

Offshore wind resource assessment through satellite images

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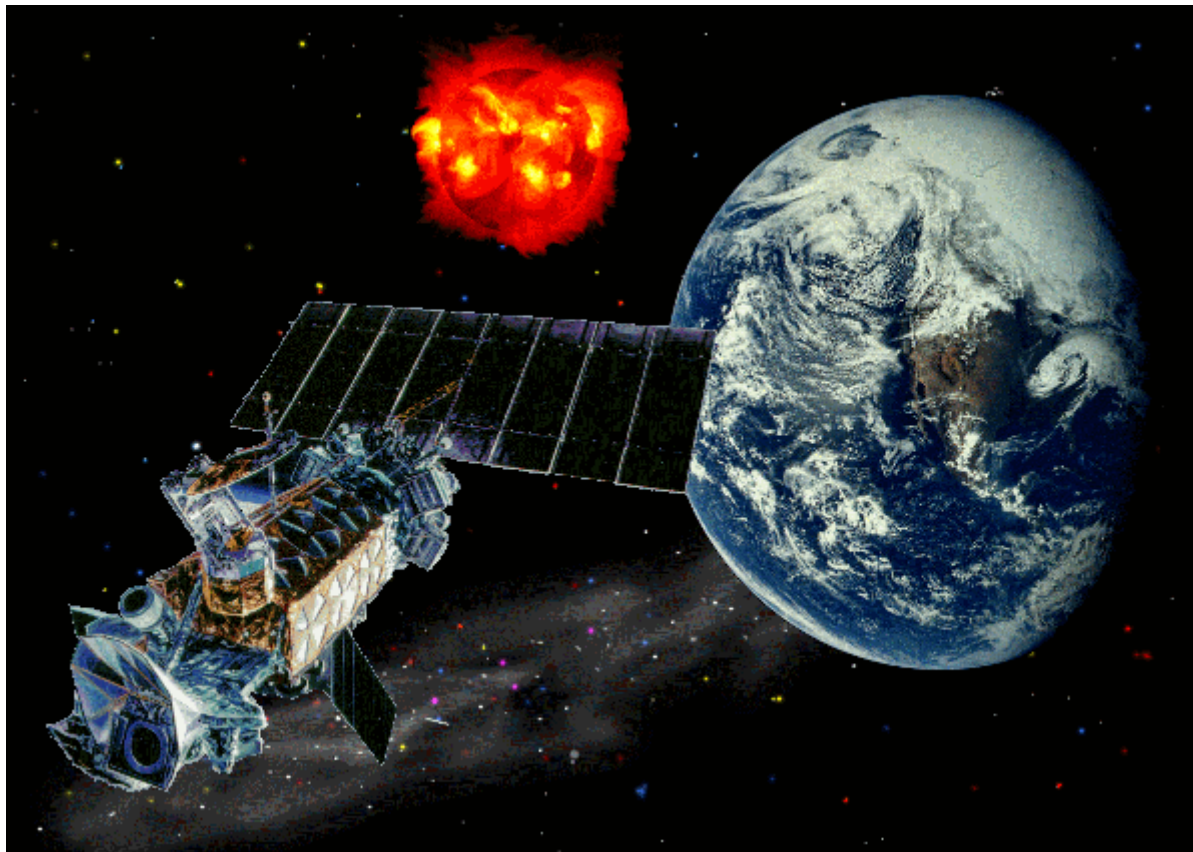
European Geosciences Union (EGU) Nice, France, 25-30 April 2004

Outline

- Objective
- Satellite SAR wind mapping method
- Wind maps from Horns Rev wind farm
- Demo of the Risø Wemsar Tool (RWT)

Objective

To use satellite SAR images for
offshore wind resource assessment
in lieu of in-situ mast observations



Available satellite SAR scenes

ERS-1/-2 SAR

ca. 400 since 1992

Envisat ASAR

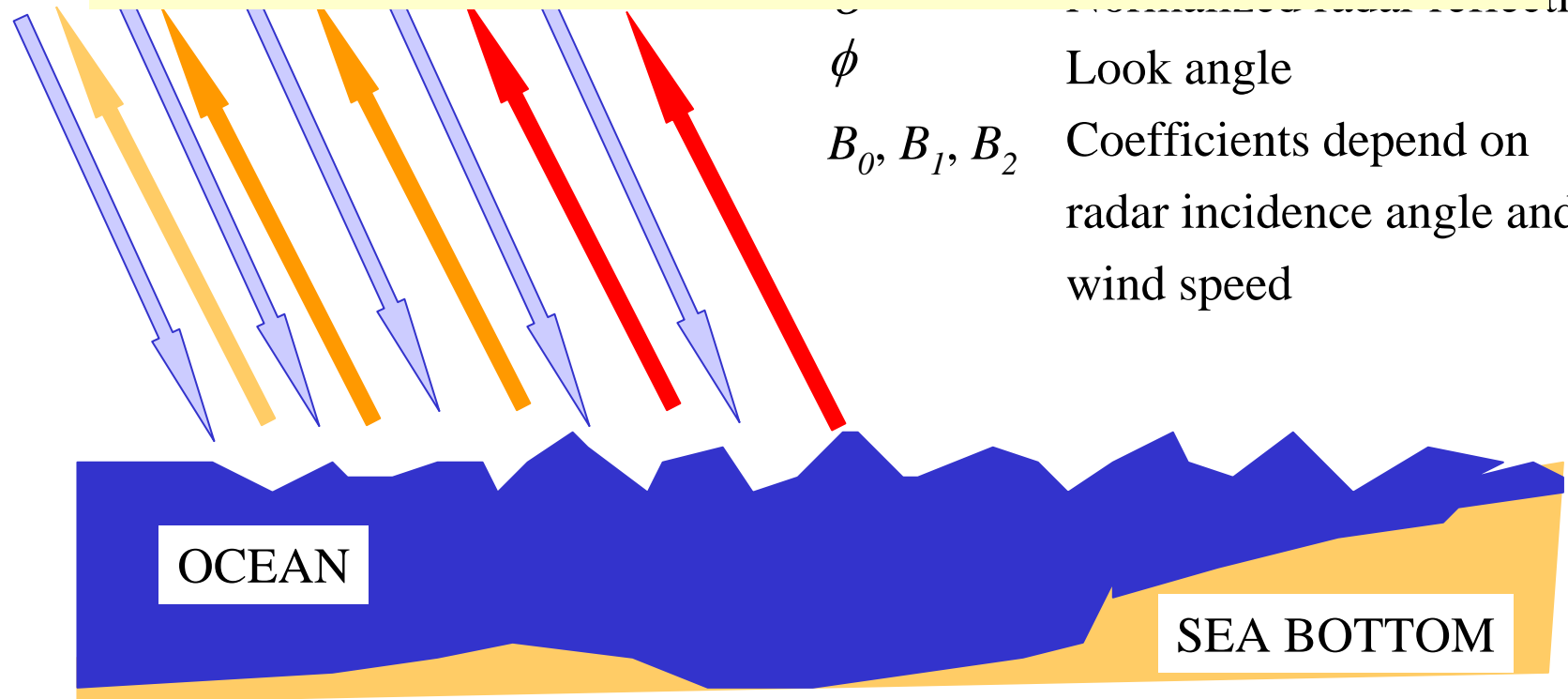
some since 2002

Radarsat

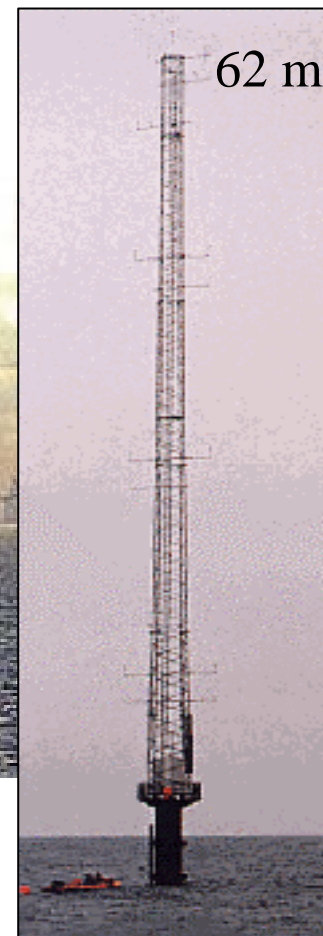
some since 1995

$$\sigma^0 = B_0(1 + B_1 \cos(\phi) + B_2 \cos(2\phi))$$

CMOD4 Stoffelen et al. 1997



Study site Horns Rev

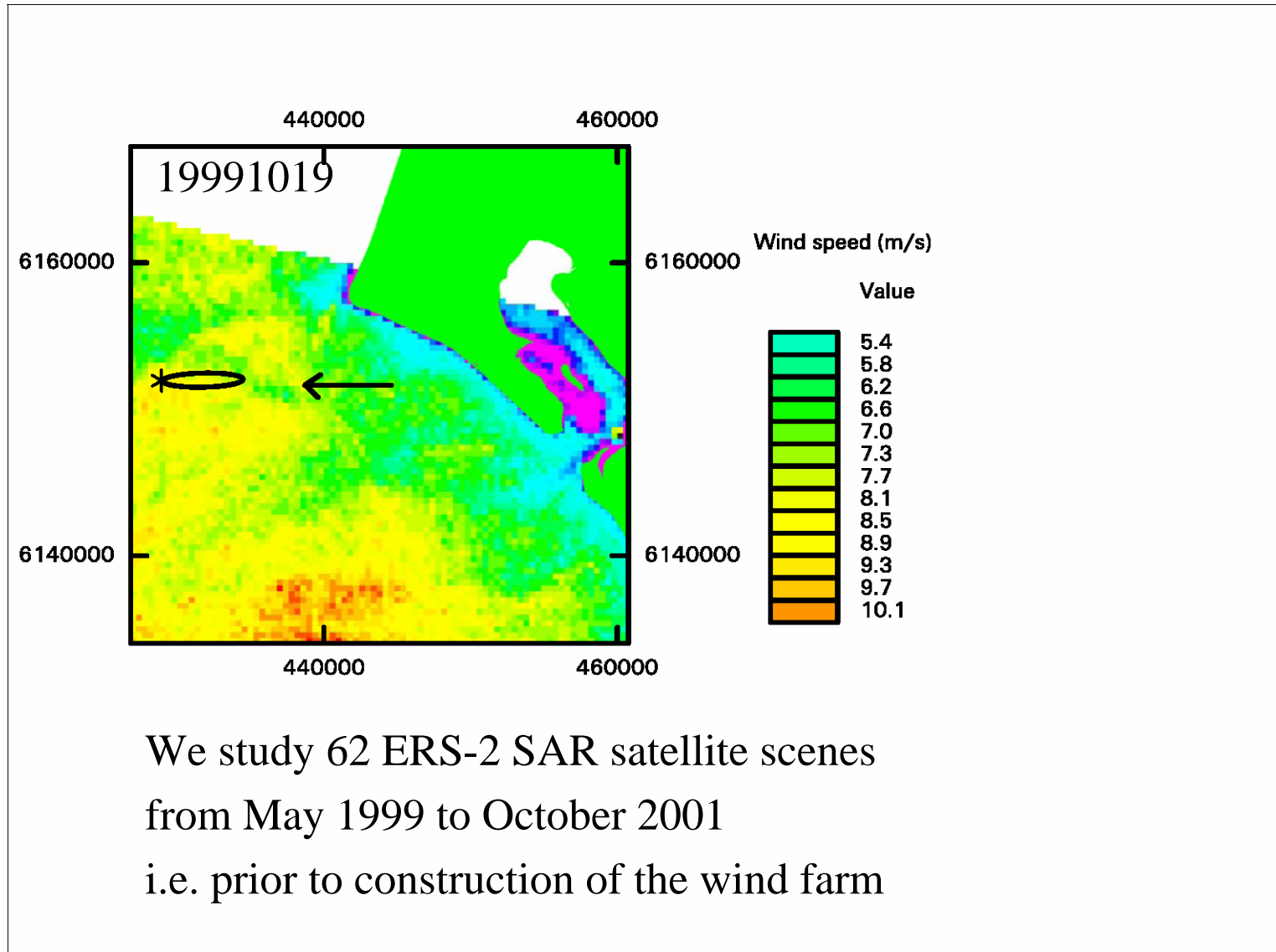


Horns Rev wind farm in the North Sea, Denmark

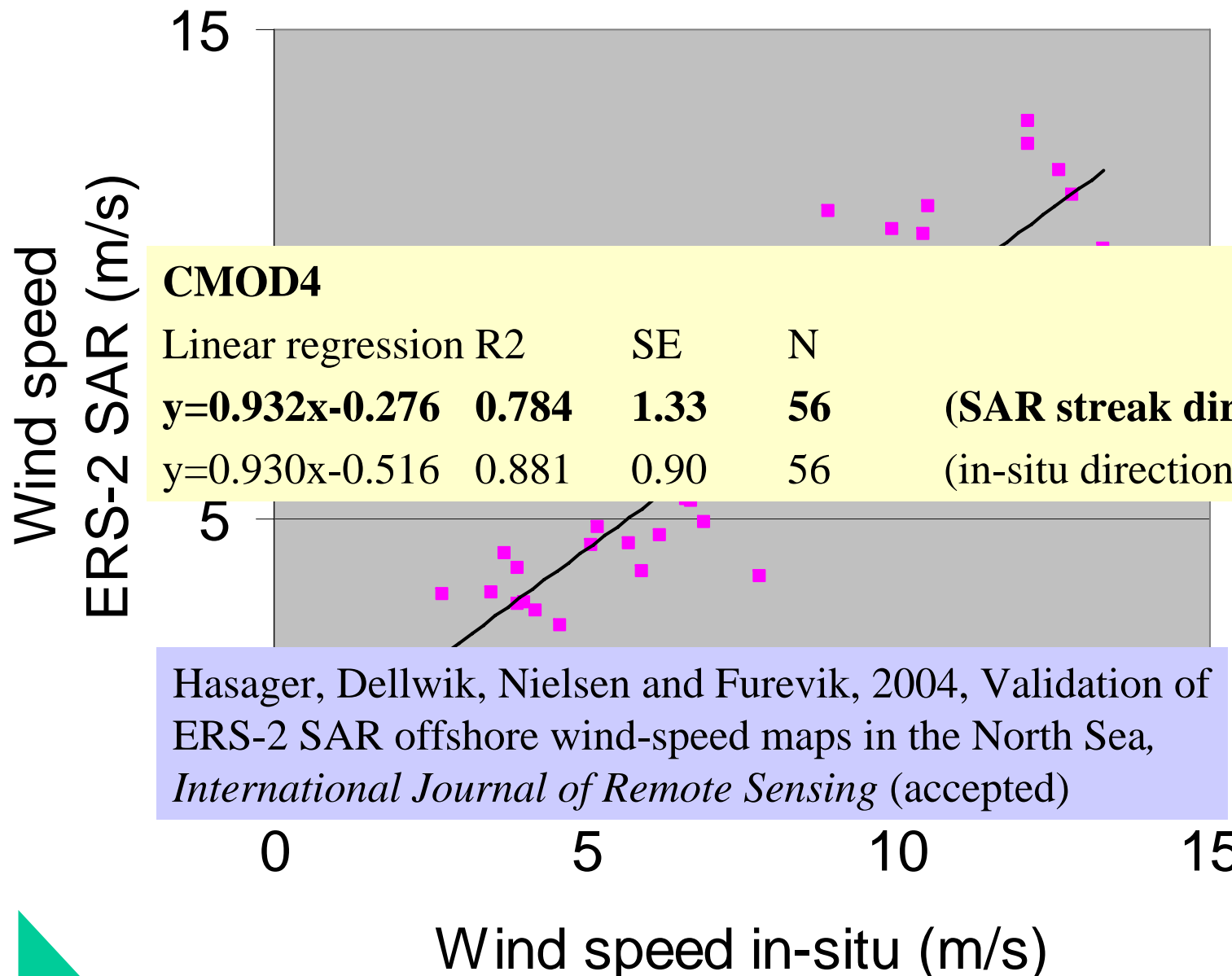




Footprint averaging per scene



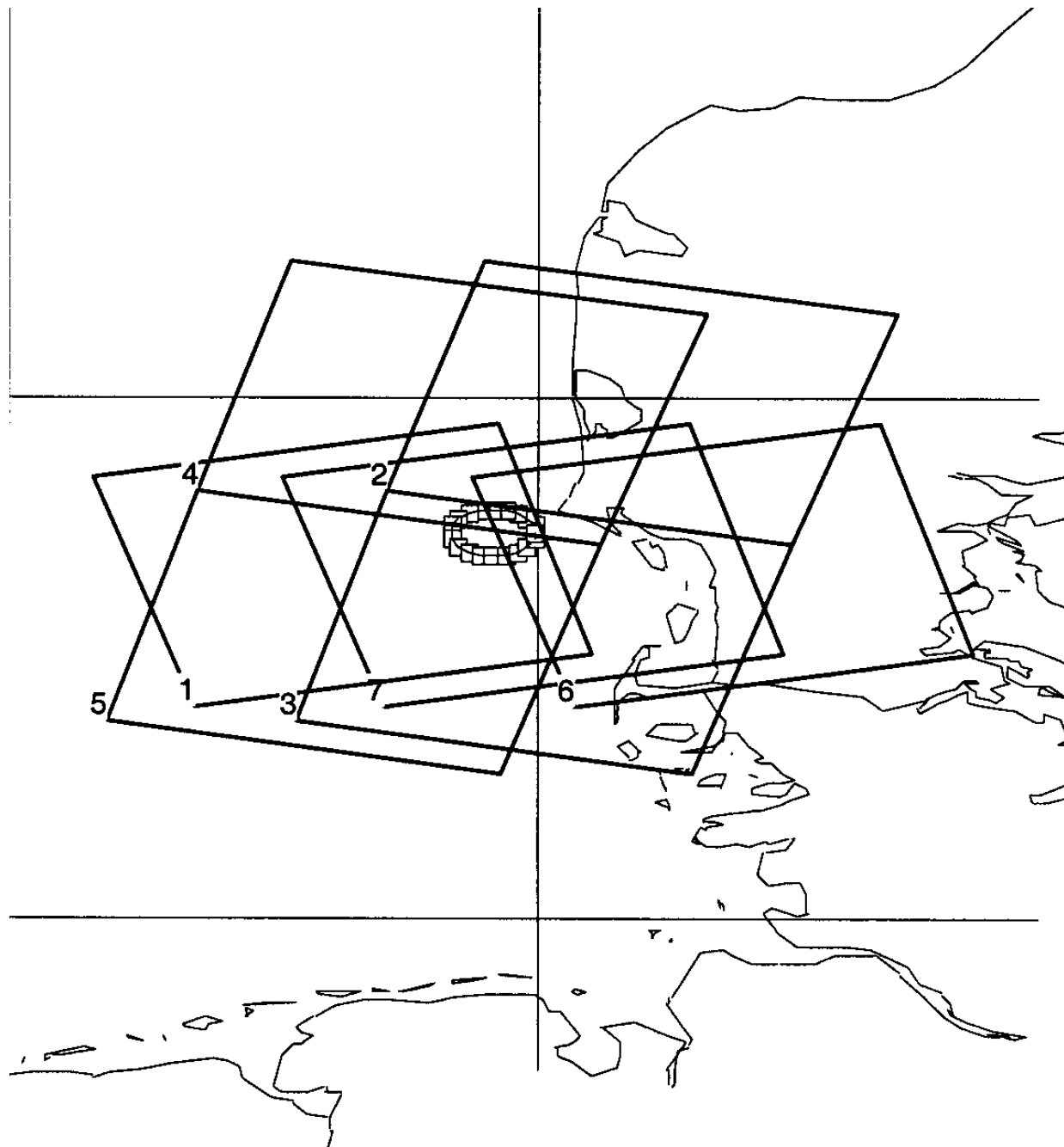
Horns Rev in the North Sea



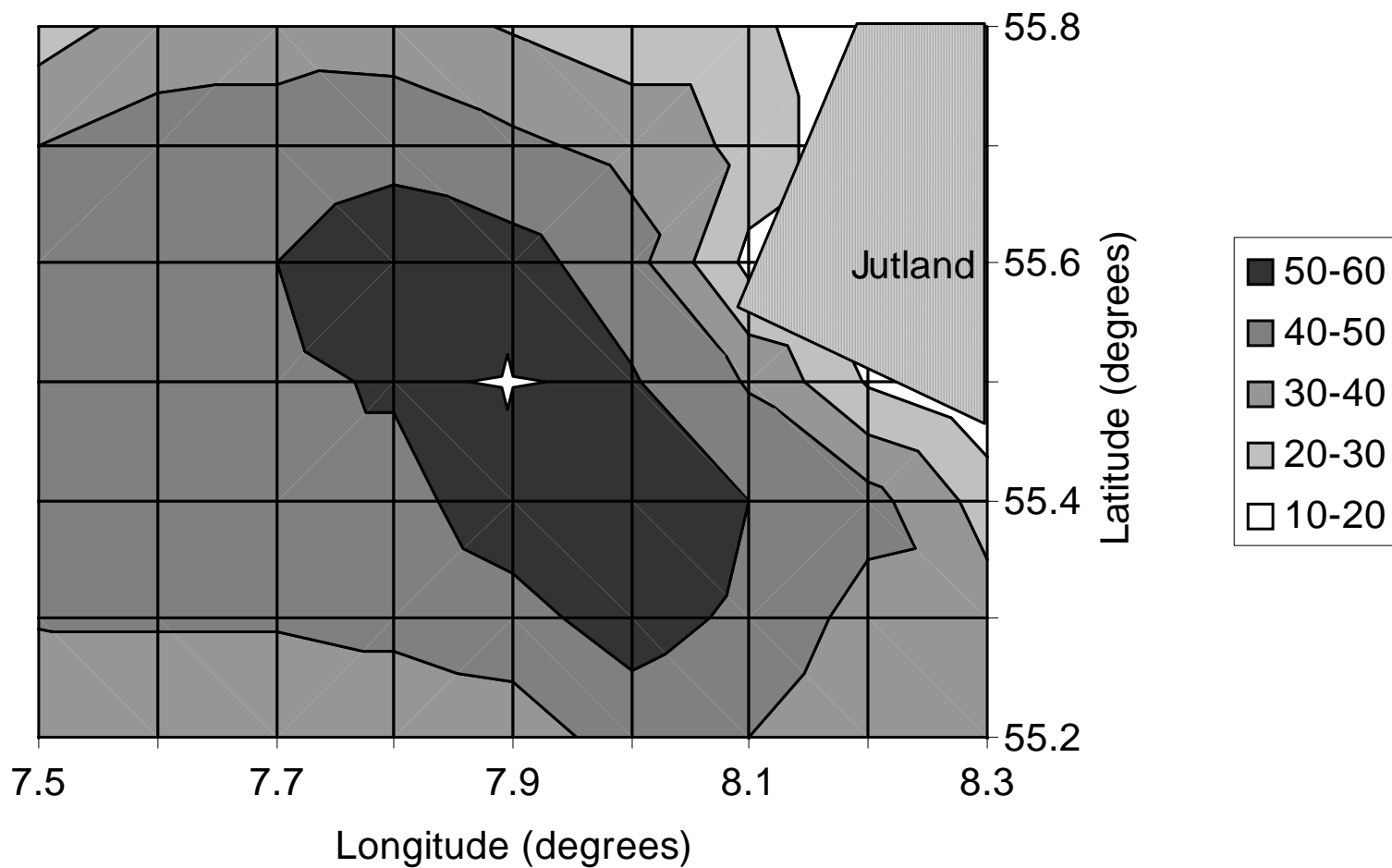
CMOD4

Linear regression	R2	SE	N	
$y=0.932x-0.276$	0.784	1.33	56	(SAR streak direction)
$y=0.930x-0.516$	0.881	0.90	56	(in-situ direction)

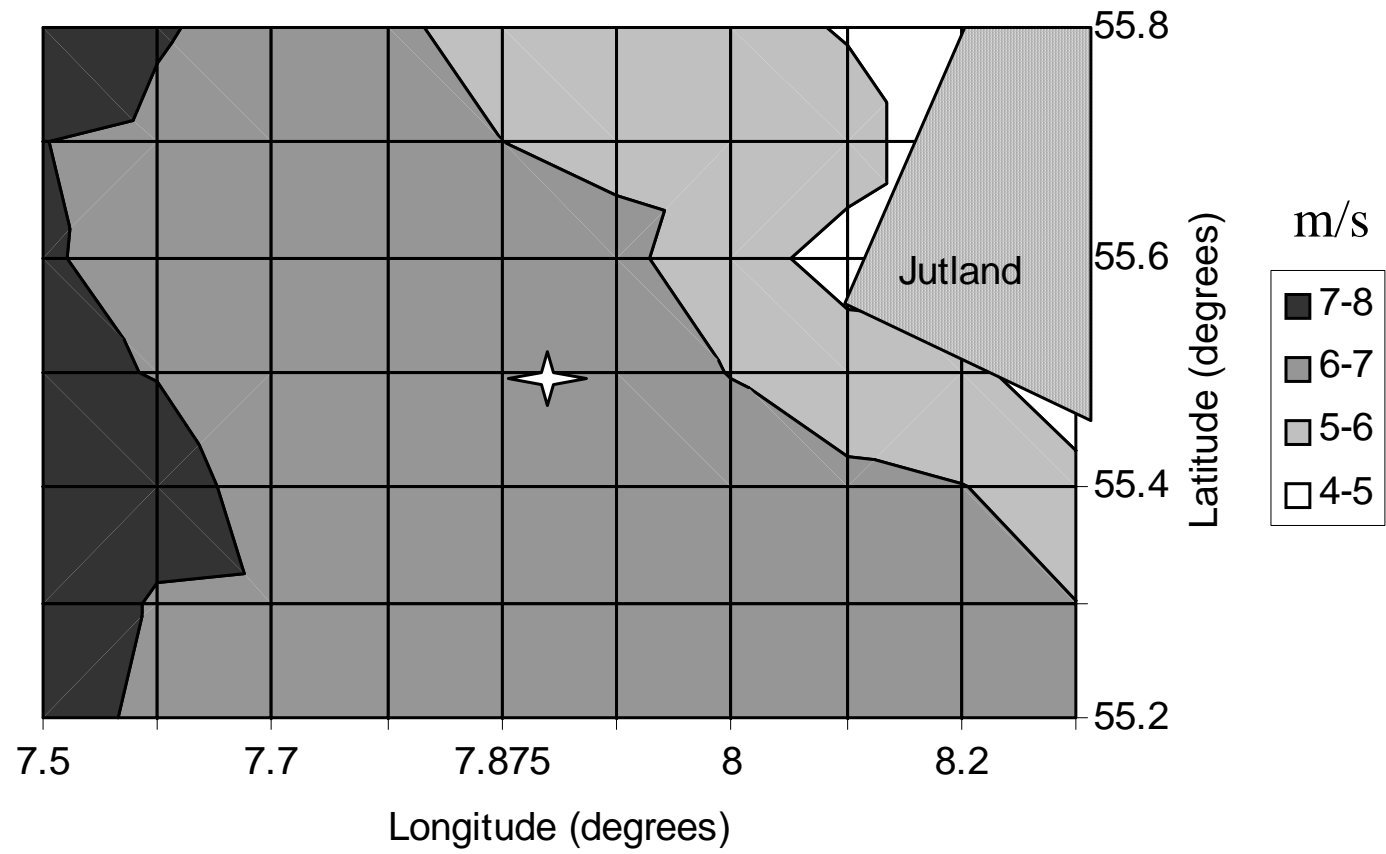
Hasager, Dellwik, Nielsen and Furevik, 2004, Validation of ERS-2 SAR offshore wind-speed maps in the North Sea, *International Journal of Remote Sensing* (accepted)



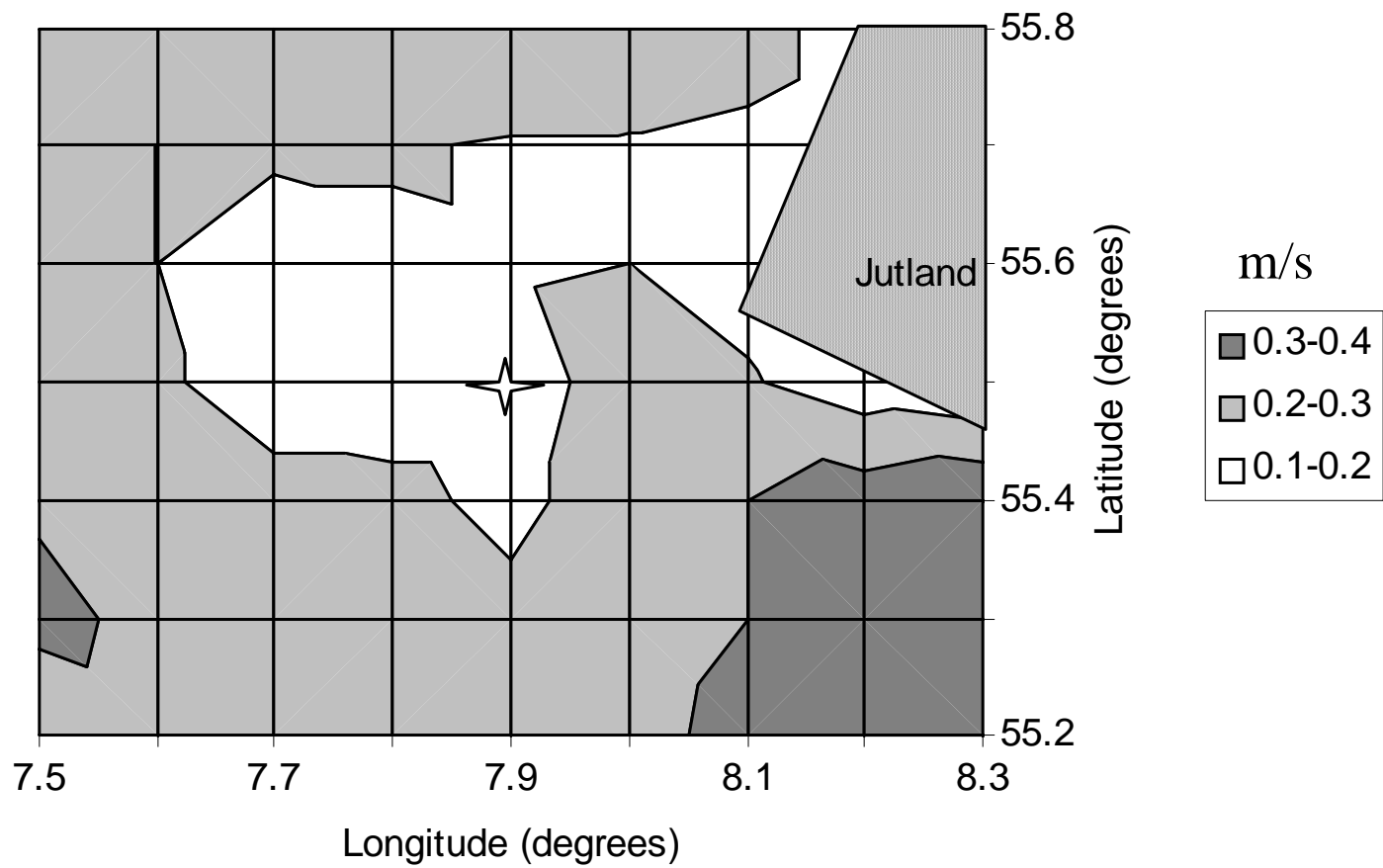
Number of SAR samples



ERS-2 SAR mean wind speed (m/s)



Standard deviation



On-line DEMO of the RWT1.0 programme

Acknowledgements

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STVF	SAR-WAKE project (2003-2004)
STVF	SAT-WIND project (2004-2005)
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EU	WEMSAR (2000-2003)

Data:

ESA EO-1356 and AO-153 for satellite data
Elsam Engineering for meteorological data