

CORDINO

**Understanding coral distribution and
conditions for growth in Norwegian waters**

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Presented by stand-in
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Geilo 29-30. January 2007

CENTRAL AMERICA 2006/2007

TRAVEL BLOG FOR MY TOUR TO CENTRAL AMERICA 2006/2007

THURSDAY, JANUARY 25, 2007

San Pedro, Guatemala 24-25/1-2007

At the first day at class, Ramon managed to fish out of me that I had been a teacher in mathematics in Norway. He then asked if I would be interested in teaching the children in one of their help projects mathematics when I was here. This sounded very interesting, and even though I know not much Spanish, I naturally was willing to help.

I started at 7.30. The first day I had absolutely no clue about what mathematical level they had, since they are between 12 and 15 years old. I choose to hold a kind of lecture, and then have a test next day.

My Spanish class was at 16.00 the second day, so I had plenty of time to go around in town and do my homework. (Yes, I did get homework.)

Today I let the pupils do the same kind of exercises that I showed them yesterday. It is basically multiplication into parentheses and multiplication and simplification of fractions, and I see that we have some work to do. The language is naturally a barrier, but the pupils are from very poor families that can not afford to pay for their school, so I think they are willing to give it a try, and I guess they also hope that my Spanish will improve.

I have decided to stay here next week also. The Spanish is tough, but I think I learn a lot in a very short time and that is good since I only have a month left of my leave from my work.

<http://oyvindthiem.blogspot.com/>

ABOUT ME



**OYVIND THIEM
BERGEN, NO**

I am working as a
ocean modeller on a
research institute

called The Bergen Center for
Computational Science which is
located in Bergen, Norway.

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MY PICTURES

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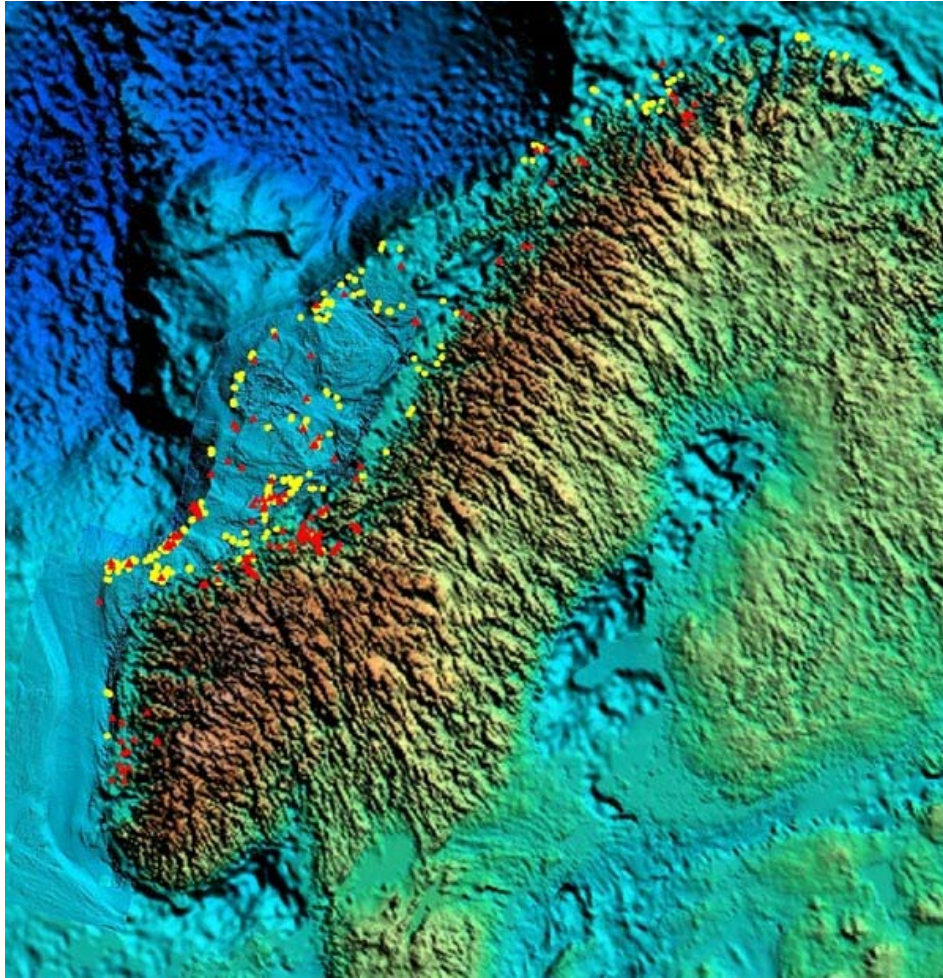
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TRAVEL IN CENTRAL AMERICA
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Coral distribution



- *Lophelia pertusa*
 - Deep/cold water coral
 - Reef builder
 - Norwegian waters
 - 250-300m depth
 - Shelf break
 - Ridges on shelf
 - Current swept areas
 - Fjord sills

Coral information



- ***Lophelia pertusa***
 - 3 times the biological diversity
 - 800 species identified in the vicinity
 - Reefs good fishing places
 - Bottom trawling
 - Damage of reefs

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Miljøtrusselen som ikke synes

Tråling ødelegger havbunnen og er en langt større trussel mot miljøet enn oljeutslipp som i Fedje, mener marinbiologer.

PER KRISTIAN AALE

(Først publisert: 29.01.07 | Oppdatert: 29.01.07 kl. 00:00)

» Siste 100 artikler

Tusenvis av sjøfugl er trolig døde fordi de er blitt tilgriset av olje fra det havarerte lasteskipet "Server" ved Fedje, og sist uke holdt 60 personer fortsatt på med å rydde opp i oljesølet. Internasjonalt anerkjente marinbiologer mener utslippet på lang sikt ikke vil ha noen store konsekvenser for miljøet. Derimot påstår de at fiskernes utstrakte bruk av trål har langt større skader.

- Den negative effekten av tråling på det marine økosystemet, er mye verre enn oljeutslipp. Tråling skjer hver dag, men oljeutslipp skjer svært sjelden, påpeker Professor Michel J. Kaiser ved Wales-Bangor-universitetet overfor Aftenposten.

Mindre mangfold.

Når trålpøsen skrapet langs bunnen, drar den med seg og ødelegger store mengder planter og bunndyr, og mange av disse artene er svært sårbare og ikke tilpasset slik røff behandling. I tillegg hvirvles det opp betydelig mengder sand som dreper mange organismer. Dette er med på å endre strukturen og funksjonen til økosystemet.

- Tråling fører til en kraftig reduksjon i levende materiale på bunnen; vi får mindre biologisk mangfold. Mange av artene på bunnen vokser svært sakte, og det kan ta tiår før de kommer seg igjen. Mye av det som blir fjernet med trålpøsen, vil kanskje aldri komme tilbake igjen, frykter Kaiser.

Han får støtte av John Gray, professor i marinbiologi ved Universitetet i Oslo.

- Den negative effekten av oljeutslipp er bare bagateller i forhold til de ødeleggelsene som fiskerne forårsaker. Den største trusselen mot det biologiske mangfoldet i havet er



- Vi innrømmer at vår aktivitet har innvirkning på faunaen, men det har all menneskelig aktivitet - ikke minst i matproduksjonen, sier Webjørn Barstad fra Fiskebåtredernes Forbund. Han sier at trål globalt er det desidert viktigste fiskeredskapet. (Foto: KV TROMSØ / SCANPIX)



Havforskningsinstituttet kartlegger bunnen i Barentshavet, og har dokumentert at havbunnen på Tromsøflaket nærmest er plyd av trålere. (Foto: HAVFORSKNINGSINSTITUTTET)



Ni av ti videoobservasjoner viste trålerspor, og i snitt ble ett spor pr. 25 meter observert. (Foto: HAVFORSKNINGSINSTITUTTET)

ANDRE NYHETER:

SKYTESKIVE



Litvinenko brukt som blink i russisk militærøvelse. [Les saken](#)

TAKKER HUNDENE



Overlevde to døgn i snøen. [Les saken](#)

SKANDALER I KØ



Presidentkandidat lurte trill rundt. [Les saken](#)

TRE DØDE



Spøk ble tragedie. [Les saken](#)

LURTE TERBOVEN



Filmstjernen Sonja Wigert var hans elskerinne. [Les saken](#)

Effects of trawling



Fragments of dead Lophelia from a trawling ground on the Norwegian continental shelf (190m depth, 17, May 1999). Ditch probably due to the trawl bobbins.

Important aspects



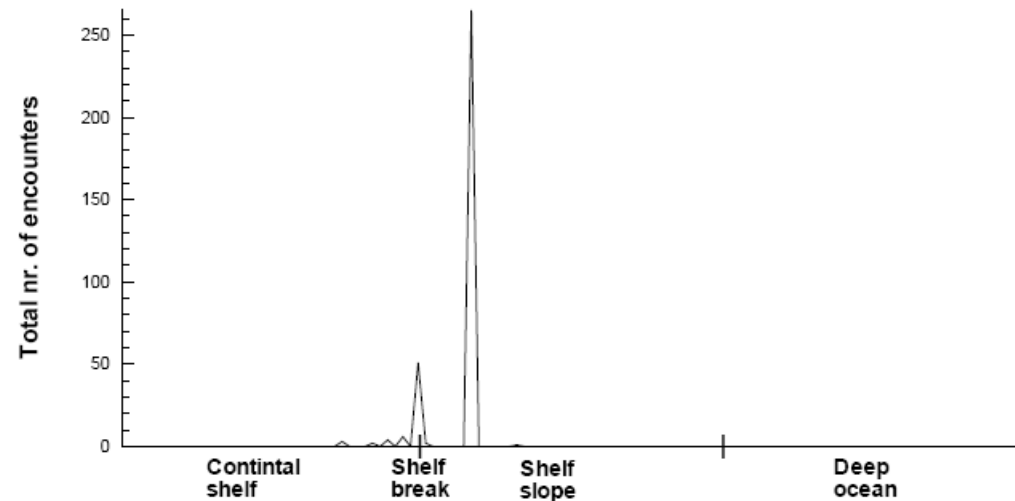
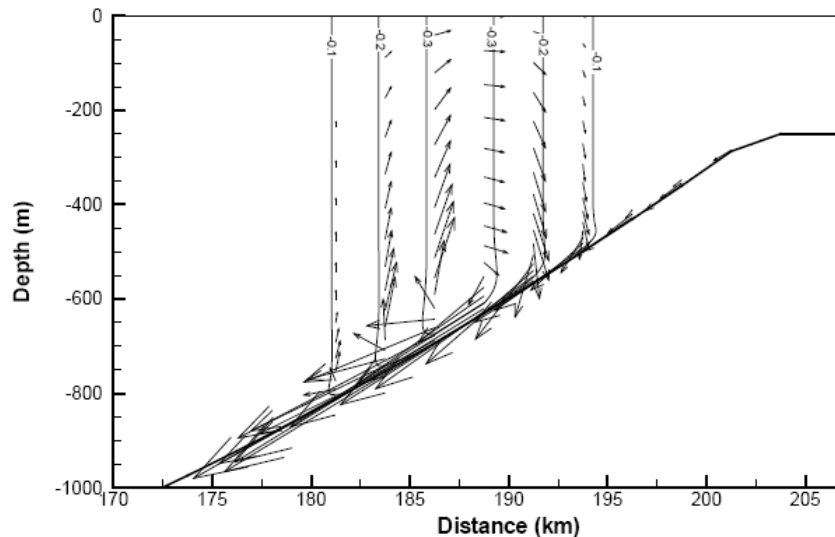
- *Lophelia pertusa*
 - Unknown
 - Larval development
 - Growth (1mm/yr)
 - Feeding
 - Ecological importance
 - Physical factors for reef development

Reef example



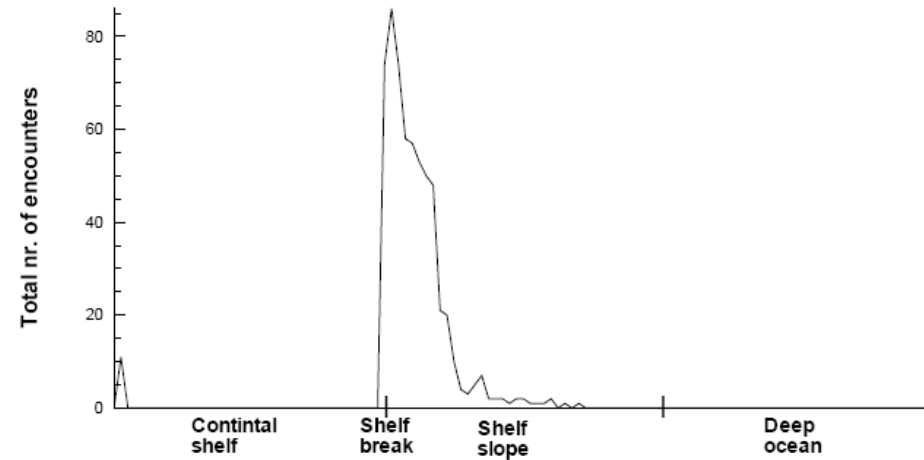
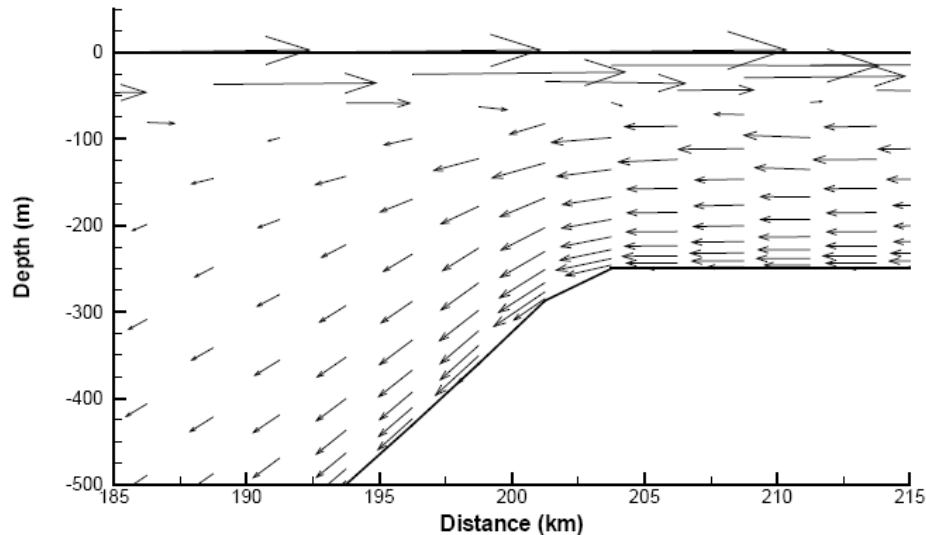
- **The Sula reef**
 - 10 000 years old
 - 30m heights
 - Length 13km
 - Width up to 400m

Previous work: Atlantic inflow



Idealized simulation of Atlantic inflow, showing that particles penetrate the benthic layer at the upper shelf slope and shelf edge.

Previous work: Atmospheric low pressures



Idealized simulation of rotating wind, showing that particles penetrate the benthic layer at the upper shelf slope and shelf edge.

The Cordino project

OVERALL OBJECTIVE: *Develop efficient and accurate simulation tools for studying nutrients transport over topography for increased understanding of distribution and conditions for growth for corals in Norwegian waters*

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SPECIFIC OBJECTIVES AND WORK PLAN:

- A. DEVELOP A THREE DIMENSIONAL NON-HYDROSTATIC TERRAIN FOLLOWING OCEAN MODEL
- B. IMPLEMENT A THREE DIMENSIONAL PARTICLE TRACKING MODEL SUITABLE FOR CORAL FOOD PARTICLES
- C. USE THE COUPLED MODEL SYSTEM TO IDENTIFY WHAT CONDITIONS CORALS NEED TO GROW AND DEVELOP REEFS BASED ON TOPOGRAPHY AND CURRENT REGIME

EDUCATIONAL OBJECTIVE:

Educate one doctoral student and two post-doctoral fellows in the field of non-hydrostatic ocean process modelling, and particle movement and design.



Activity A

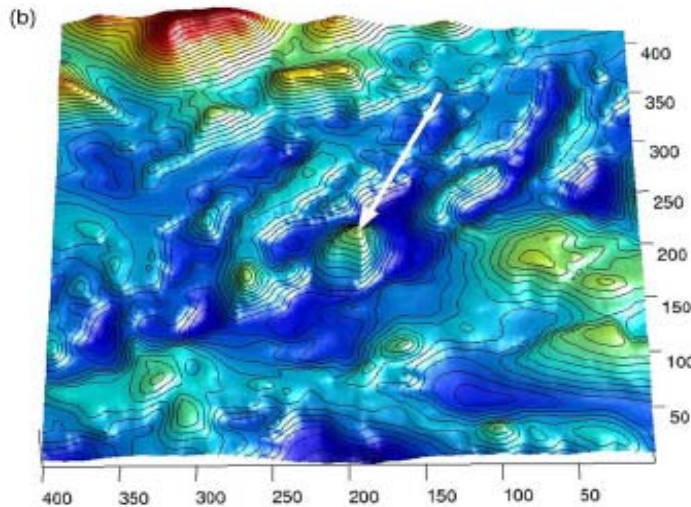
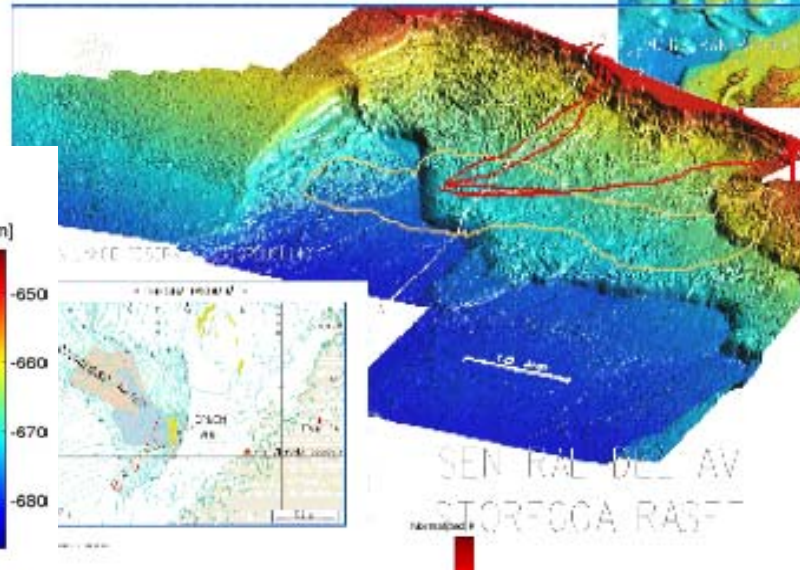
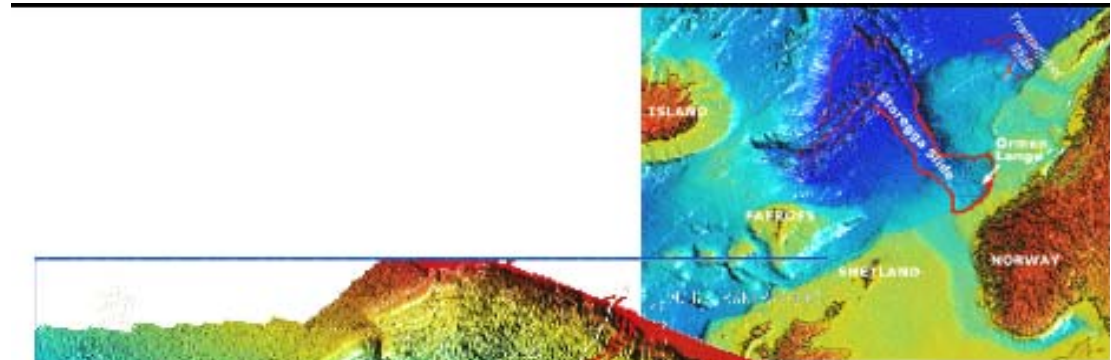
PI: Jarle Berntsen (Dep. Mathematics, UoB)

- Find a efficient three dimensional non-hydrostatic pressure solver
- Develop and implement the algorithm
- Test the algorithm

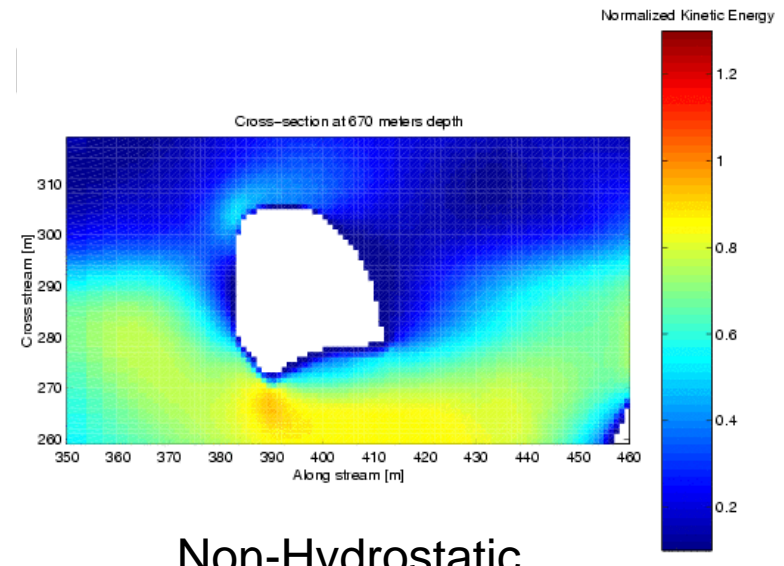
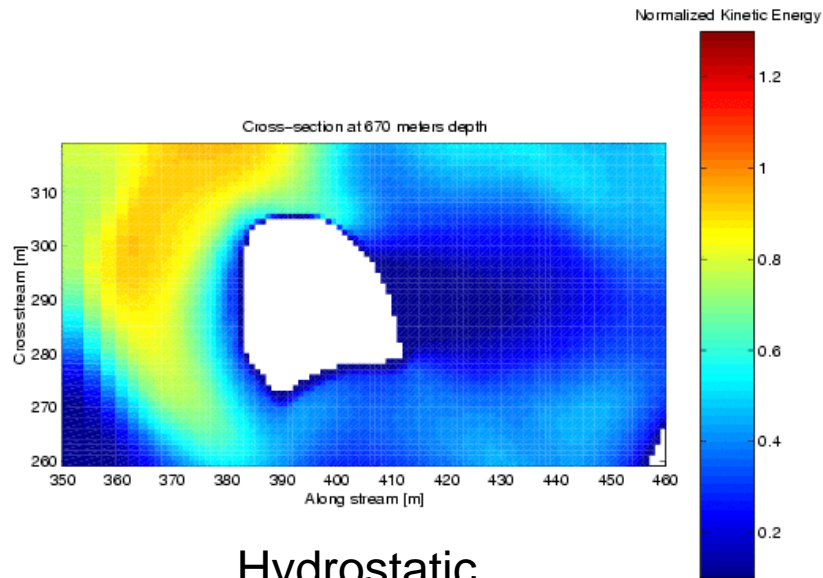
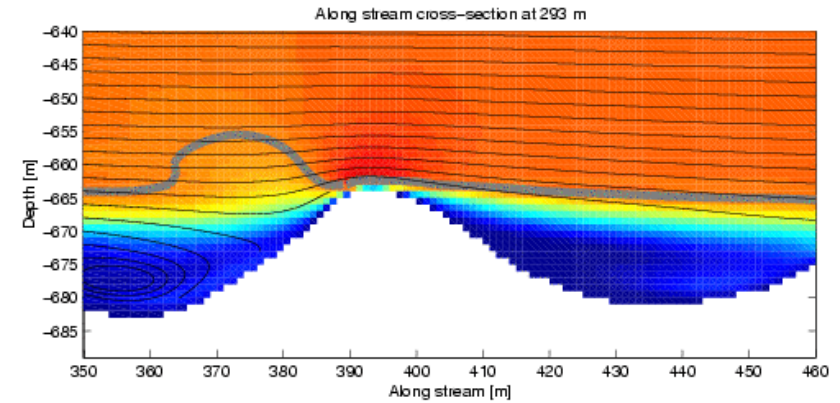
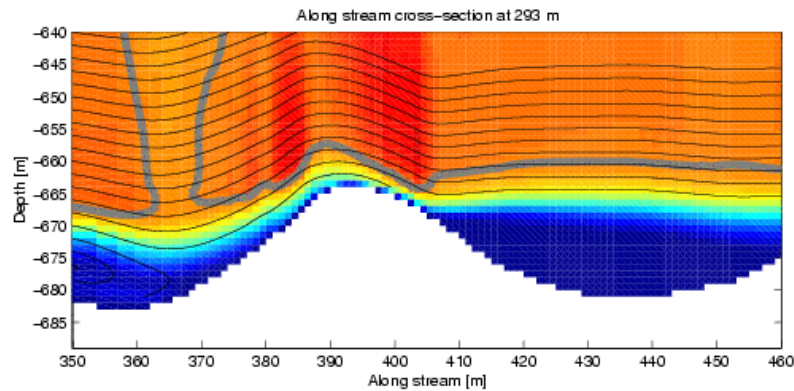
Bergen Ocean Model (BOM)

- Continuously improved since 1995 by primary developer prof Jarle Berntsen, Math Dept Uib, with contributions from IMR, Dept of Informatics UiB, and BCCS.
- The model has been used in hydrodynamic applications on meso-scale and shelf scale down to micro/industrial scales with a resolution of magnitude 1mm-100m.
- Terrain following grid (Sigma co-ordinates) enables good resolution for vertical boundary layers over complex topography.
- Arakawa C-grid with excellent wave dispersion properties in the horizontal.
- Implemented in Fortran 90, can be run in parallel via OpenMP/MPI.

The Ormen Lange exploration



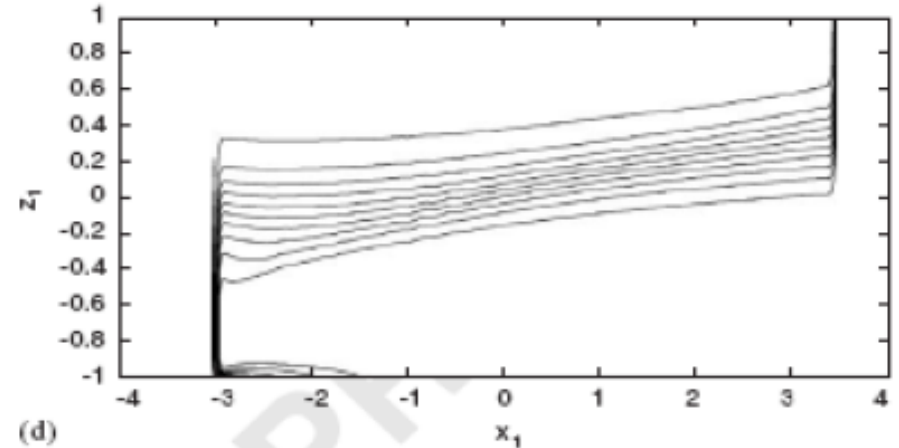
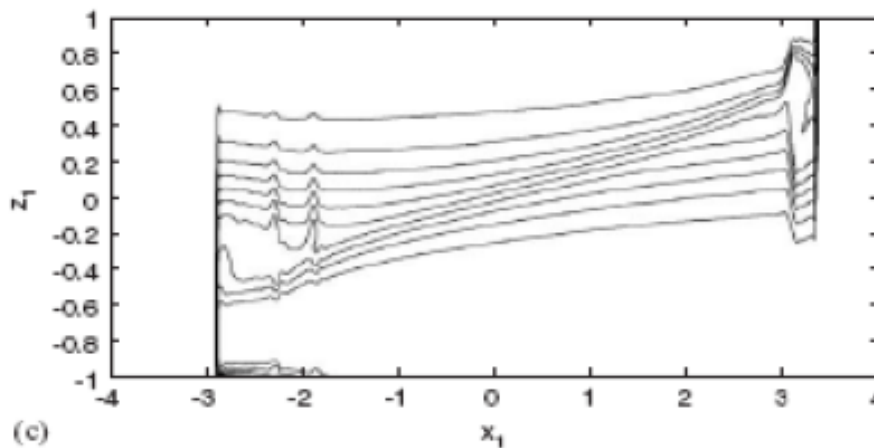
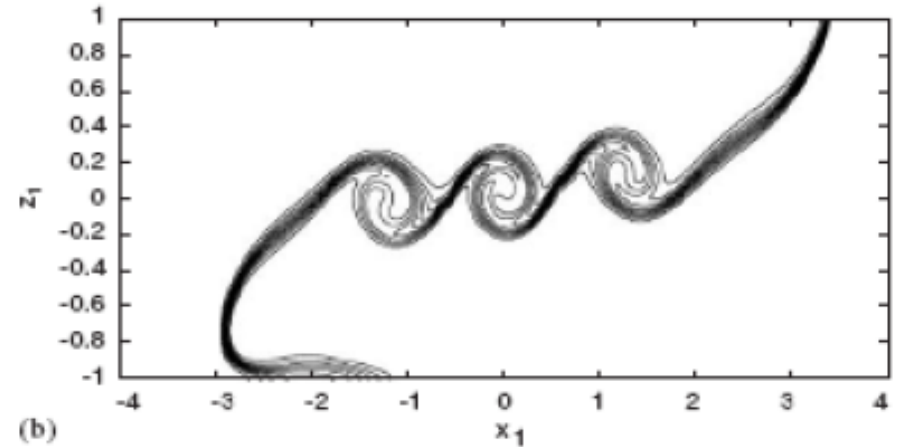
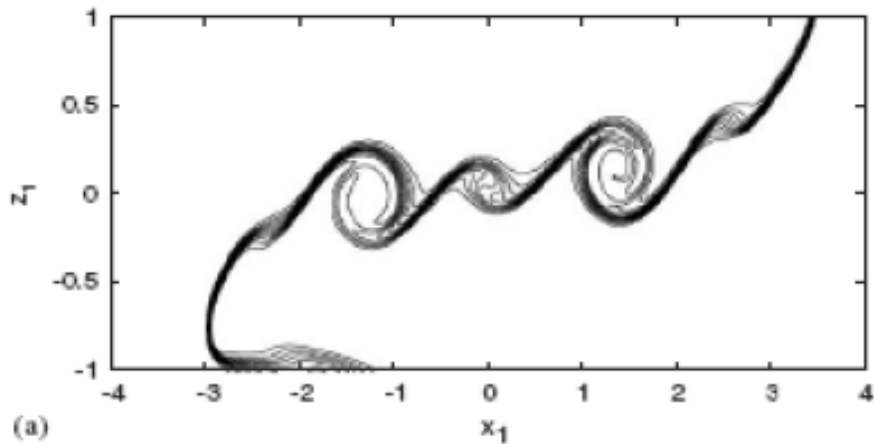
Flow over fine scale topography



Hydrostatic

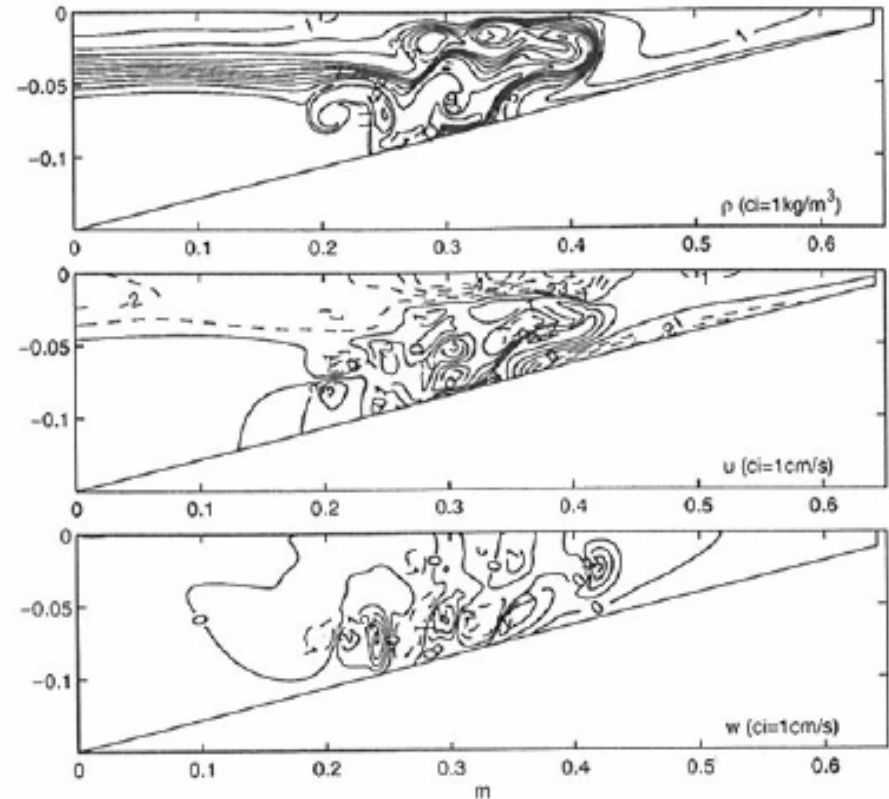
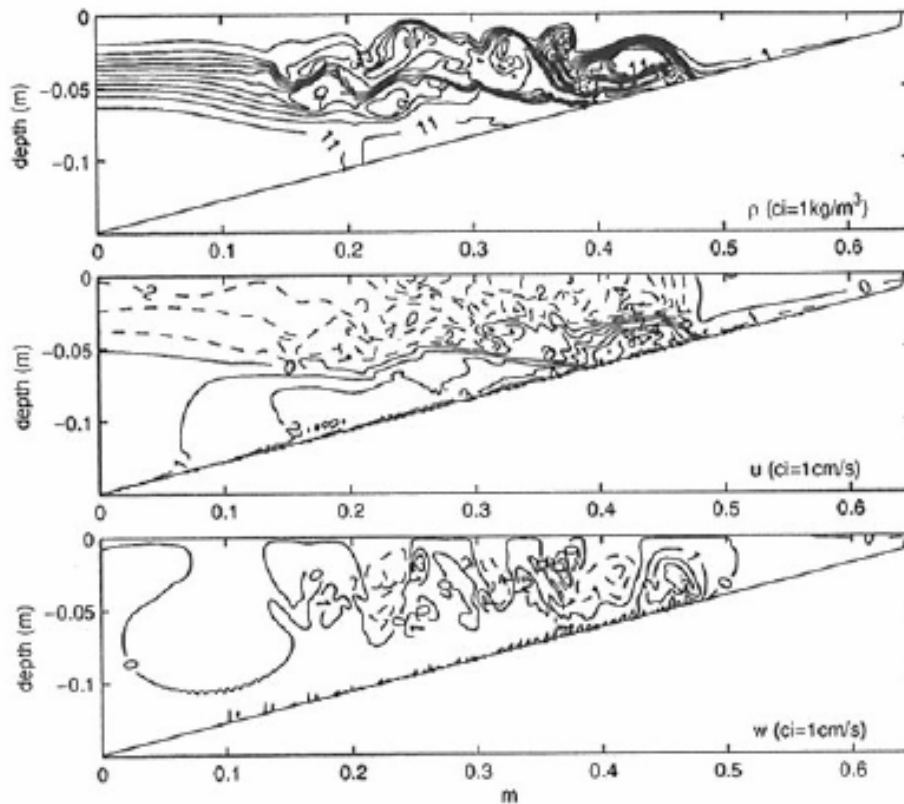
Non-Hydrostatic

Hydrostatic vs. Non-hydrostatic



Berntsen et al. / Continental Shelf Research 1

Necessity for terrain following coordinates



Activity B

PI: Bjørn Ådlandsvik (IMR)

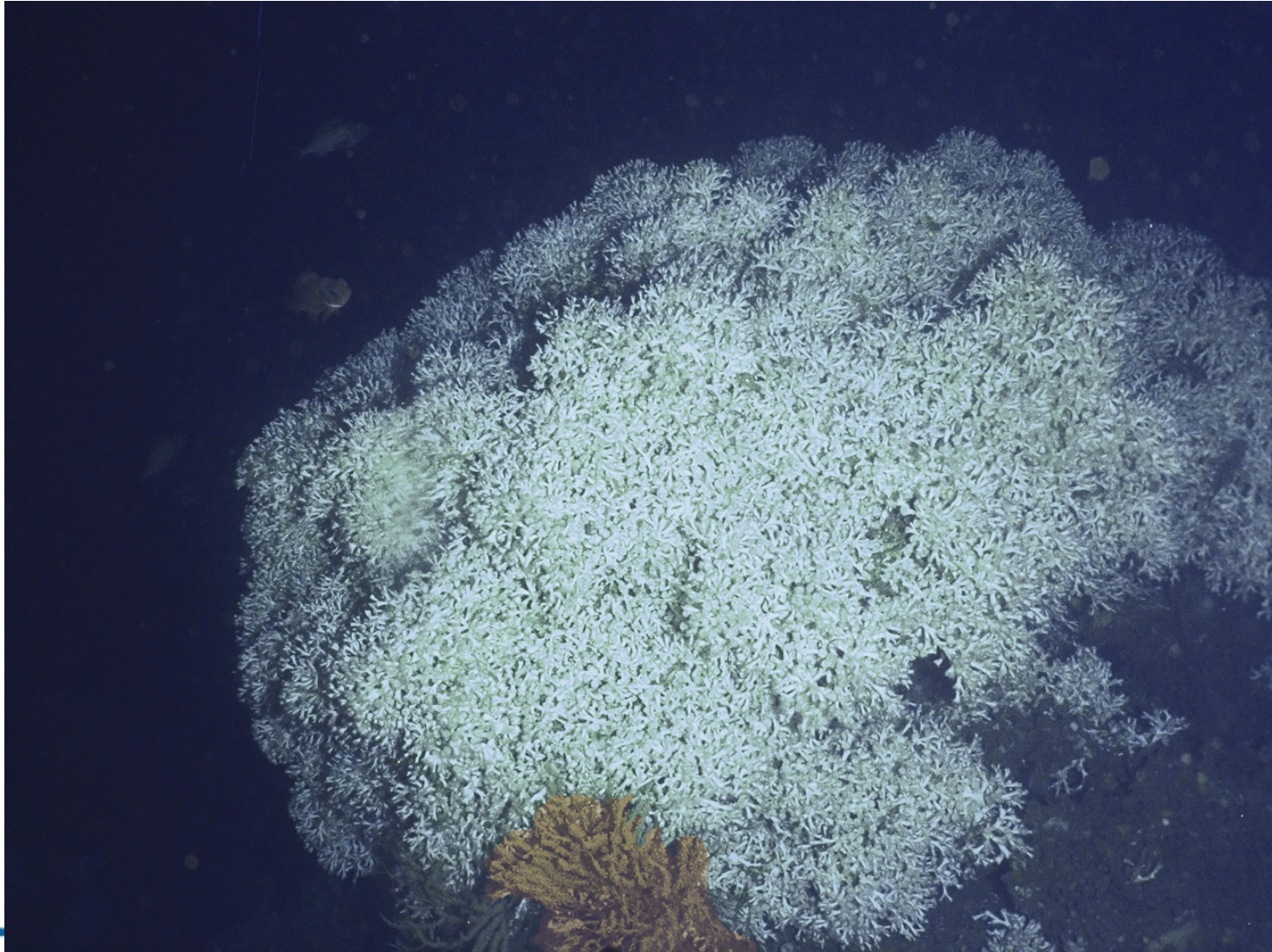
- State of art of particle tracking methods
- Find good methods for particle tracking and select the best suited algorithm
- Develop and test the method

Activity C

PI: Jan Helge Fosså (IMR)

- High resolution studies
- Can the coral reef modify the currents toward more favourable conditions?
- Will the bottom topography be decisive for where the corals settle?
- Will the current condition effect the shape of reefs
- Real area modeling

Secrets revealed?



Thanks to:

The Research Council of Norway for founding this project through the
eVITA program.■

Project Number: 176874/V30

