Comparison of the model results to field observations

SERPENT

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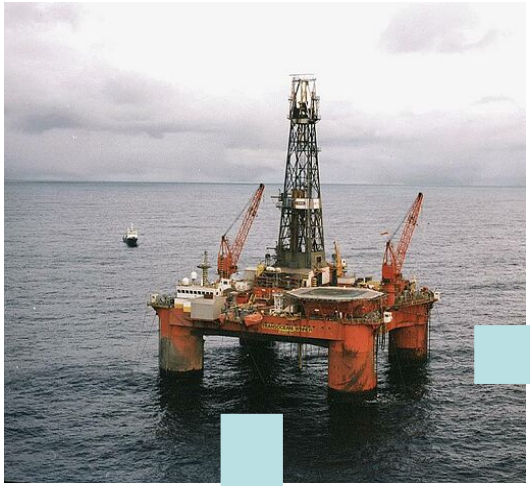
SERPENT: Scientific & Environmental Rov Partnership using Existing iNdustrial Technology

- Collaborative research project between National Oceanography Centre, Southampton, and Statoil
- Motivation behind the work
  - Environmental impact of drilling discharges
  - Knowledge of ecosystems in new areas

NEW:

- close proximity to well

Discharges of drill spoil



From the rig to the water column

-Physical effects of suspended particles

- Toxicity

From the rig to the seabed sediment

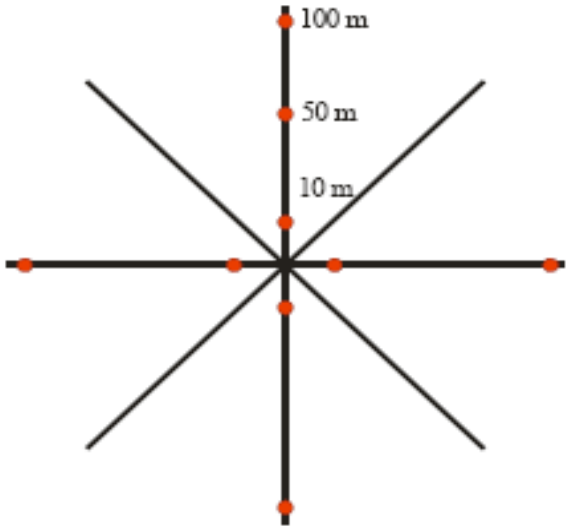
- Change in sediment structure (grain size)
- Burial of organisms
- Oxygen depletion
- Toxicity

Approach 2006

- Both pre- and post drilling observations /studies are performed
- Pre-drilling observations / sampling were normally carried out by ROV personnel on instruction / guidelines from scientist
- The scientist visits the rig sometime after the top-hole sections were drilled to do the post drilling observations / sampling

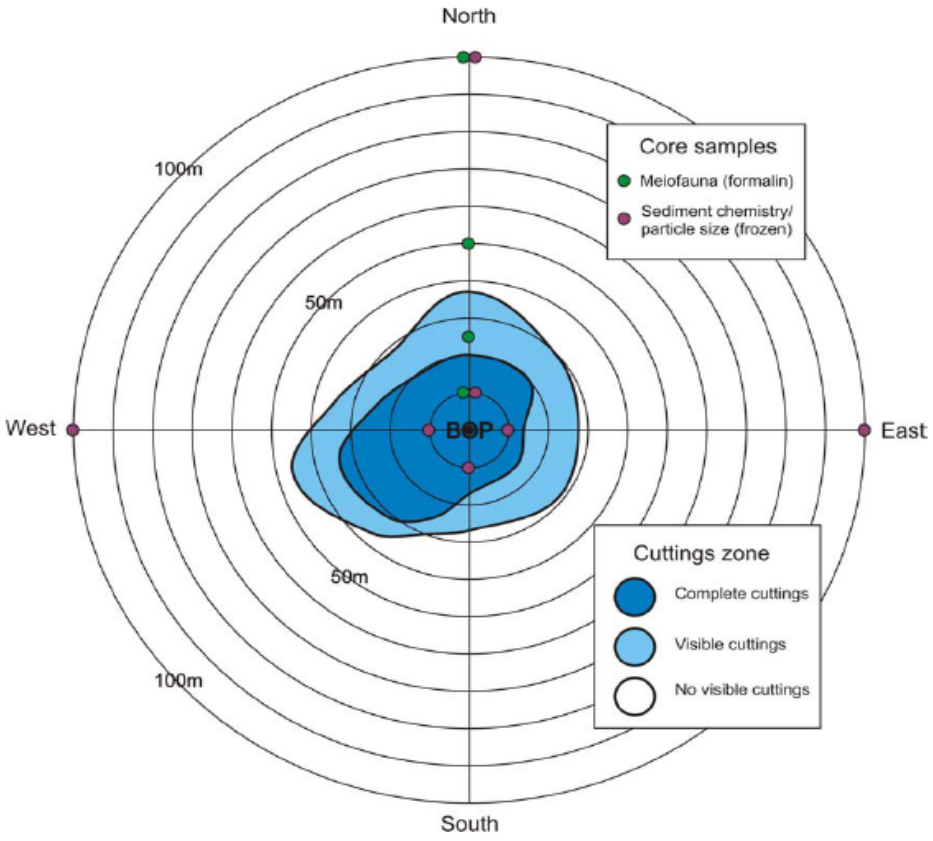
Experimental approach 1

- Video transects

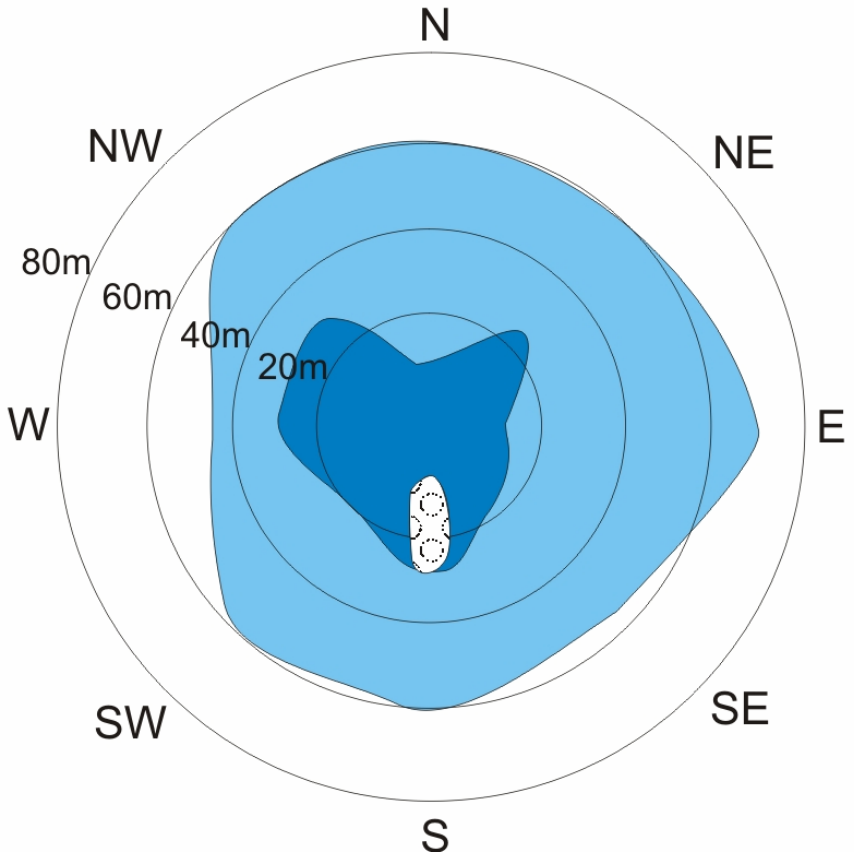


- Marker buoys

Sediment impact maps



Well A



Well B

Experimental approach 2

- Ekman grab

- Push cores

Heavy metals analysis

- Increase in Barium post-drilling (example Well A)

	Pre-drilling		Post-drilling			
	W 10 m	W 100 m	W 10 m	E 10 m	E 100 m	N 100 m
Barium	95	92	3800	5400	140	94
Lead	14	10	12	9.8	8.2	15
Cadmium	0.12	0.11	0.42	0.12	0.12	0.08
Chromium	34	35	23	29	34	34
Copper	15	15	26	41	14	14
Zinc	65	64	56	45	59	62

Other information provided by SERPENT

- Biodiversity indices
- TOC (total organic carbon)
- Particle size analysis
- Particle morphology

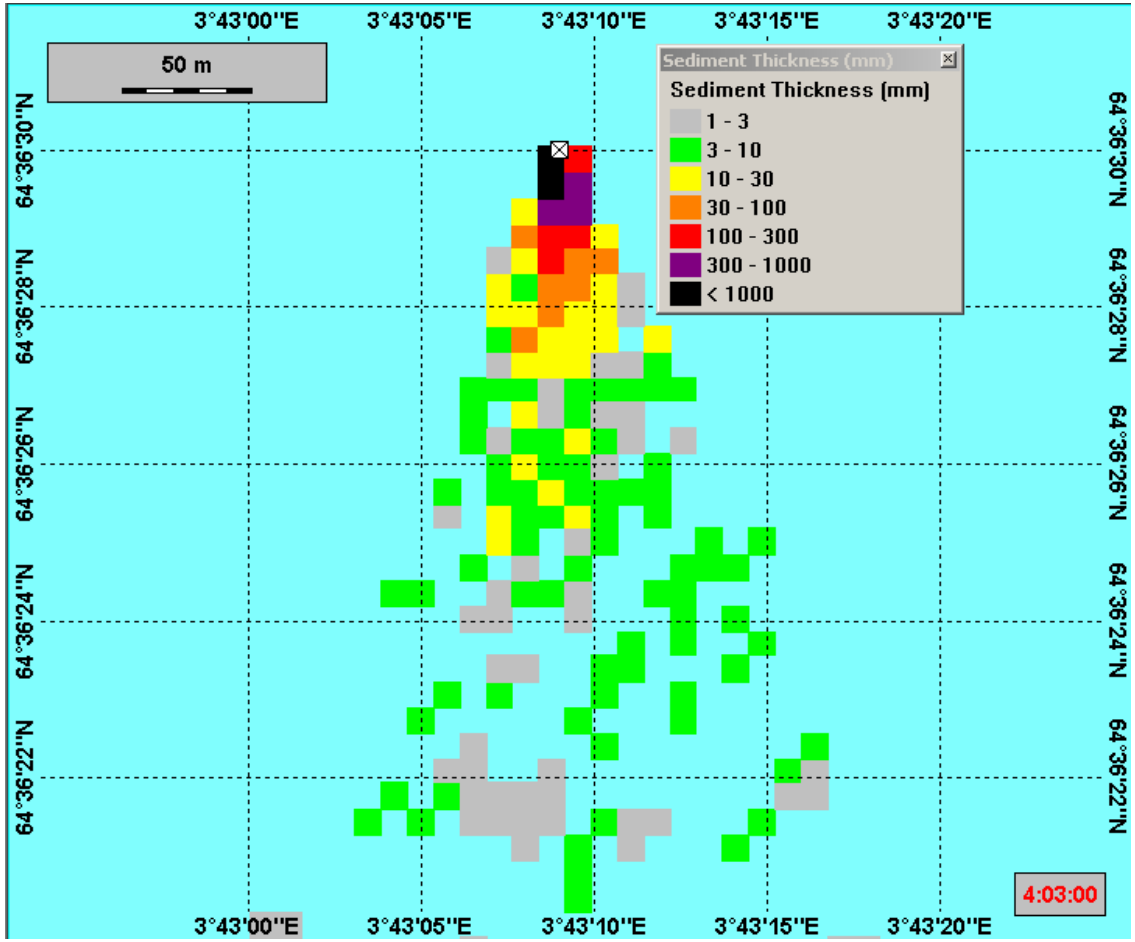
Conclusions SERPENT 2006

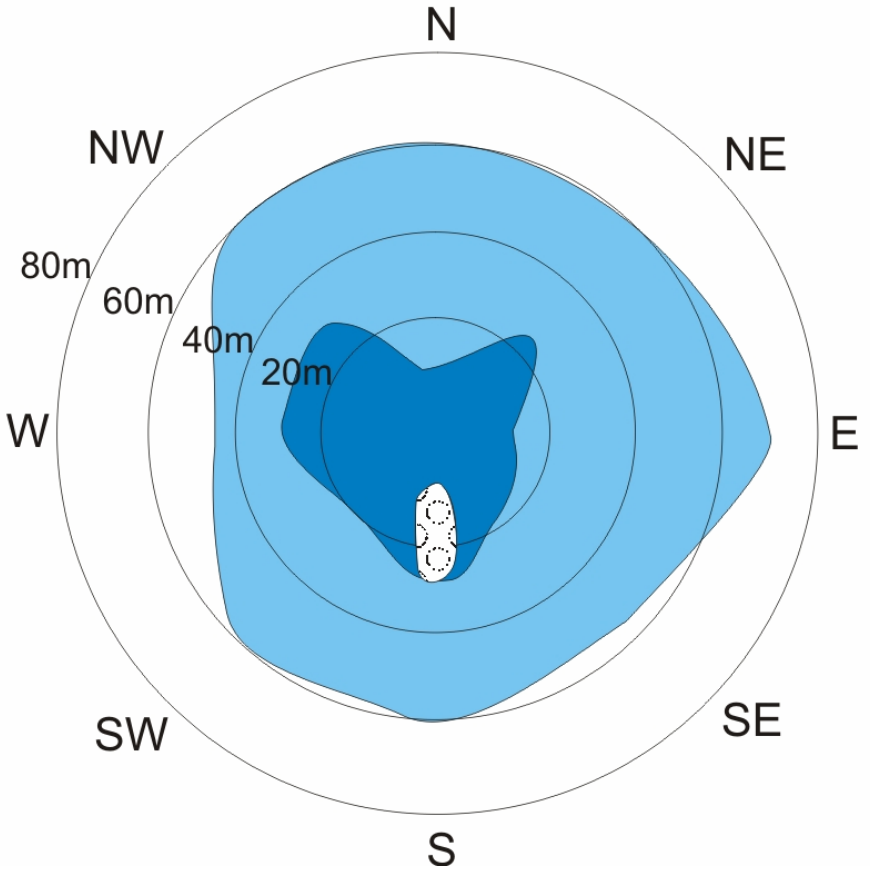
- The area affected by discharged drill spoil extends from 15 - 80 m around the well.
- Spreading occurs predominantly in the preferred current direction.
- Chemical analysis of cores have confirmed the visual observations.
- Morphology of drill spoil is different from that of seabed sediment.
- Biological response is observed following the discharge.
- Mapping of the ecosystems in different area has started/ been complemented.

EIF DD results vs. Field observations / measurements

- EIF calculation has been performed for two of the wells visited by SERPENT in 2006, Tornerose and Edvarda.
- So far only deposition area has been compared
- Further comparison needed

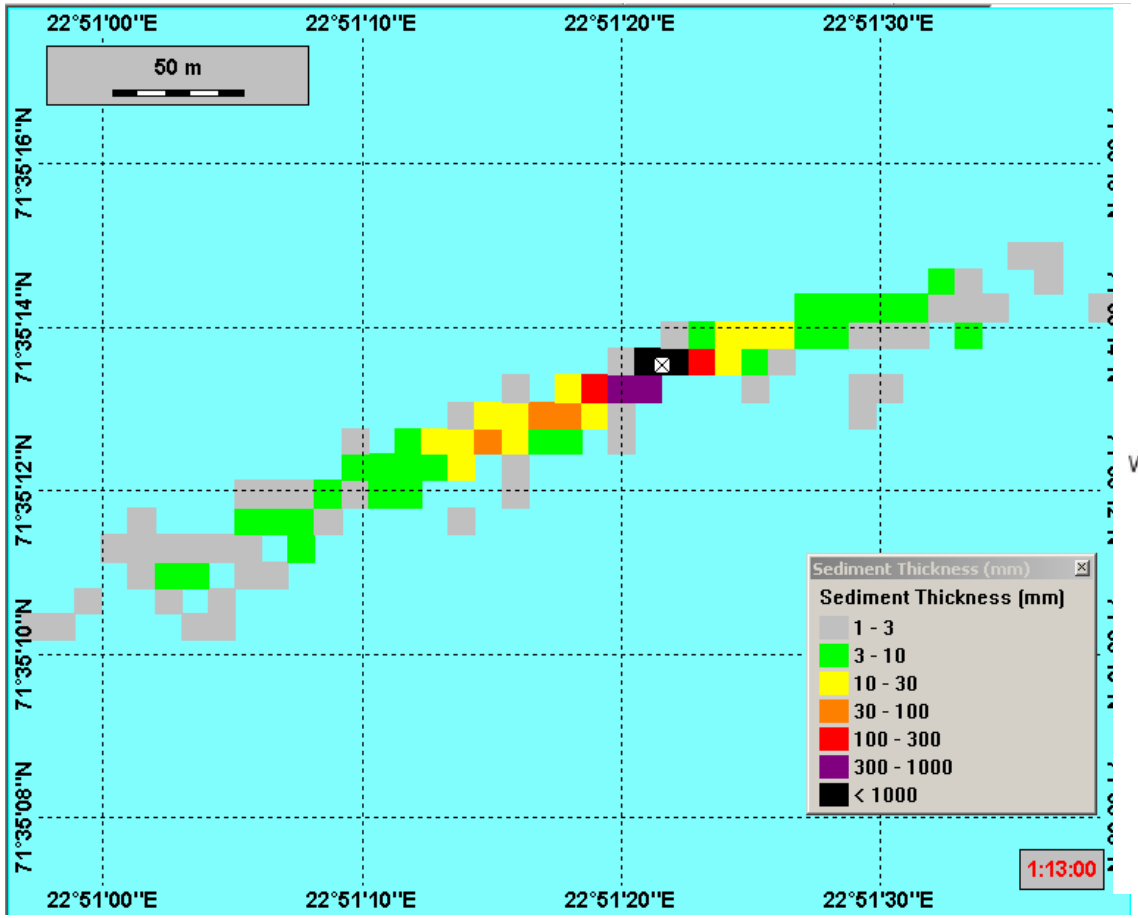
Deposited layer thickness – Well B
(EIF results vs field measured values)

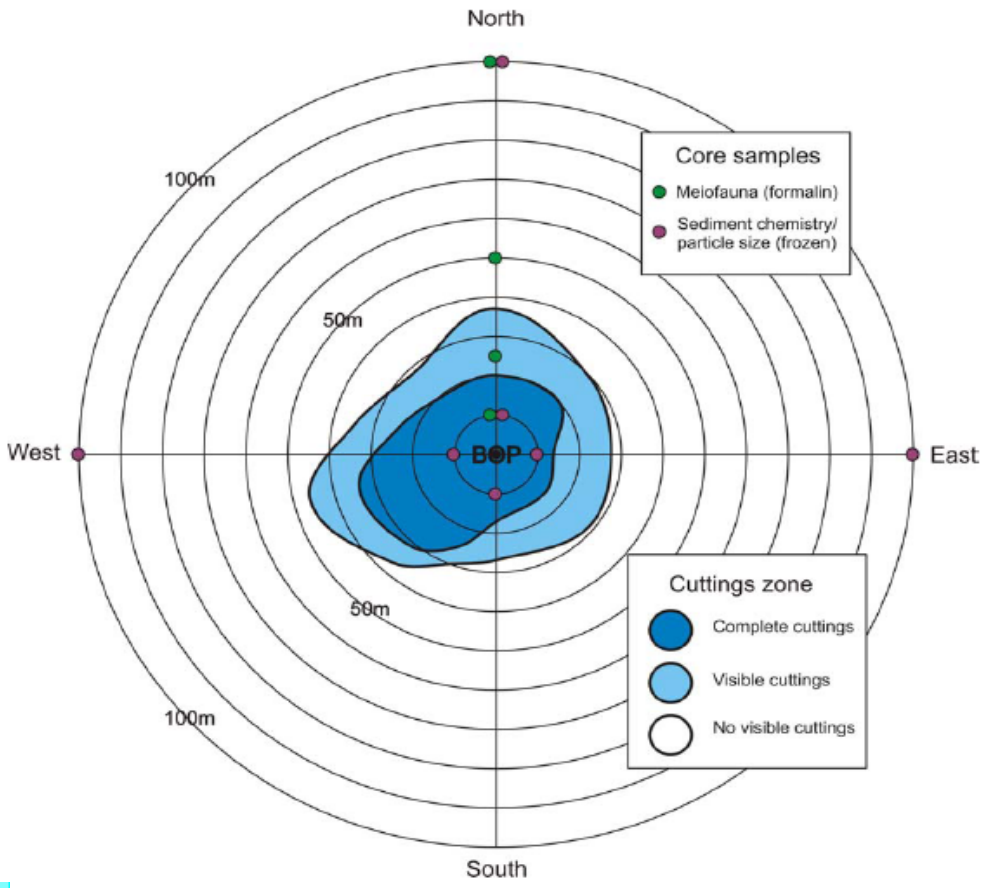




Deposited layer thickness – Well A

(EIF results vs field measured values)





Uncertainties when comparing model results to field data (I)

- Current data – use of simulated current profile from year 2000
- Discharge period – in reality discharges takes place over several weeks. In the model the estimated discharge period is calculated based on length of well multiplied with a predefined ROP (rate of penetration)
- Only drilling discharges are considered in the simulation when comparing field data. In reality it is expected that also cement discharges will have an impact / contribute to the results from the field measurements.

Uncertainties when comparing model results to field data (II)

- Re-suspension is not fully implemented the EIF calculations.
- Uncertainty with respect to the sampling procedure during monitoring (ref. top 3 cm?)
- Background values of heavy metals not included in the calculations

Conclusion

- The comparison shows that model results are not unrealistic to the Serpent field observation. However too few results to draw any conclusion
- More results and comparisons are needed
- Plans SERPENT 2007
  - 3 – 4 wells will be visited
  - Same observations / samples as in 2006 however a closer follow up of sediment accumulation
- Dependent on the SERPENT observations in 2007 an EIF calculation will be carried out for one of the visited wells and a comparison between field measured data and the results from the EIF calculation will be carried out

Acknowledgement

The oil companies financing the ERMS program are acknowledged for financial support as well as scientific input during the program.

Contractors in the program have been: Akvaplan-niva, Battelle, MUST, RF-Akvamiljø, SINTEF, TNO and University of Oslo, with SINTEF as the co-ordinator of the program.