Simulation of wake effects between two wind farms

Hansen, Kurt Schaldemose

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Simulation of wake effects between two wind farms

THE EUROPEAN ENERGY RESEARCH ALLIANCE
DESIGN TOOLS FOR OFFSHORE WIND FARM CLUSTER

Kurt S. Hansen
Senior Scientist
DTU Wind Energy – Fluid Mechanics

Support by
SEVENTH FRAMEWORK PROGRAMME

Outline

- Introduction EERA-DTOC;
- Layout of the offshore wind farm cluster;
- Participants & models;
- Identification of a flow case;
- Results from SCADA data analysis;
- Results from the cluster models;
- Comparison of park efficiency;
- Conclusion & acknowledgement;

Introduction to EERA-DTOC

EERA:
European Energy Research Alliance

EERA-DTOC.EU

The **DTOC** project combines expertise to develop a multidisciplinary integrated software tool for an:
optimised design of offshore wind farms and clusters of wind farms.

The wake models results are compared to the measurements of wake effects:

1) between wind turbines and;
2) between wind farms;

Offshore wind farm cluster

Rødsand II wind farm

- Owner: E•ON
- SWP: 2.3-92.6m, VS & VP
- Spacing: variable 5 – 6 – 7 - 10D
- Operational status: good
- 1 month data 5-10 m/s representing East & West

Problems

- Lack of inflow reference & time stamps

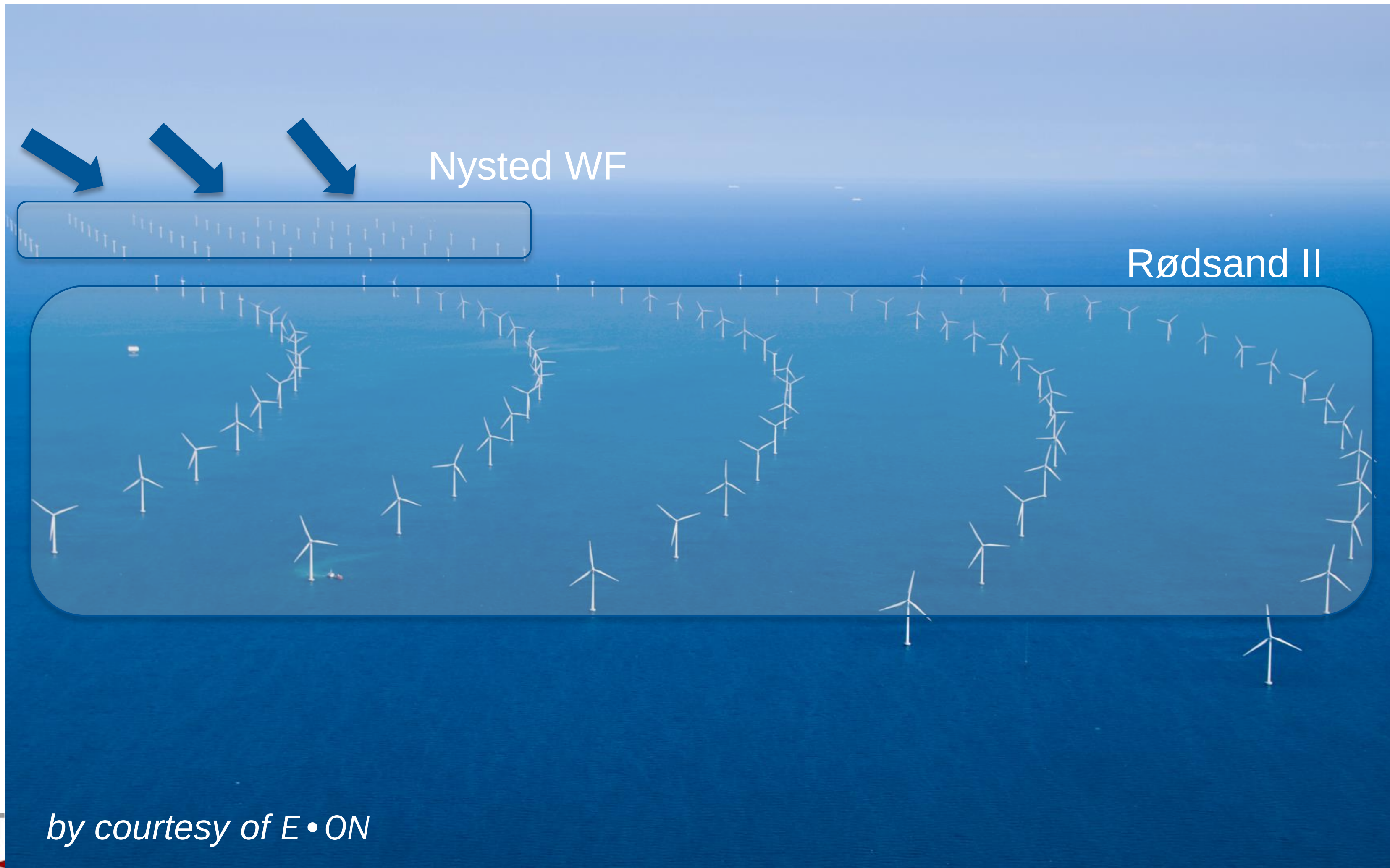
Nysted wind farm

- Owner: DONG Energy A/S
- Bonus 2.3-82.4 m, 2-speed, active stall
- Principal spacing: 10.1 & 5.6 D
- Annual eq. full load hours≈3300

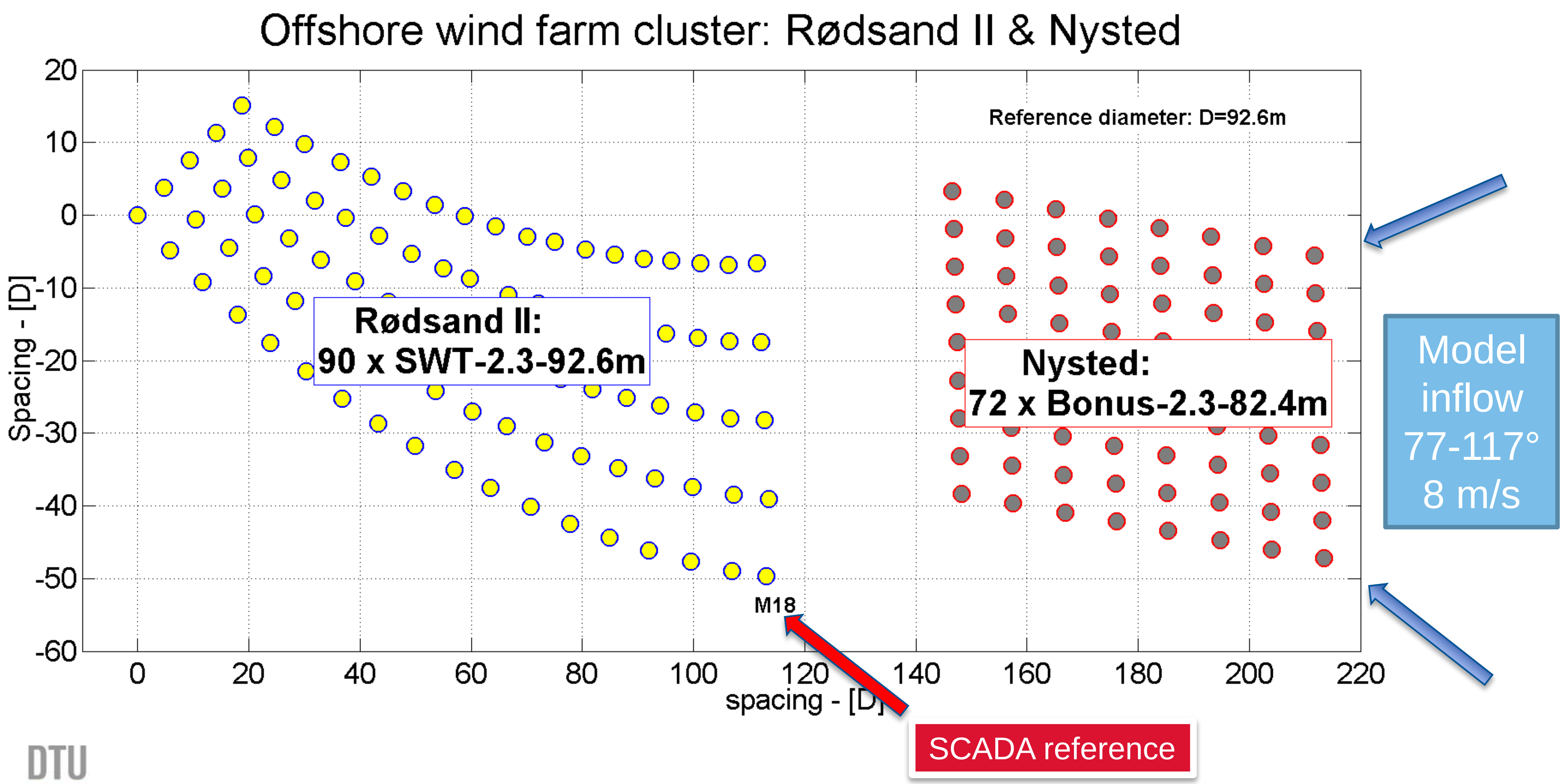
Problems

- Different owner
- Lack of synchronization ←

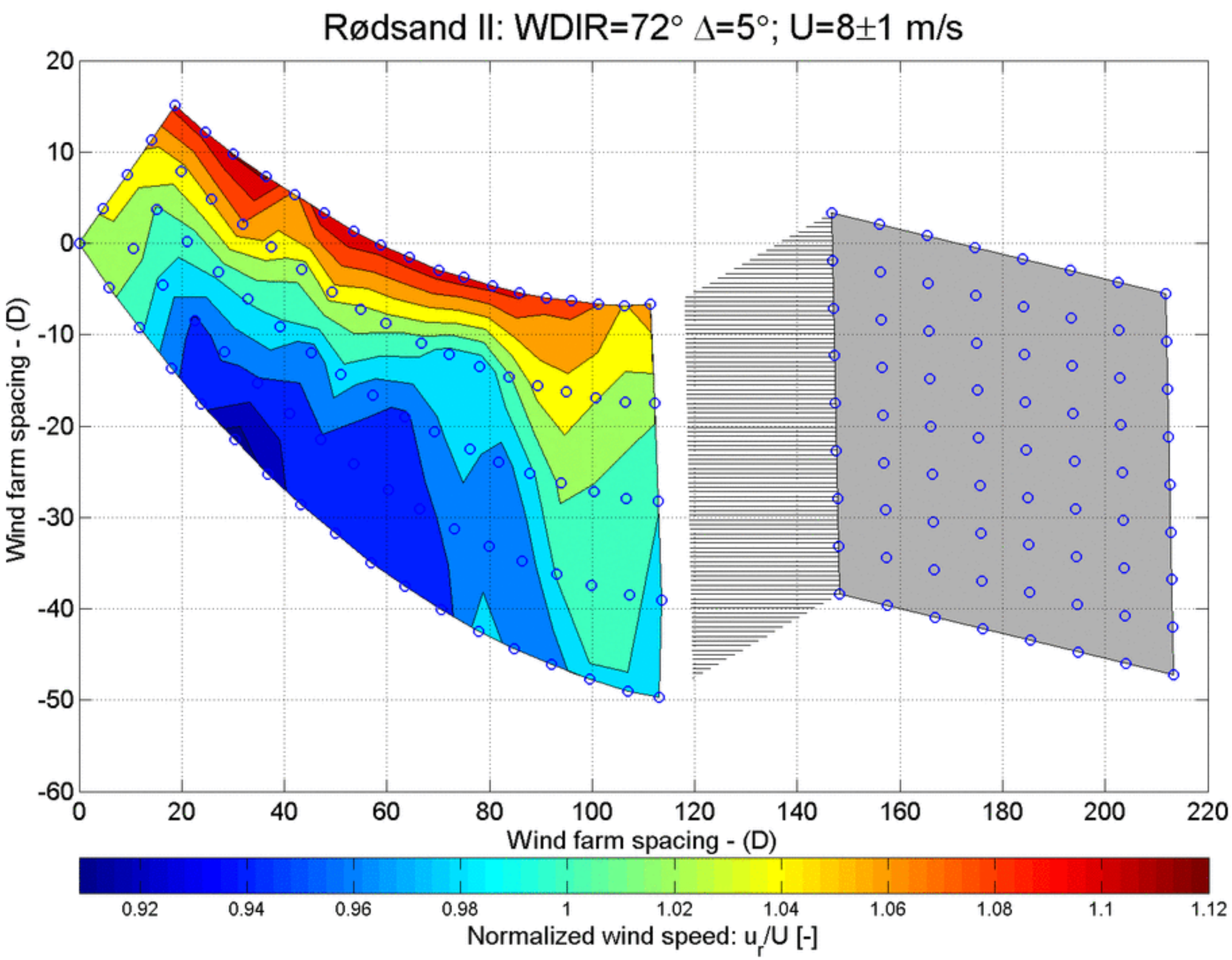
Cluster layout



Wind farm clustering



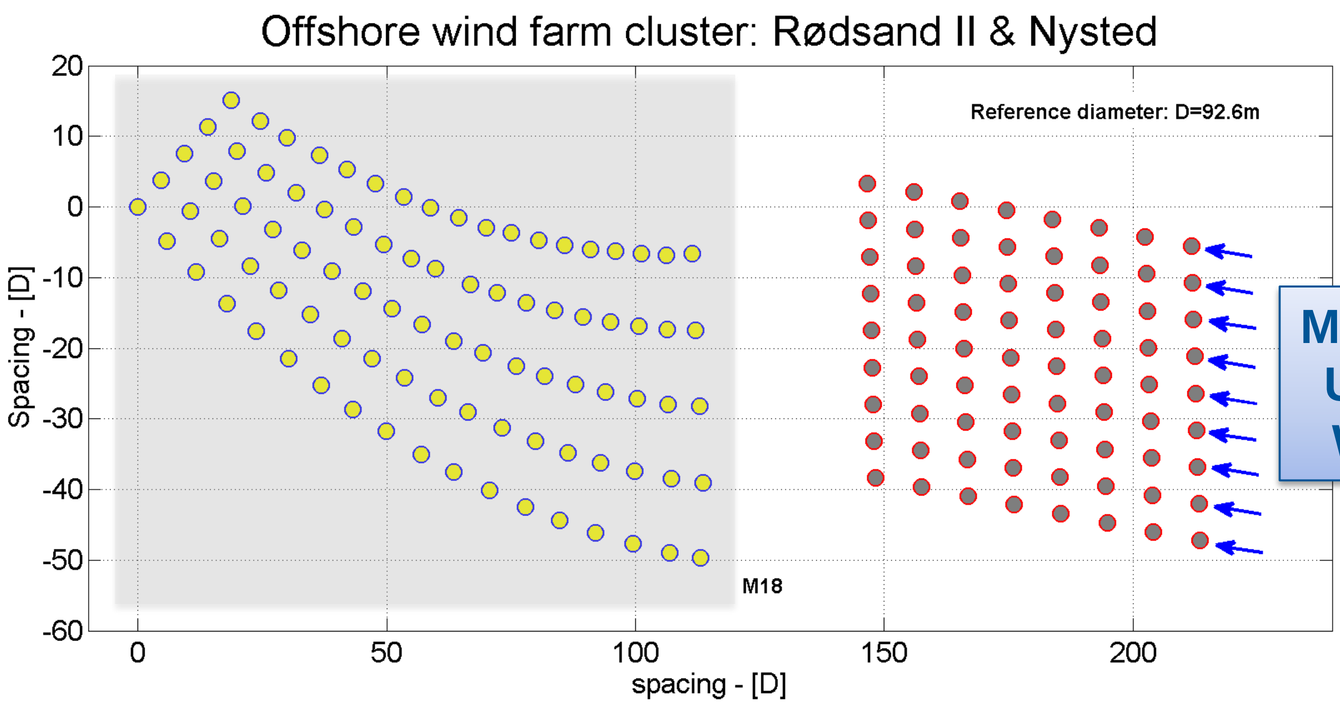
Visualisation of SCADA analysis



Participants & models

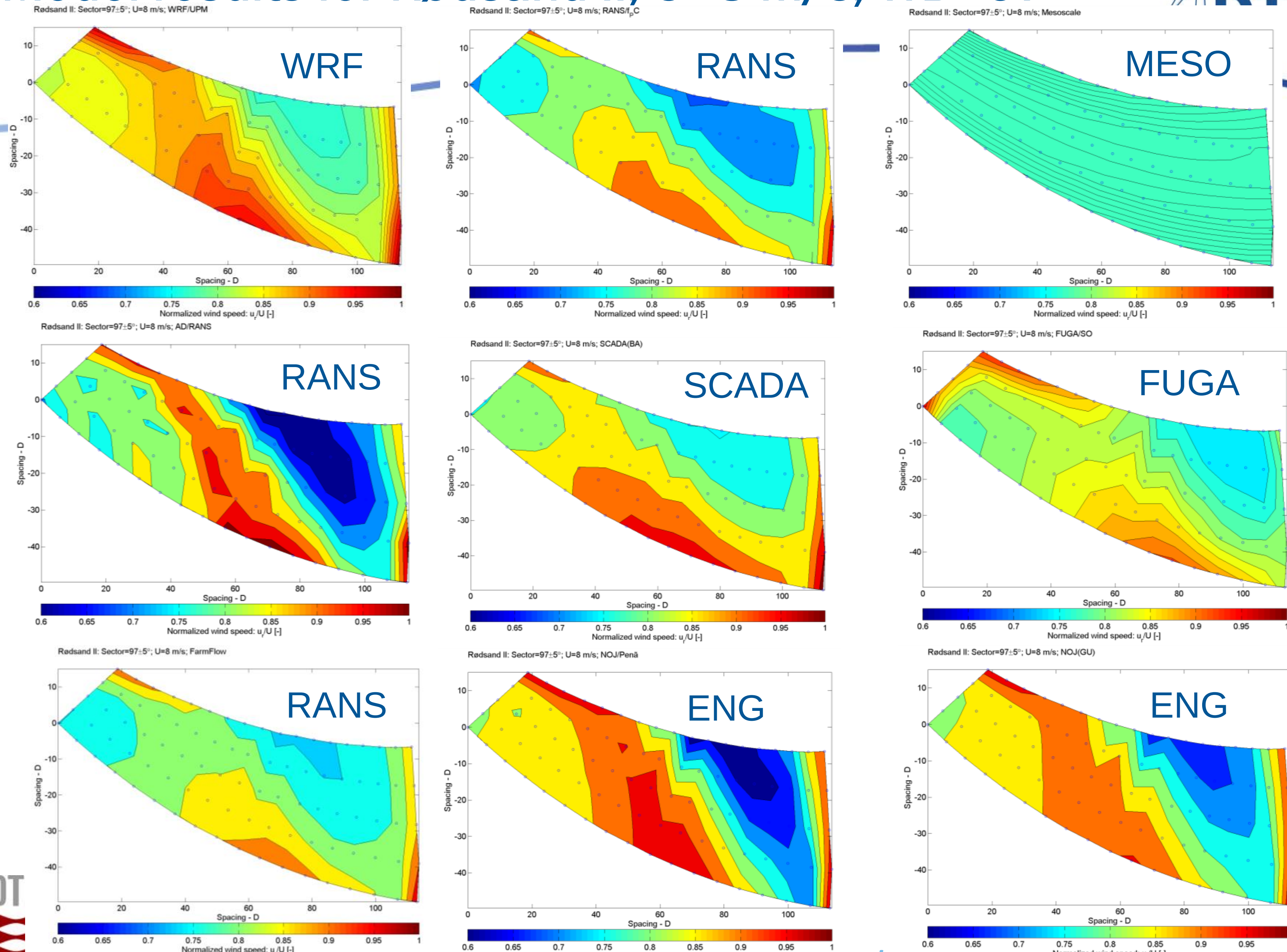
	Models	Affiliation
	SCADA(BA)	DTU Wind Energy/K.S.Hansen
1	FUGA/SO	DTU Wind Energy/S. Ott
2	NOJ(GU)	DTU Wind Energy/A. Pena
3	NOJ/Penã	DTU Wind Energy/A. Pena
4	WRF/UPM	Ciemat/A.Palomares
5	Meso/PV	DTU Wind Energy/P.Volker
6	AD/RANS	UPORTO/J.L. Palma
7	CFDWake	CENER/B.G. Hevia
8	CRESflowNS	CRES/ J. Prospathopoulos
9	FarmFlow	ECN Wind Energy/J.G Scheepers
10	RANS/f_PC	DTU Wind Energy/P.vd Laan

Model results for Rødsand II, U=8 m/s; WD=97

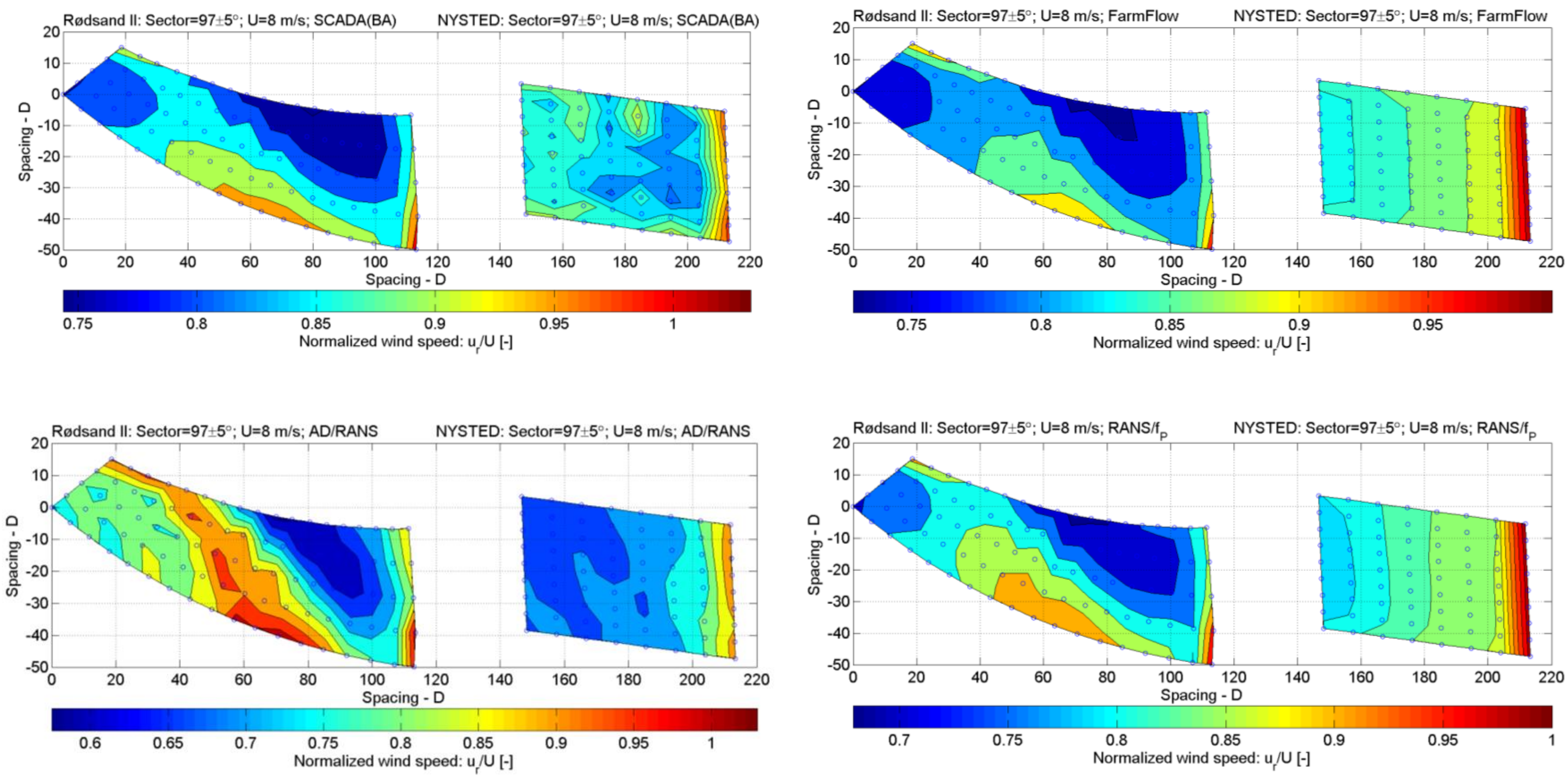


Model inflow
U_{hub}=8 m/s
WDIR=97°

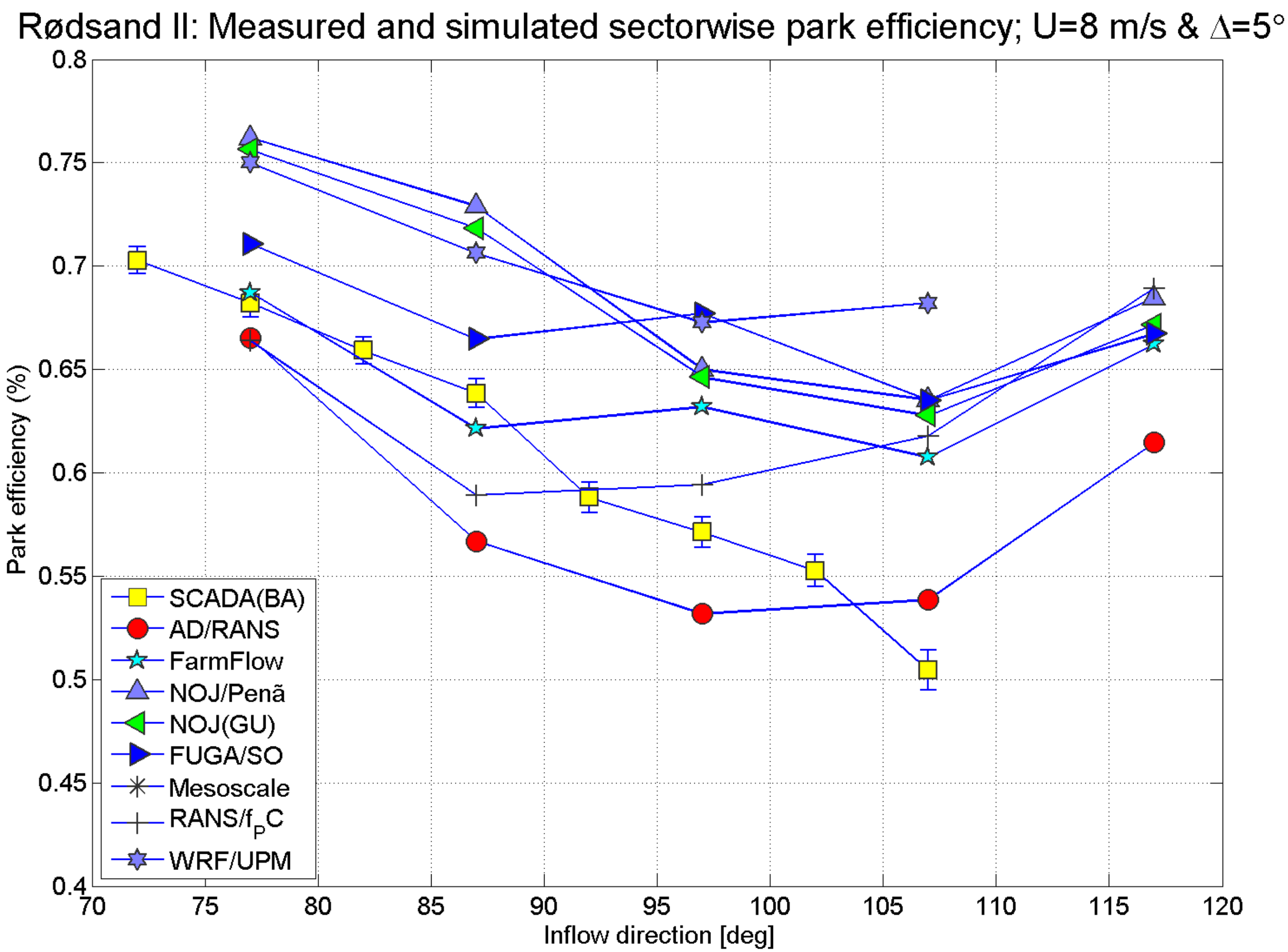
Model results for Rødsand II, U=8 m/s; WD=97 °



Cluster modeling results, U=8 m/s; WD=97 °



Park efficiency comparison



Conclusion

- The benchmark have demonstrated that both size and location of the distinct deficit zones - caused by the Nysted wind farm have been predicted well by the models.
- The benchmark concludes that several park models are able to handle the clustering of wind farms and ready to be integrated in the software, developed as part of “Design Tool for Offshore Wind Farm Cluster” (EERA-DTOC).

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