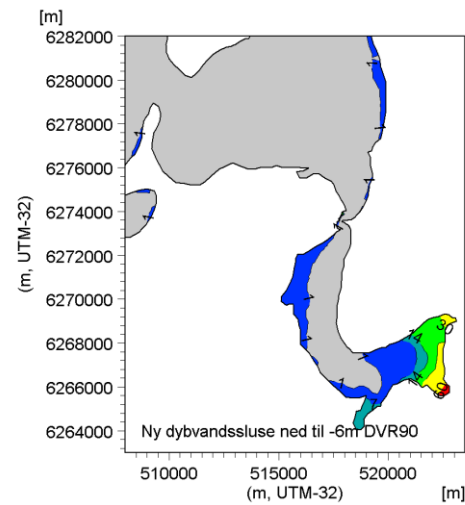
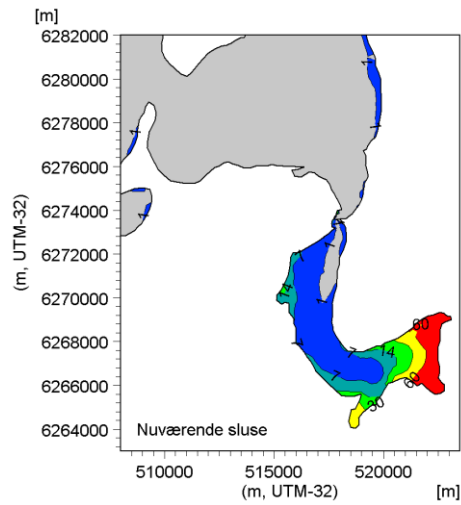
Modellering af muslinger i Hjarbæk Fjord

- Vigtige forudsætninger for etablering af større bestande af muslinger er at der er adgang til føde (fytoplankton; klorofyl) og at saltforholdene er i orden.
- Modellen for Hjarbæk Fjord er baseret på den overordnede Limfjordsmodel. Der er to forhold der gør sig gældende for den generelle Limfjordsmodel, som har en betydning for modelleringen af klorofyl-a i Hjarbæk Fjord:
 - Modellen for Limfjorden modellerer ikke biomassen af muslinger eksplicit, som det eksempelvis er gjort i modellen for Ringkøbing Fjord. I Limfjordsmodellen modelleres udelukkende et græsningstryk, som korrigeres for iltindhold og fødegrundlag.
 - I den overordnede Limfjordsmodel er der ikke kalibreret specifikt på Hjarbæk Fjord, og der er derfor valgt en tilgang, hvor der for hele Limfjorden er benyttet et specifikt og ensartet potentielt græsningstryk fra muslinger på organisk partikulært materiale.
- Derfor kan modellen ikke benyttes (i sin nuværende form) til at modellere en evt invasion af sandmuslinger / blåmuslinger

>13 psu



> 4 psu



Antal dage under 4psu

- Above 60
- 30 - 60
- 14 - 30
- 7 - 14
- 1 - 7
- Below 1
- Undefined Value

Effekter af græsning fra muslinger

Tabel 7-2 Sommermiddelværdi af klorofyl-a i Hjarbæk Fjord. Bemærk at enheden er µg/l

	<i>Nutid</i>	<i>Uddybet sluse</i>	<i>Reference situation</i>
Koncentration	30 µg/l	32 µg/l	33 µg/l

Tabel 7-5 Sommermiddelværdi af klorofyl-a i Hjarbæk Fjord.

	<i>Nutid</i>	<i>Uddybet sluse</i>	<i>Reference situation</i>
Koncentration	7 µg/l	7 µg/l	7 µg/l

Tabel 7-3 Middelværdi af sigtdybden i vækstperioden i Hjarbæk Fjord.

	<i>Nutid</i>	<i>Uddybet sluse</i>	<i>Reference situation</i>
Sigtdybde	2,2 m	2,1 m	2,1 m

Tabel 7-6 Middelværdi af sigtdybden i vækstperioden i Hjarbæk Fjord.

	<i>Nutid</i>	<i>Uddybet sluse</i>	<i>Reference situation</i>
Sigtdybde	2,9 m	3,1 m	3,2 m

Tabel 7-8 Sommermiddelværdi af klorofyl-a og middelværdi af sigtdybden i vækstperioden i Hjarbæk Fjord. Begge belastningsscenerier er uden græsning fra muslinger.

	<i>Nutid</i>	<i>Reference situation</i>
Koncentration	37 µg/l	8 µg/l
Sigtdybde	1,8 m	2,5 m



Tak for Jeres opmærksomhed