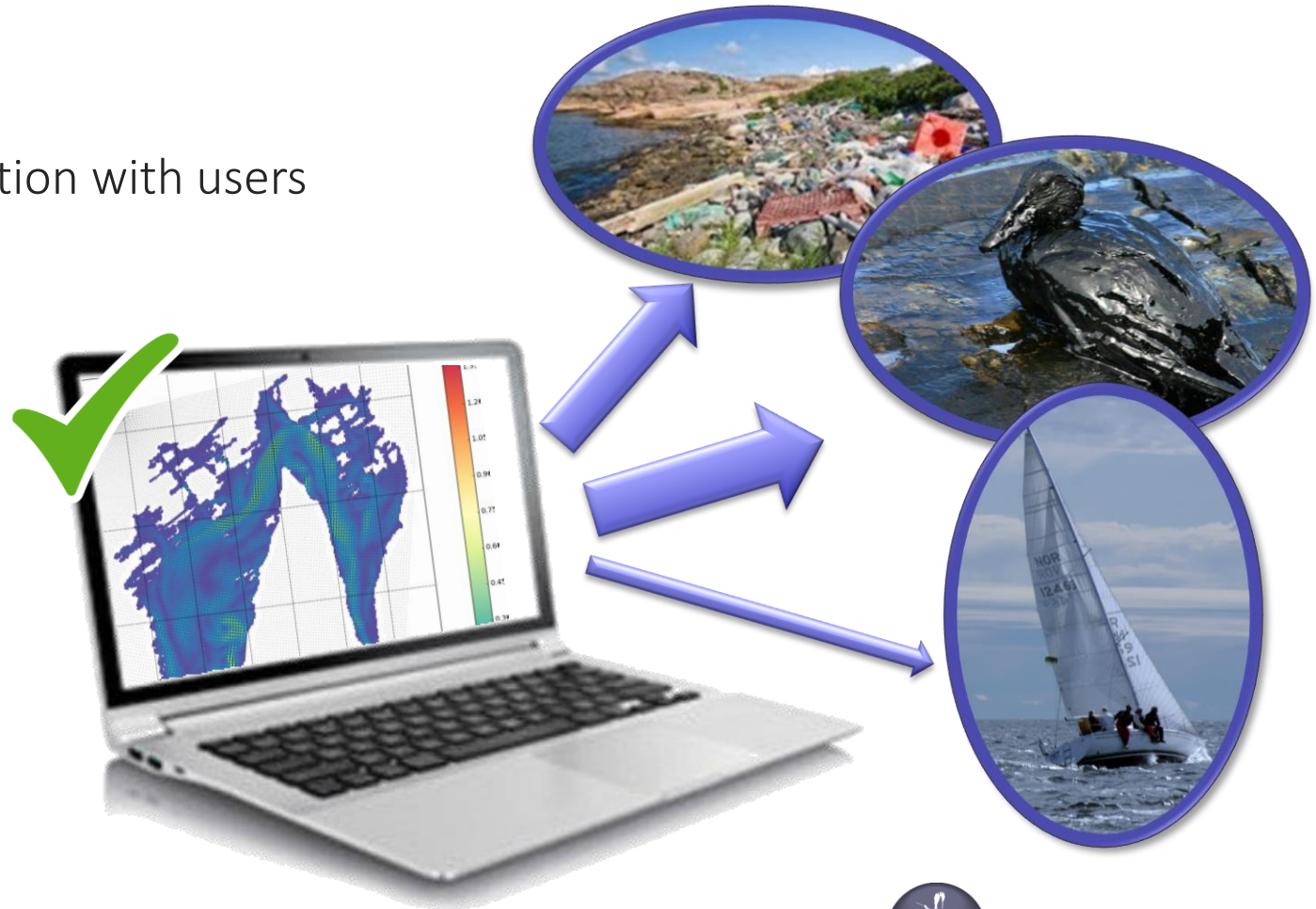**JONSMOD 2018**

Applications of the Oslofjord model

Karina Hjelmervik, USN
Nils M. Kristensen, MET
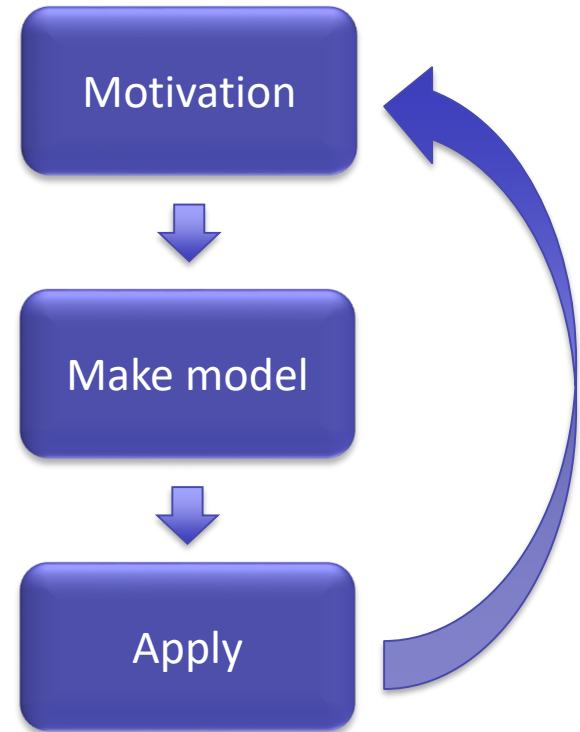
Applications of the Oslofjord model

- Motivation
- Communication with users
- Applications

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Our motivation

- Curiosity / research
- Try new techniques
- Hopefully apply it on something useful

Does not imply research funding

Motivation → Make model → Apply → Motivation

Case 1: Planned discharges
Purified sewage / hazardous waste

Possible users:
NOAH, UMB, NIVA

Case 2: Discharge
Sewage / Clorine

Possible users:
County council, NIVA

Case 3: Simulator training
Education

Possible users:
USN, Pilot service

Case 4: Ocean forecasting
Safety planning

Possible users:
Ferries, leisure boats

Case 5: Vertical profiles
Divers / Sonar operations

Possible users:
FFI, Divers

Case 6: Harbour design
Breakwaters / quay

Mulig bruker:
Harbour administration

Case 7: Search and rescue
Man over board

Possible users:
DSB, Rescue company

Case 8: Temperature
Leisure water activities

Possible users:
Bathing, city council

Case 9: Oil spill
Full City 09/Godafoss 11/ Golden Trader 11

Possible users:
Coastal administration, Exxon

Case 10: ???

Project organization

Case 1
Model development

Case 2
Oil drift

Case 3
Harbour design
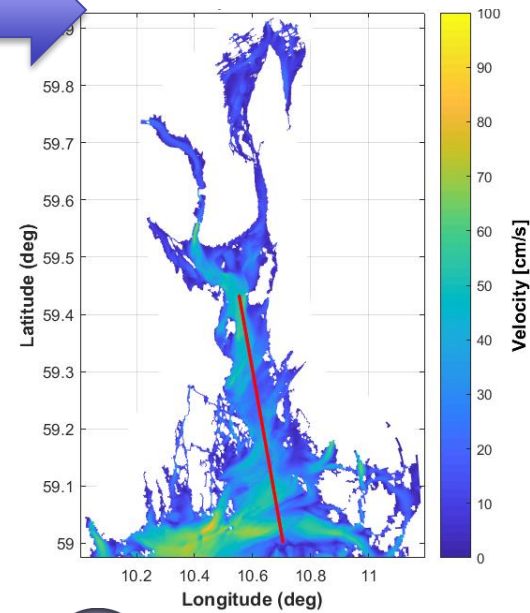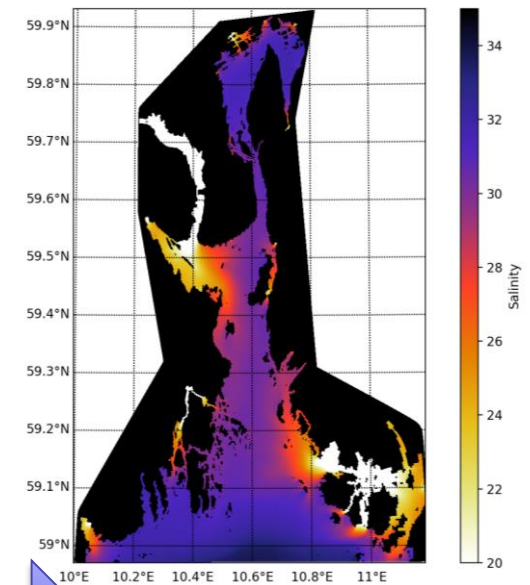
User group

User group

Research group
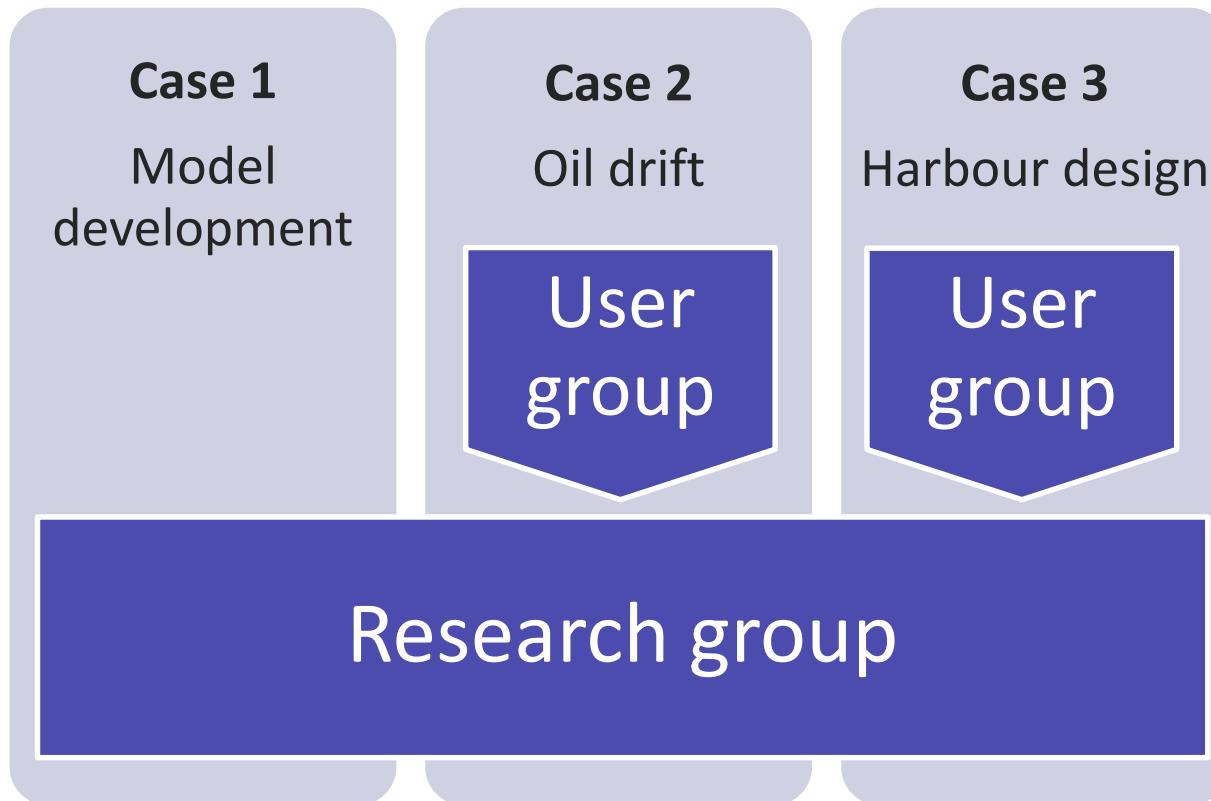
Mimic reality through equations

$$\frac{\partial u}{\partial t} + \vec{v} \cdot \nabla u - fv = -\frac{\partial \varphi}{\partial x} - \frac{\partial}{\partial z}\left(\overline{u'w'} - \nu \frac{\partial u}{\partial z}\right) + F_u + D_u$$
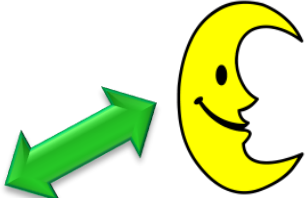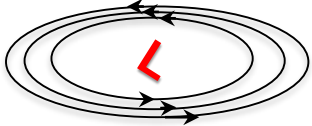
$$\frac{\partial T}{\partial t} + \vec{v} \cdot \nabla T = -\frac{\partial}{\partial z}\left(\overline{T'w'} - \nu_T \frac{\partial T}{\partial z}\right) + F_T + D_T$$

$$\rho = \rho(T, S, P)$$

$$\frac{\partial v}{\partial t} + \vec{v} \cdot \nabla v + fu = -\frac{\partial \varphi}{\partial y} - \frac{\partial}{\partial z}\left(\overline{v'w'} - \nu \frac{\partial v}{\partial z}\right) + F_v + D_v$$

$$\frac{\partial \varphi}{\partial z} = -\frac{\rho g}{p_o}$$

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$

$$\frac{\partial S}{\partial t} + \vec{v} \cdot \nabla S - \frac{\partial}{\partial z}\left(\overline{S'w'} - \nu_S \frac{\partial S}{\partial z}\right) + F_S + D_S$$
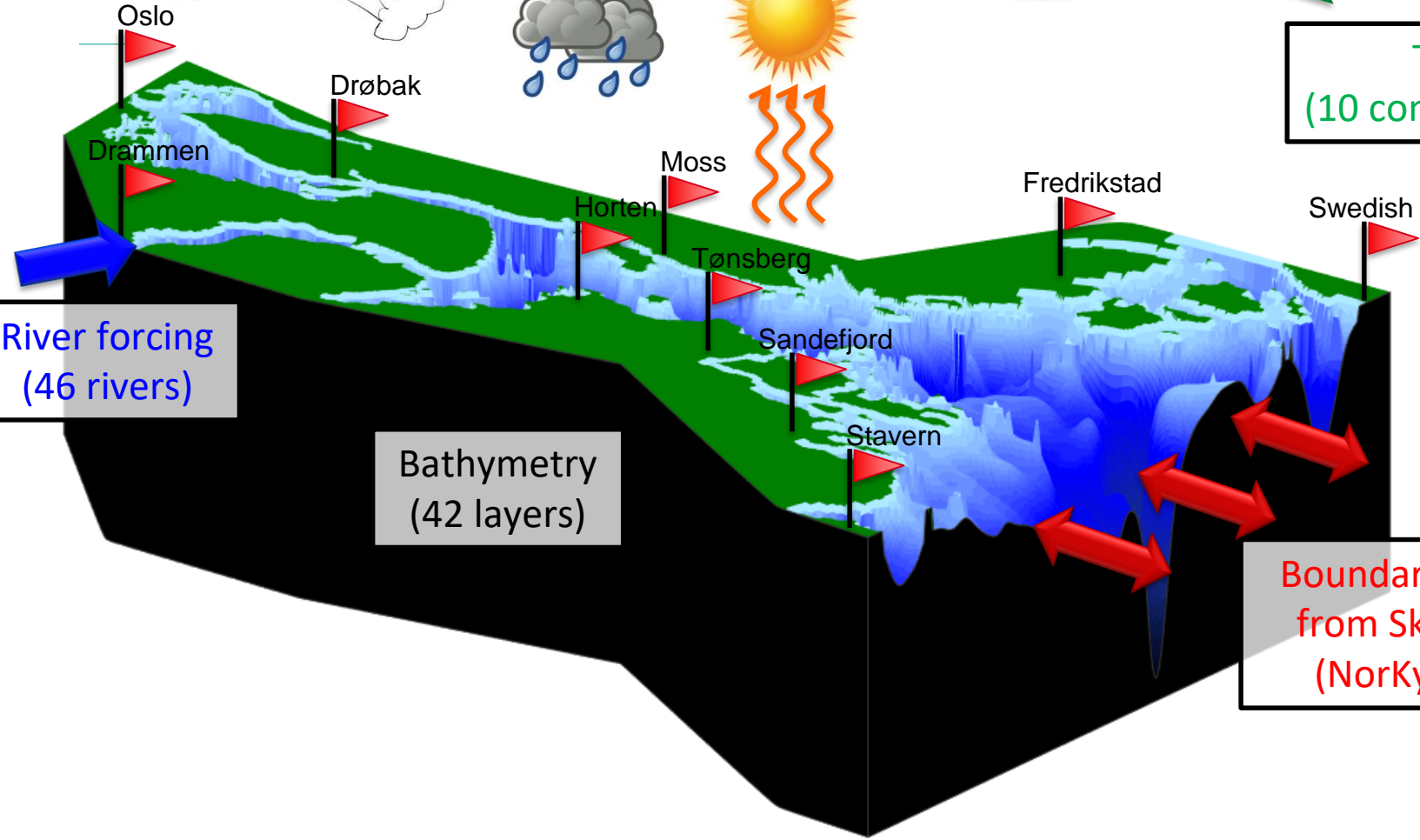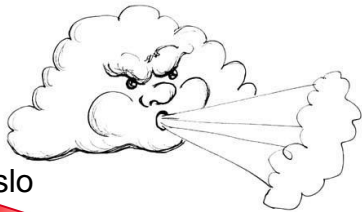
Atmospheric forcing
(Arome 2.5km)

Tide
(10 components)

Oslo

Drøbak

Drammen

Moss

Horten

Fredrikstad

Swedish boarder

Tønsberg

River forcing
(46 rivers)

Sandefjord

Stavern
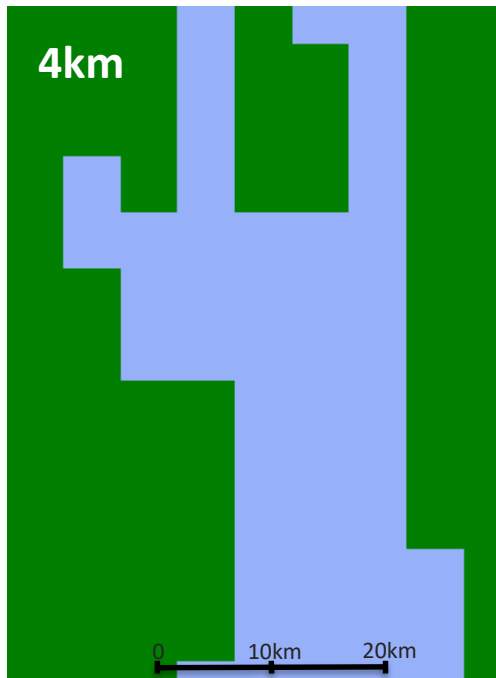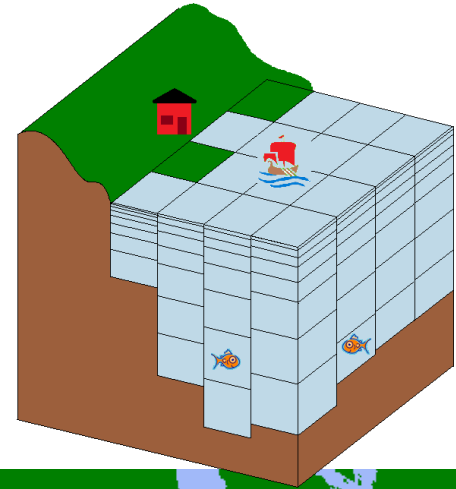
Bathymetry
(42 layers)

Boundary forcing
from Skagerrak
(NorKyst800)

Resolution

Representative values in each box

4km

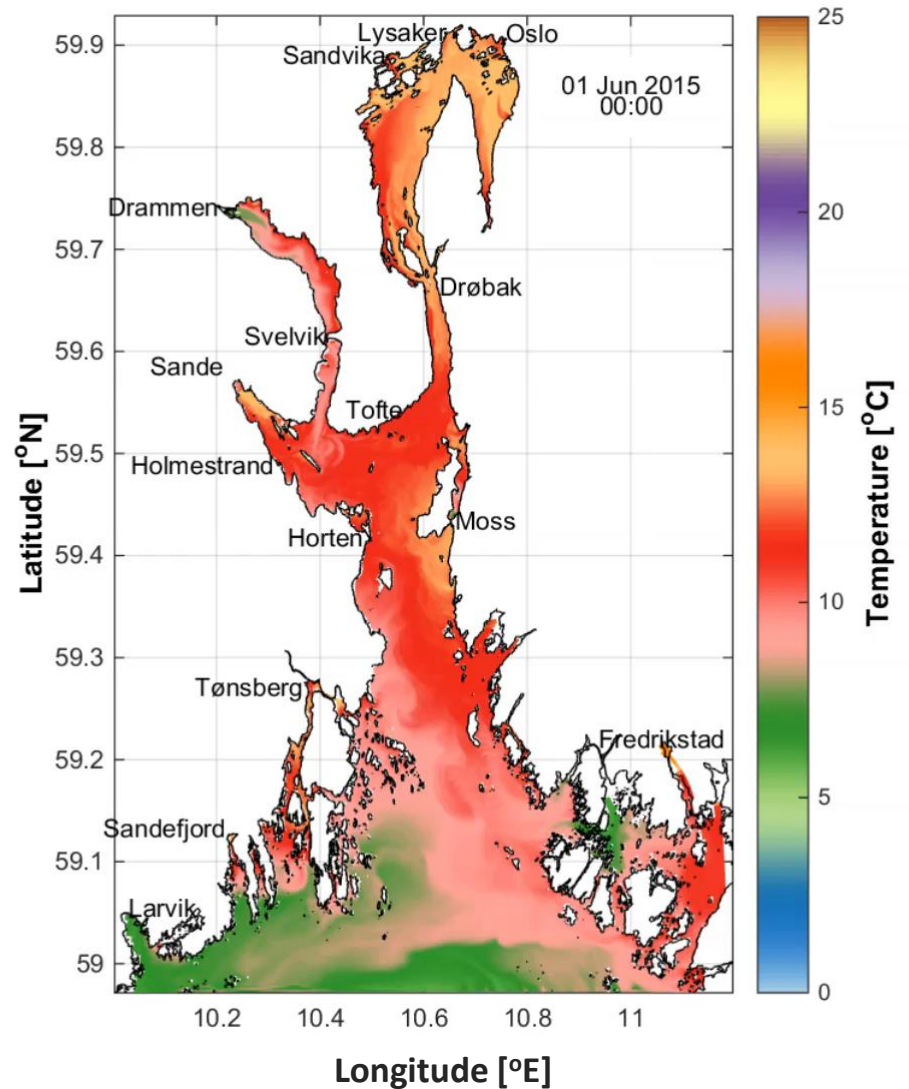**800m**

100m

Resolution

**150 boxes
Fast calculations**

**614 400 boxes
More detailed**

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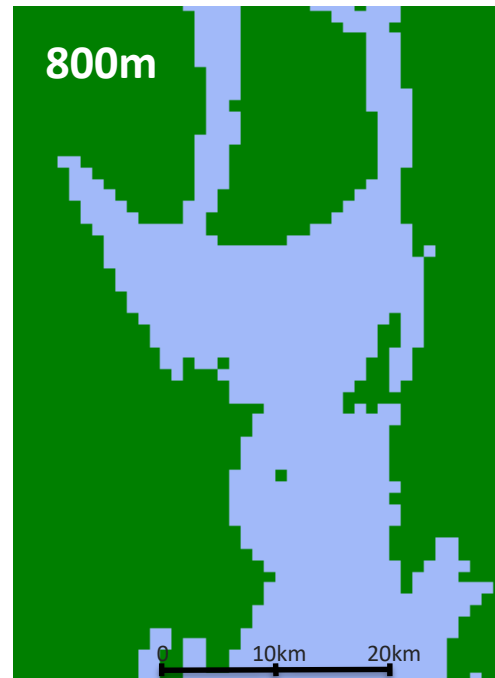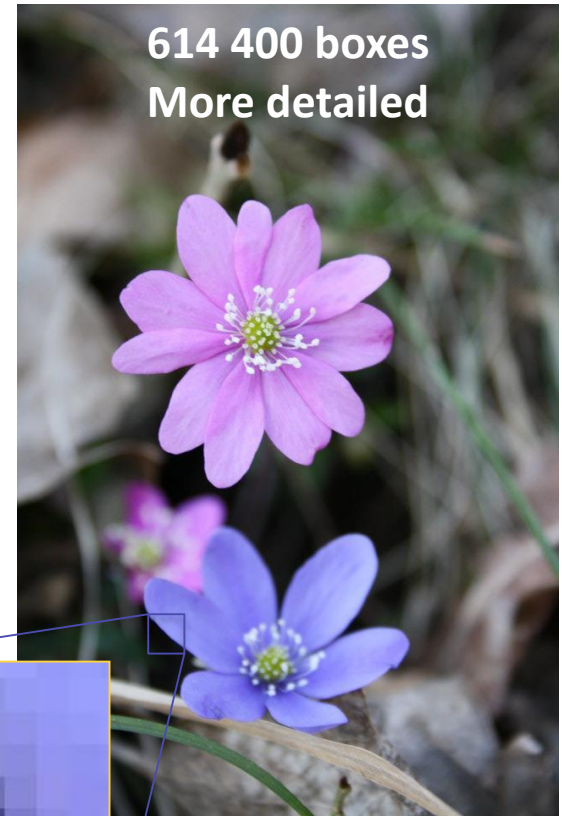
Dynamics

- Cold river water
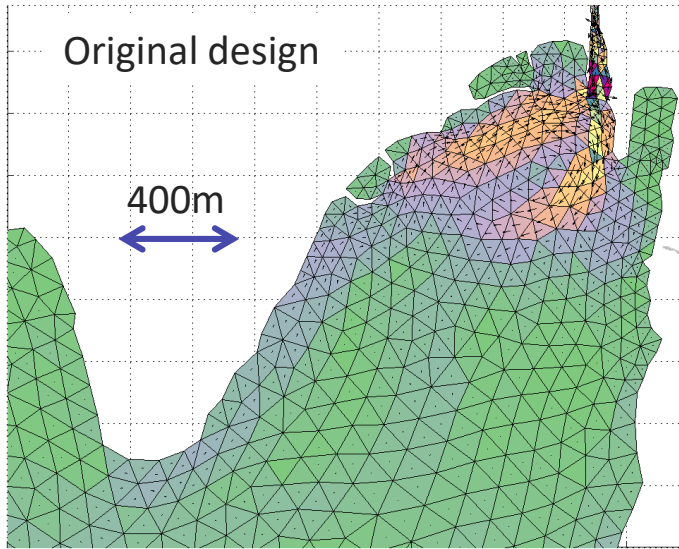- Cold ocean water
- Daily variations
- Seasonal variations
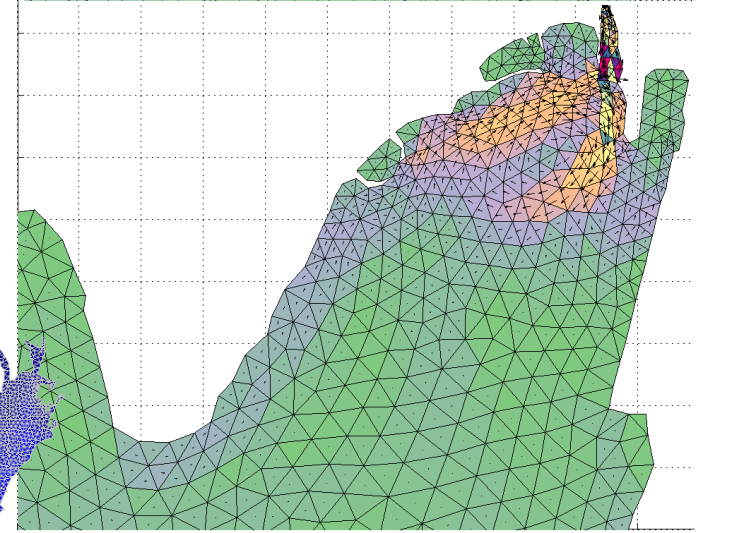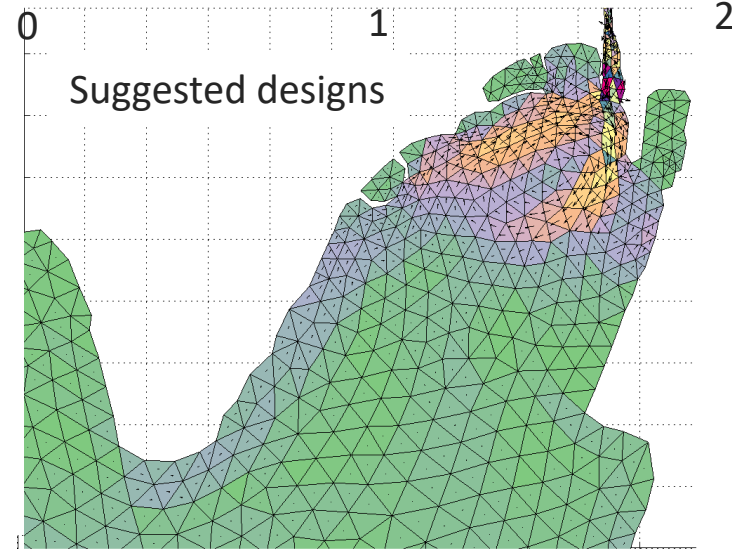- Depth variations

Fear of sediment transport

1926

Harbour design

Original design

400m

FVCOM model

Mean velocity [cm/s]
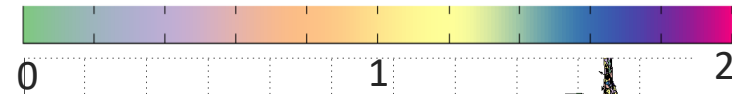
0   1   2

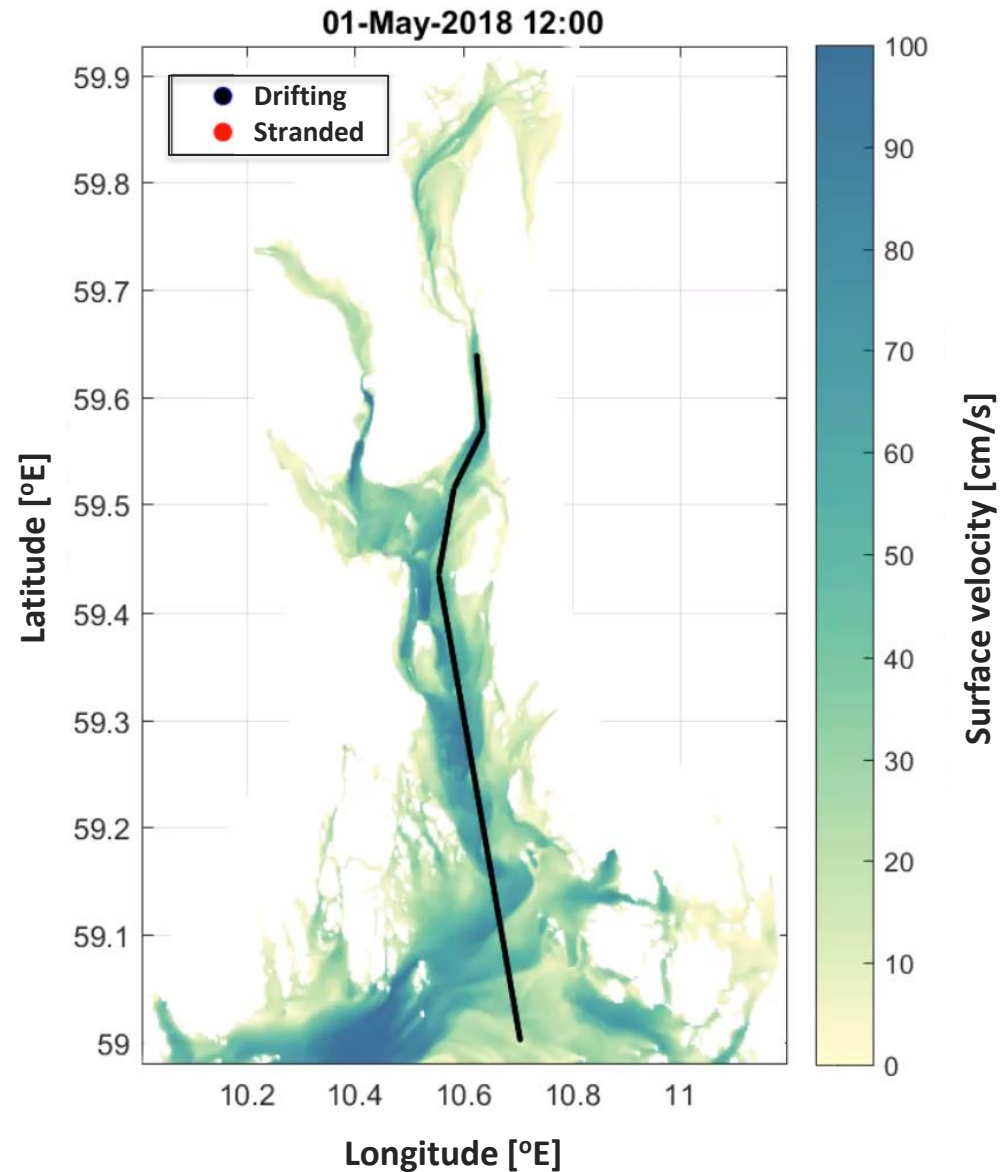Suggested designs

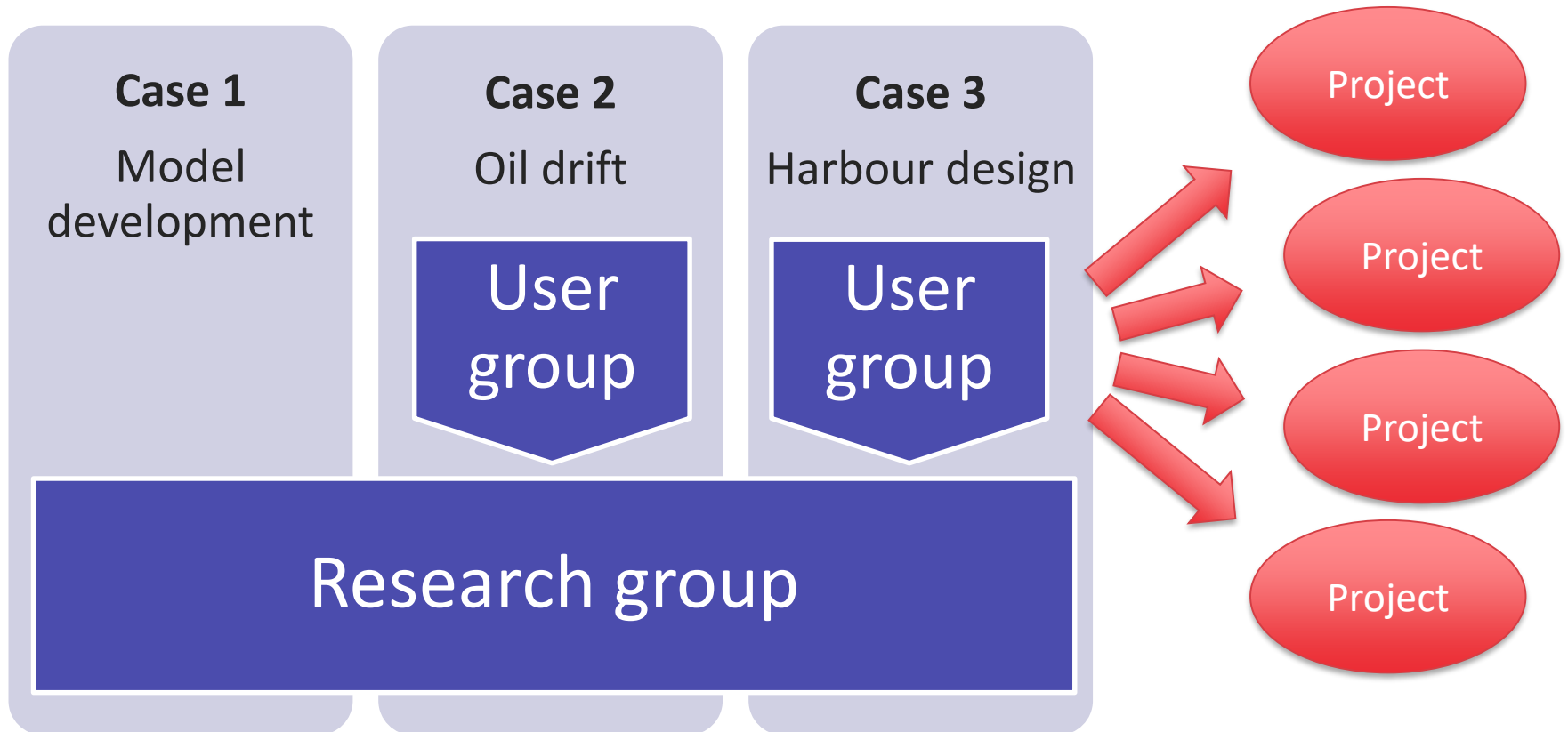University of South-Eastern Norway
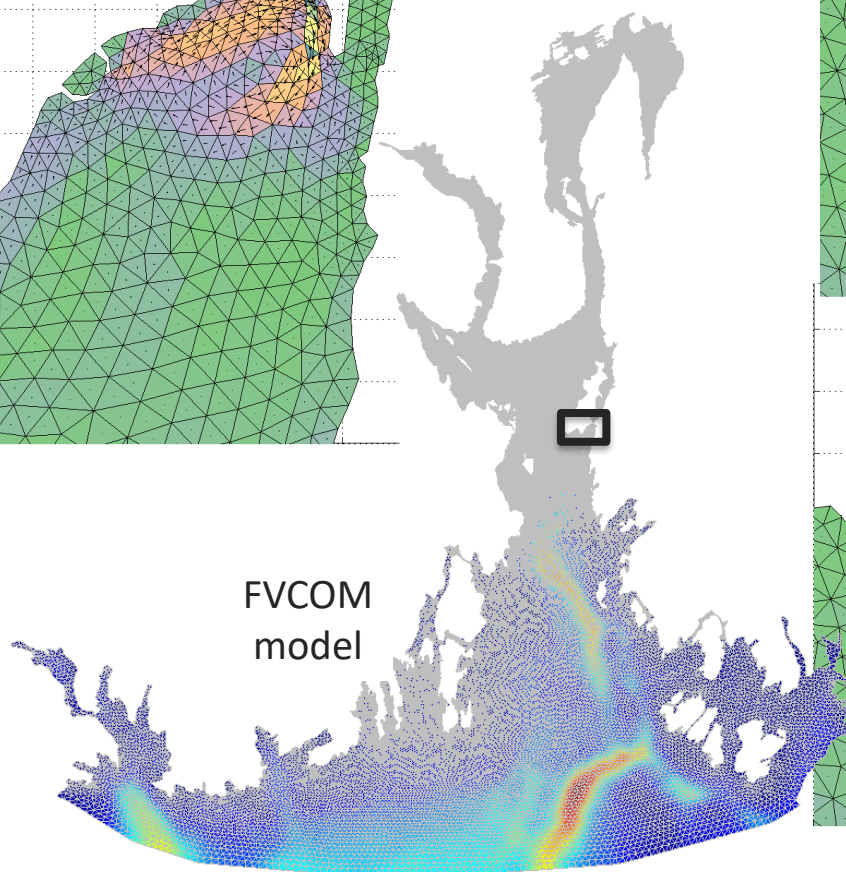
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Oil spill accident

Oil drift

- ROMS
  - Curvilinear grid

- OpenDrift
  - 100 elements in the TSS after 0, 3 and 6 hours

01-May-2018 12:00

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Project organization

Case 1
Case 1
Model development

Case 2
Oil drift
User group

Case 3
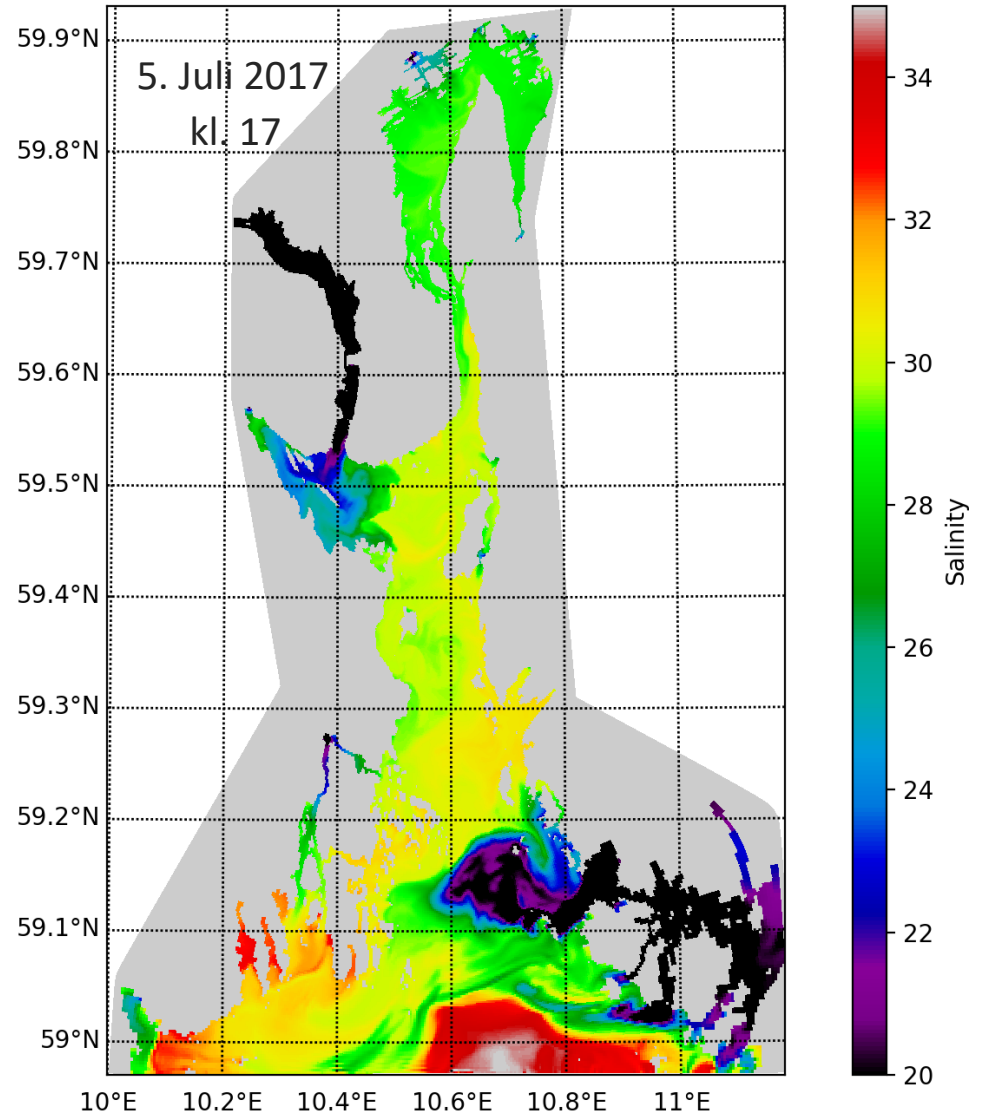Harbour design
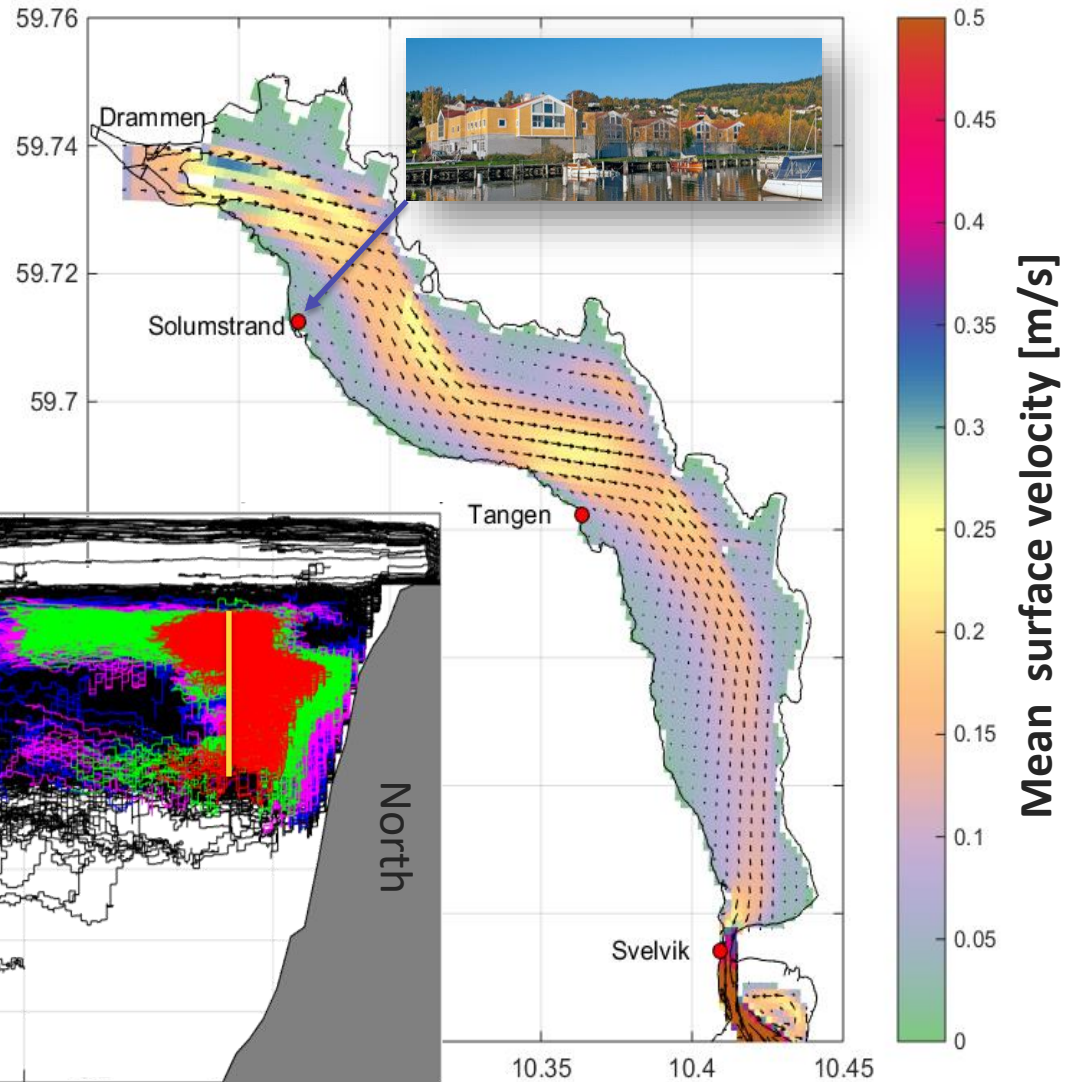User group

Research group

Project

Project

Project

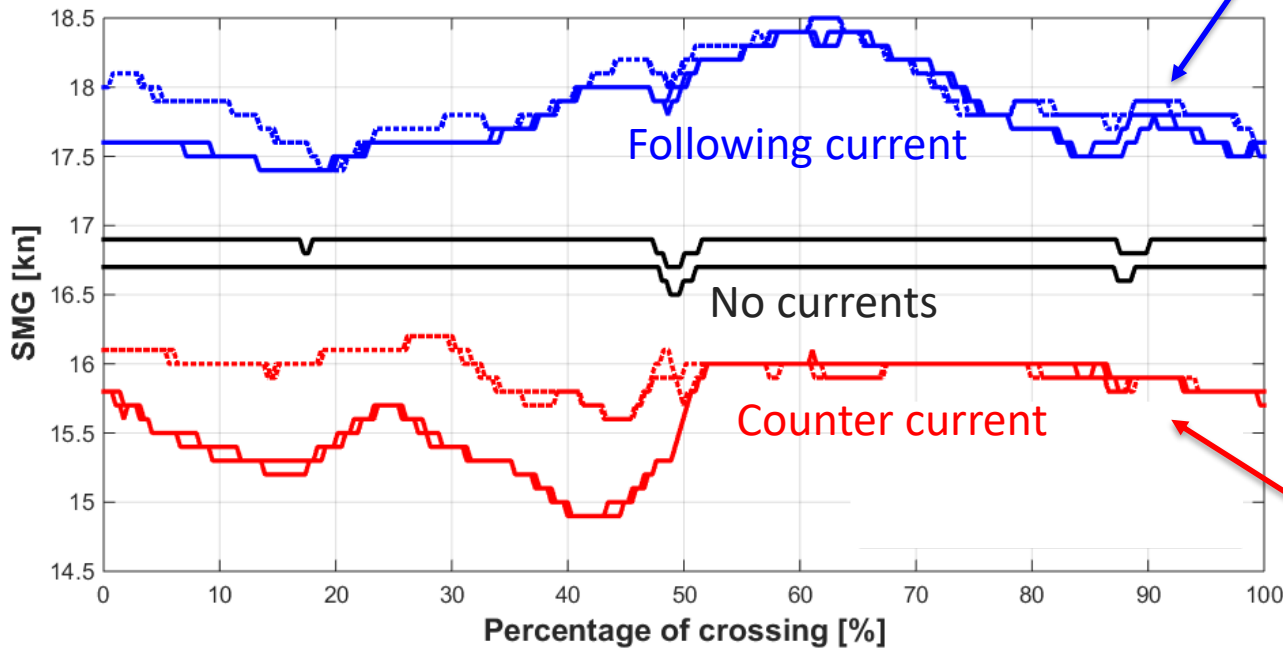Project

Salmon parasite

- A study on salinity after heavy rainfalls

5. Juli 2017 kl. 17

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Waste waters

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Fuel saving

Following current

No currents
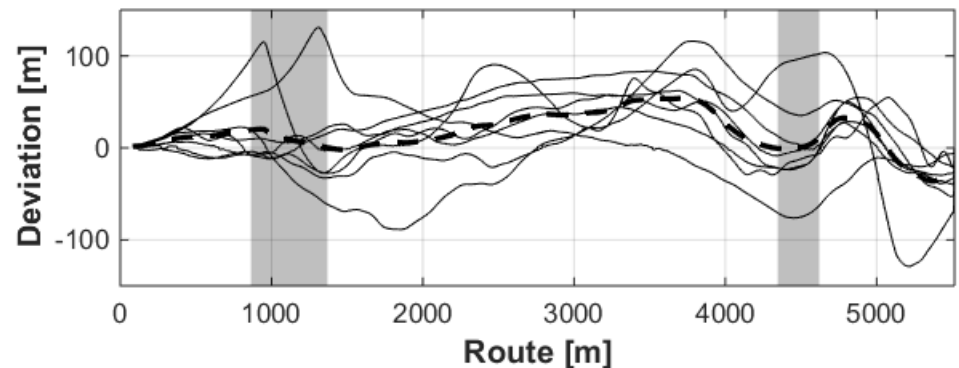
Counter current
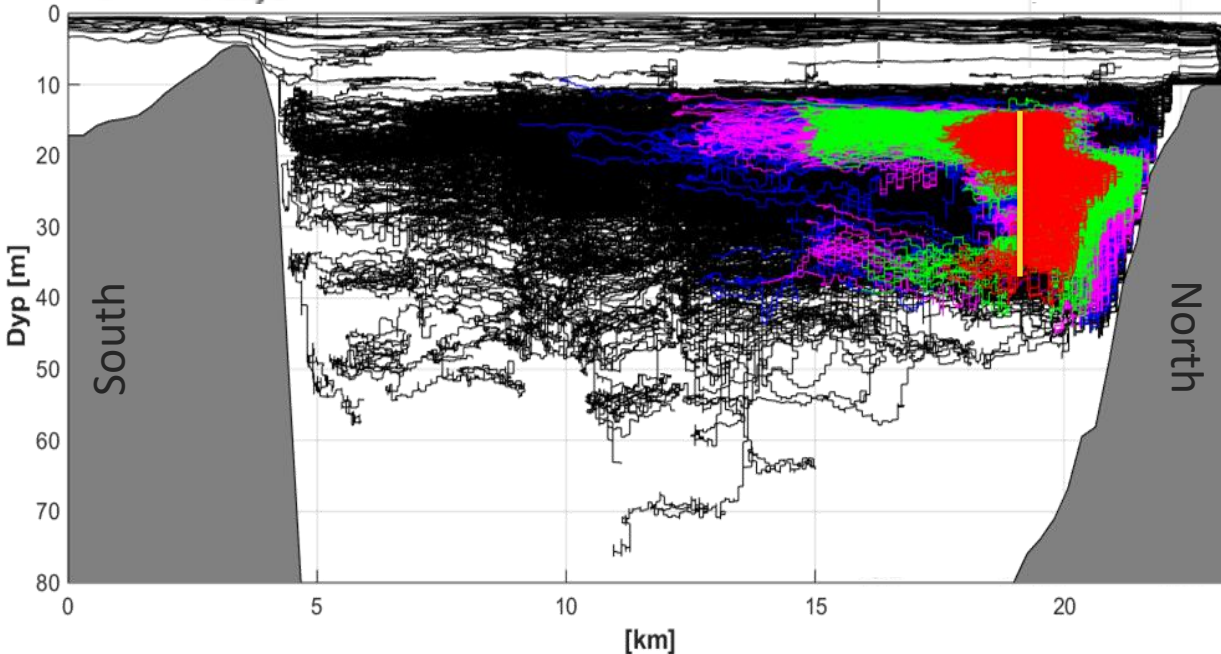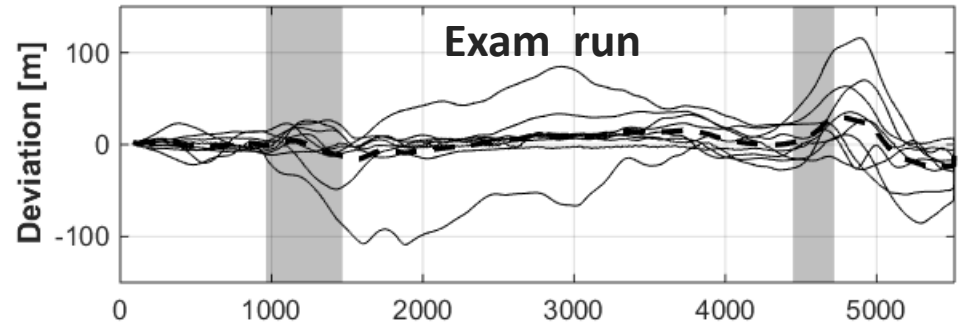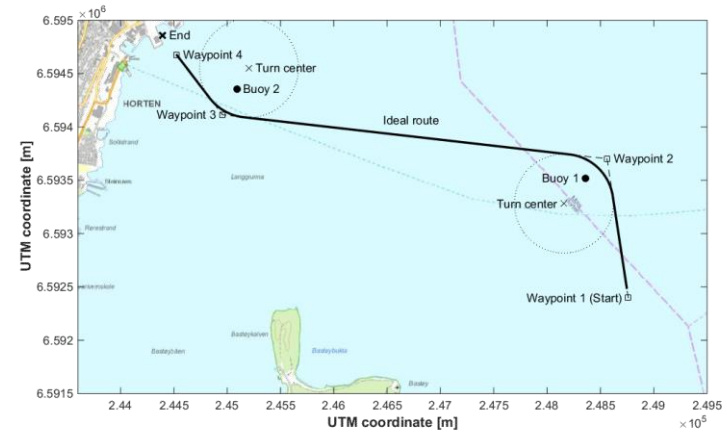
Axis labels: SMG [kn] vs Percentage of crossing [%]
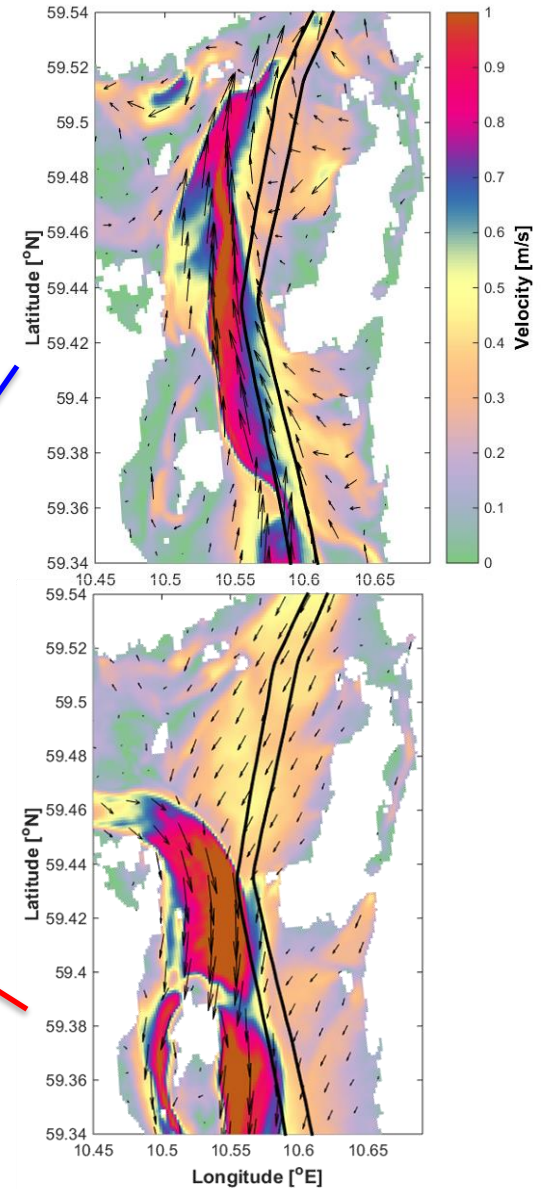
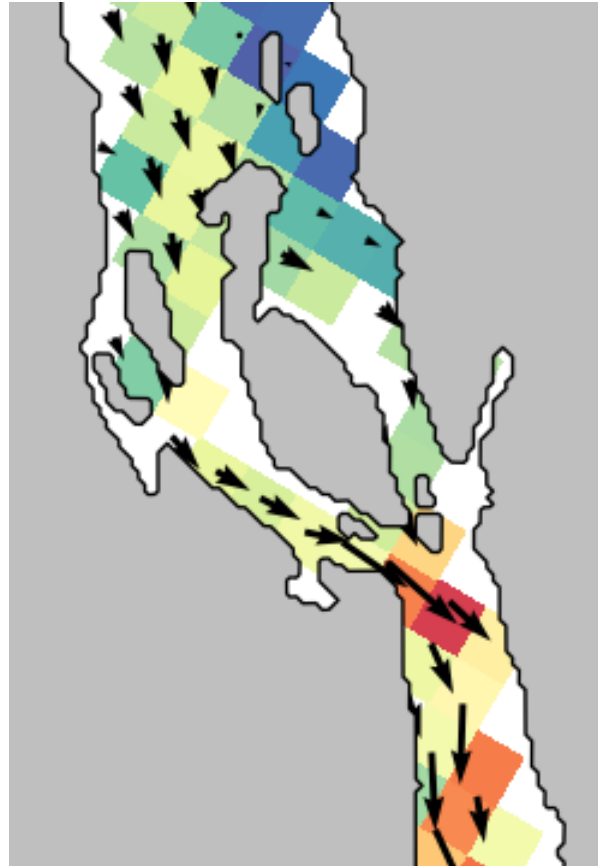# Simulator training

4 runs + exam

- Control group
  - Trained on homogeneous currents

- Experiment group
  - Trained on realistic currents
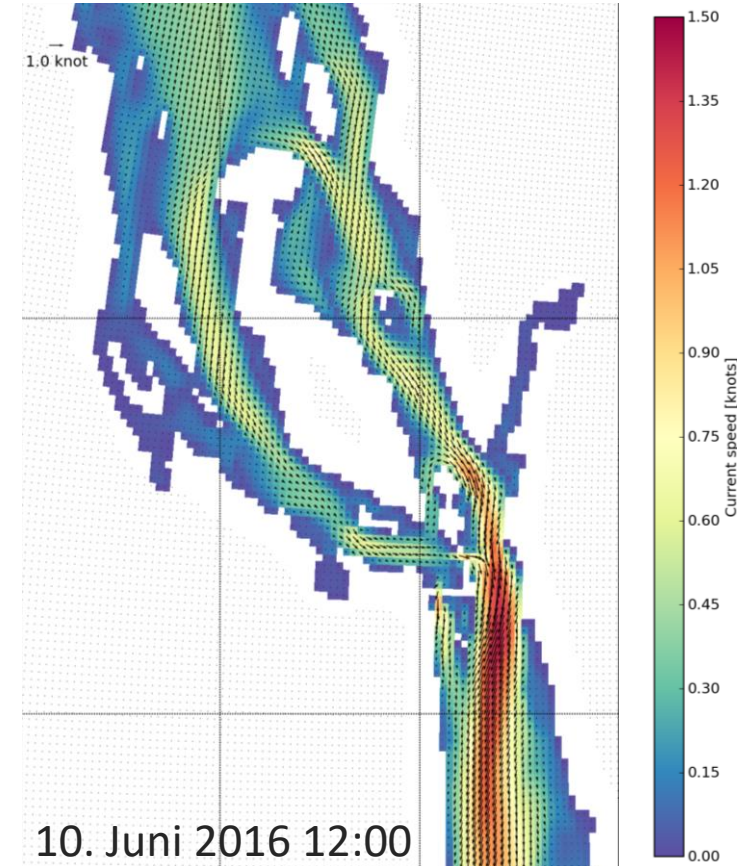
Weather briefing before sailing races
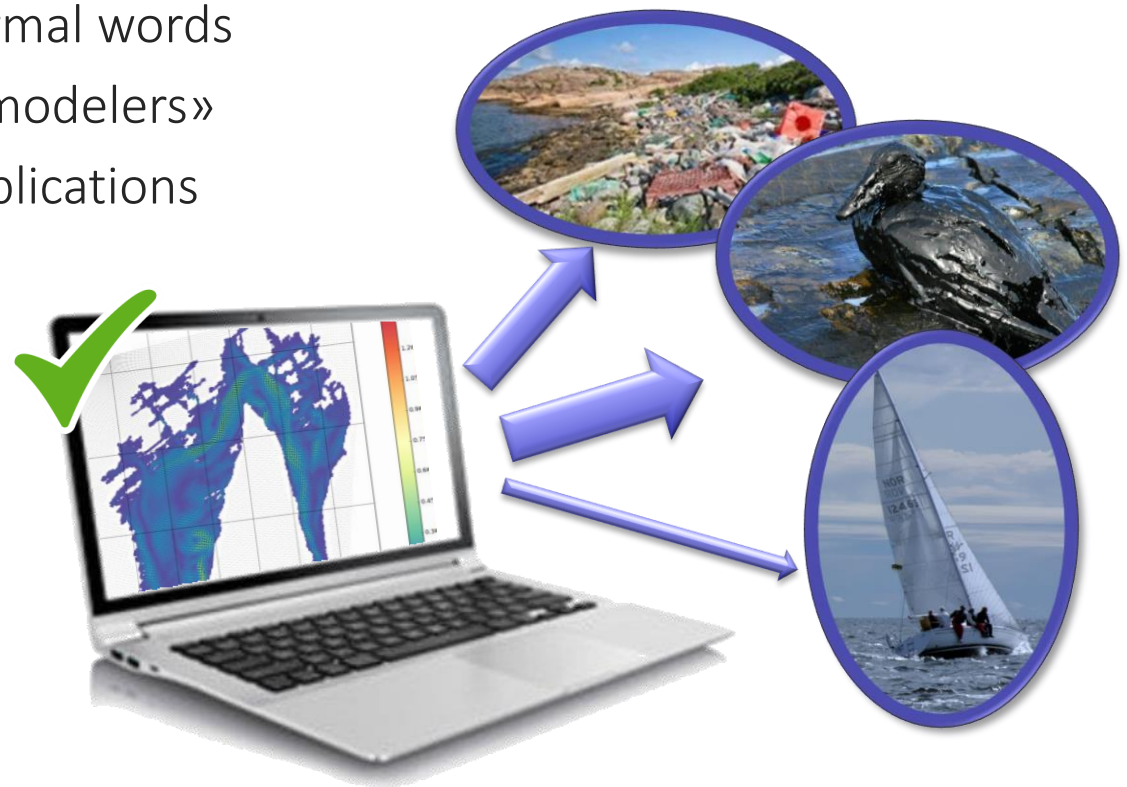
Prior model (NorKyst 800) Oslofjord model (FjordOs)

10. Juni 2016 12:00

Lessons learned

- Communicate with normal words
- Cooperate with «non-modelers»
- Numerous possible applications

Thank you