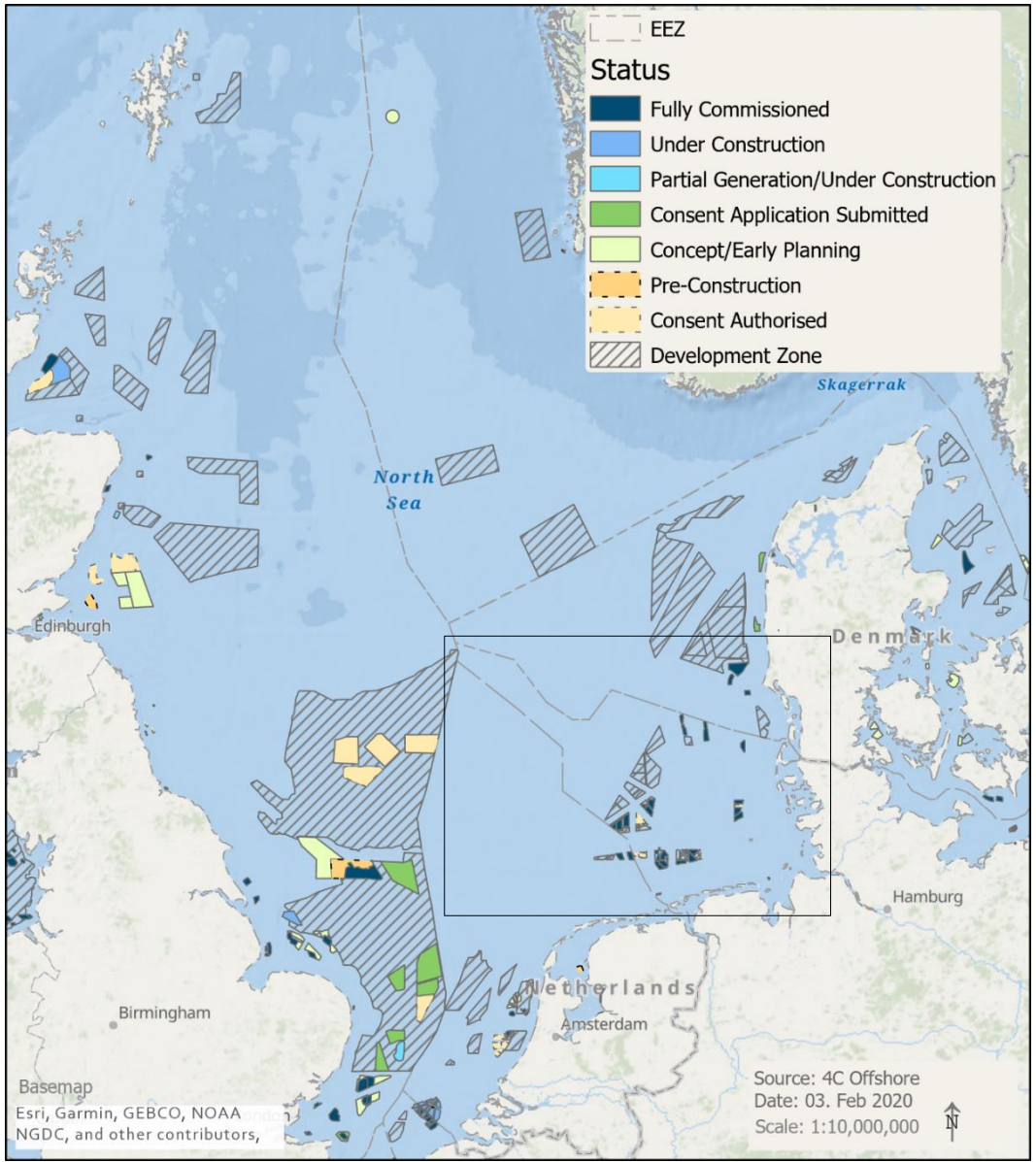
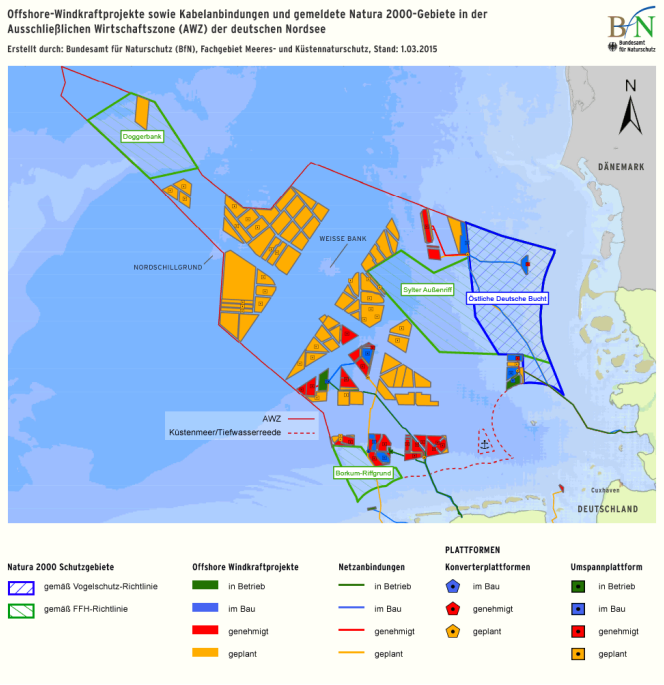
Offshore Renewable energy (ORE) in the North Sea

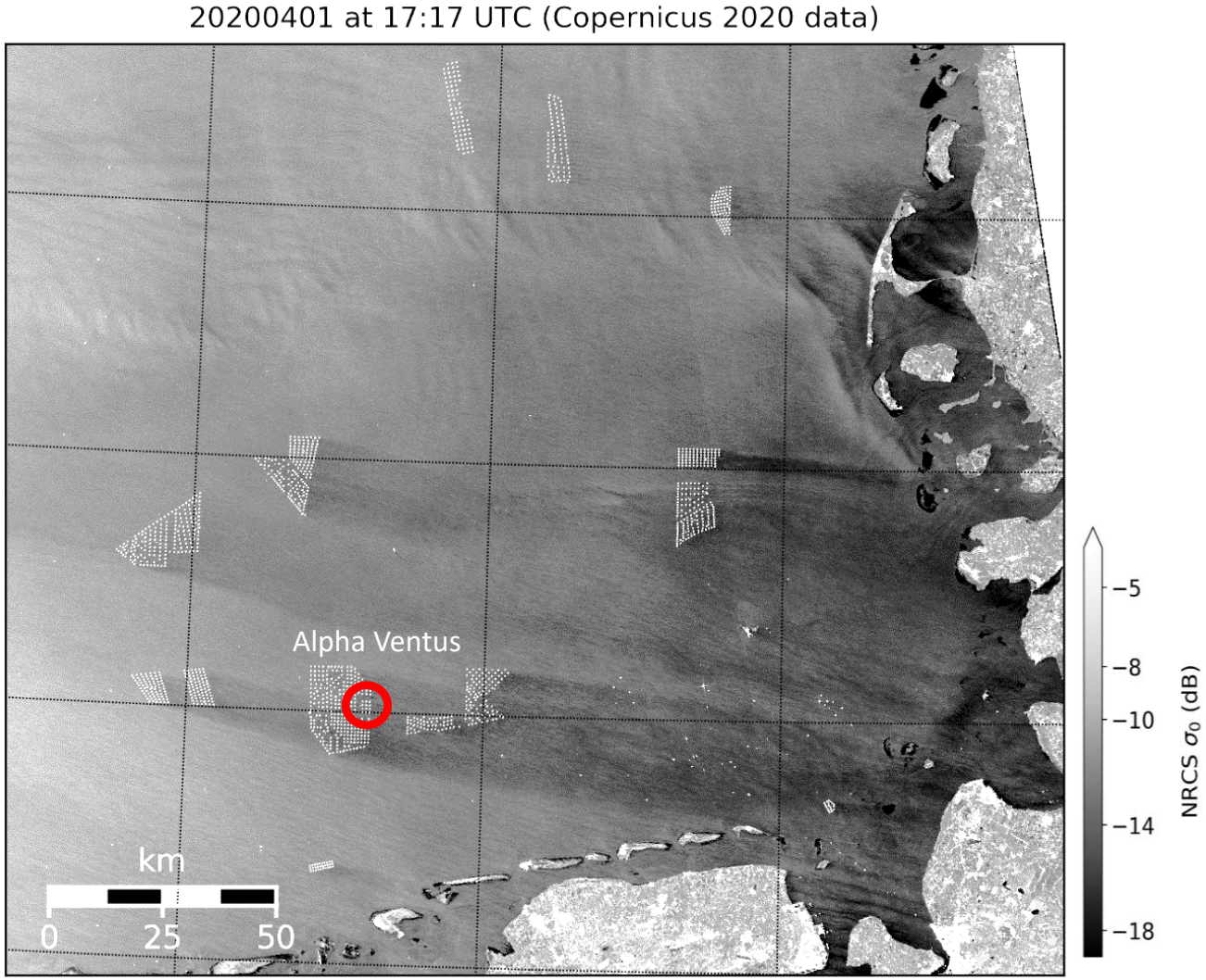




➔

Massive intervention into physical, biological, chemical components of the North Sea system **on larger scales**

Sentinel-1A Synthetic Aperture Radar (SAR) image of German Bight



Very ambititious political goals, e.g.,

- Green Deal (scale up ORE by factor of 25 until 2050)
- Coalition agreement of upcoming German government further tightend the goals for OFW

NOOS Offshore Renewable Energy Inititative

History of Initiative
The idea of a dedicated NOOS WP on ORE was discussed at the last annual meeting.
First steps were to check

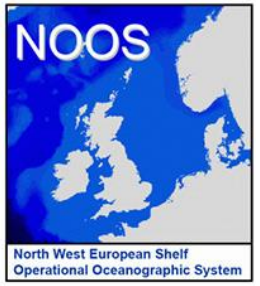
- Who is interested?
- What could be the scope of such a WP?

Mail send around on March 15, 2021 asking for response until Easter

Initial group of colleagues indicating interest
Sebastien Legrand (*RBINS, Belgium*)
Pieter Gurdebeke (*Agency for Maritime and Coastal Services, Belgium*)
Jacob Woge Nielsen (*DMI, Denmark*)
Birgitte Rugaard Furevik (*MetNo, Norway*)J
Jon Rees (*CEFAS, UK*)
Jeremy Blackford (*PML, UK*)
Johannes Schulz-Stellenfleth (*Hereon, Germany*)
Jochen Horstmann (*Hereon, Germany*)
Ole Anders Nost (*NIVA*)
Evgeniy Yakushev (*NIVA*)

NOOS Offshore Windfarm Meeting on 11 June 2021

Required Offshore Windenergy Research
1) Process understanding



Atmospheric Wakes

- How long ? How intense ?
- Which are the dominating parameters (ABL stability ← SST, …) ?
- Superposition of wakes (e.g.,turbulence)

Coastal effects

- Offshore wind speed gradients (due to land/sea surface roughness jump)
- Dependence on sea state and ocean temperatures

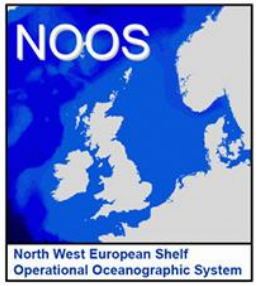
Impacts of OWF on ocean

- Directly due to foundation structrure (mixing, …)
- Indirectly due to atmospheric wakes (wind drag, ocean waves)
- Impact on biology (e.g. due to mixing, aquaculture, no-fishing zones, …)
- Artifical islands / sea cables / sediment transport

Two way Interaction between atmosphere and ocean

- Coupled model systems

Required Offshore Windenergy Research
2) Application oriented



High resolution coupled model systems

- Short term forecast (relevant for operational applications)
- Longer term (e.g., scenarious including climate change)
- Including accuracy information ➔ decision making (industry, agencies)

Dedicated observation systems

- Atmospheric boundary layer (near ocean surface, ….)
- Observations before and after OWF installation
- Observations of free stream conditions is already a problem
- Long term observatories for impact studies
- Data exchange with OWF operators desirable but challenging

Data assimilation systems

- Assimilation into high resolution coupled systems
- Accuracy quantification

NOOS Offshore Windfarm Meeting on 11 June 2021 1/2

Sebastien Legrand (*RBINS, Belgium*), Pieter Gurdebeke (*Agency for Maritime and Coastal Services, Belgium*), Jacob Woge Nielsen (*DMI, Denmark*), Birgitte Rugaard Furevik (*MetNo, Norway*), Jon Rees (*CEFAS, UK*), Jeremy Blackford (*PML, UK*), Johannes Schulz-Stellenfleth (*Hereon, Germany*), Jochen Horstmann (*Hereon, Germany*)

Johannes Schulz-Stellenfleth

- Satellite data analysis to study atmospheric wake effects
- Modelling studies to look at impacts on the ocean (e.g. waves)
- Coupled modelling and data assimilation

Jacob Woge Nielsen

- Operational ocean wave modelling
- Service quality assessment by OWF operator
- Dedicated quality metrics

Jon Rees

- Cable impacts (sediment dynamics and protection measures)
- Impacts of waves on benthos and stratification
- Other ocean energy sources (waves, currents, water level) in development
- Floating offshore windfarms

NOOS Offshore Windfarm Meeting on 11 June 2021 2/2

Sebastien Legrand
- Licensing process
- Environmental Monitoring program
- Report on impacts (e.g. sediment plumes, benthic habitats, …)

Birgitte Rugaard Furevik
- Floating Offshore Windfarms
- Research-based-innovation (SFI) program “Blue”
- Research on waves

Jochen Horstmann
- Use of marine radar to observe waves and atmospheric gusts around OWF
- Short terms wave forecasts to be used in OWF operations

Jeremy Blackford
- High resolution modelling
- Ocean stratification
- Far field circulation effects

Pieter Gurdebeke
- Influence of OWF on existing operational observations

Conclusions from Discussion 1/3

- There is need for consistent information on OWF activities at the North Sea scale, e.g. likely scenarios for the further growth of wind farm sites in the different countries. This is required to make impact and scenario studies comparable. Accurate and high-resolution information on bathymetry is of particular importance in the OWF context.

- Possible perturbations of existing observations used in operational systems by OWFs is a topic of relevance

- The measurement of free stream conditions is already a challenge in some areas and this will become even more difficult in the future. Strategic planning of observations is therefore of growing importance.

- It probably makes sense to extend the scope of this group towards “ocean energy” in general, because current/wave and tidal energy is of increasing interest (in particular in the UK at the moment)

- There is a growing number of activities in the floating OWF sector (in particular UK and Norway) and this leads to particular modeling/observation requirements

Conclusions from Discussion 2/3

- The activity can help to exchange information on observations and modeling of OWF related processes. There is general interest concerning physical, biological and chemical processes. The role of scales (e.g. OWF size, influence radius, etc) needs more analysis.

- Uncertainty information (e.g. via ensembles) is critical for many OWF applications

- A web folder (powerfolder.hereon.de/NOOS_Ocean_Energy) is installed to exchange documents within the group (password protected)

- It would be nice to have a common database of relevant publications (maybe via Zotero)

- There is some need for common metrics to be used in OWF impact studies

- Activities within this group should be coordinated with and connected to other OWF related activities outside NOOS (e.g., in OSPAR, ECOWIND (Jeremy Blackford))

Conclusions from Discussion 3/3

- There was agreement that networking activities within this group should continue and a respective recommendation will be given at the next NOOS annual meeting. Further discussion is still required to define an optimized format, e.g. meeting intervals etc.

- The amount of different aspects to be considered in the OWF context is overwhelming and some structuring and prioritization is required

- It would be good to iterate a short document to define the objectives/priorities of this group and to plan cooperation

What next?

- Are there more NOOS partners interested in this ?
- Are there more opinions about the scope and format of a ORE NOOS WP?
- Iterate short document based on input from annual meeting
- Maybe start with ORE NOOS WP meeting half-way between annual meetings?
- Maybe more concrete planning, e.g. about collection of scenarious?