Satellitbilleder og vejrprognoser

SAT-MAP-CLIMATE project

Partners

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Funding

ESA-følgeforskning, Forskningstyrelsen 1999-2002

PROJECT OBJECTIVE

Satellite-based bio-geophysical parameter mapping and aggregation modelling for weather forecasting and climate models

Earth observation satellite data

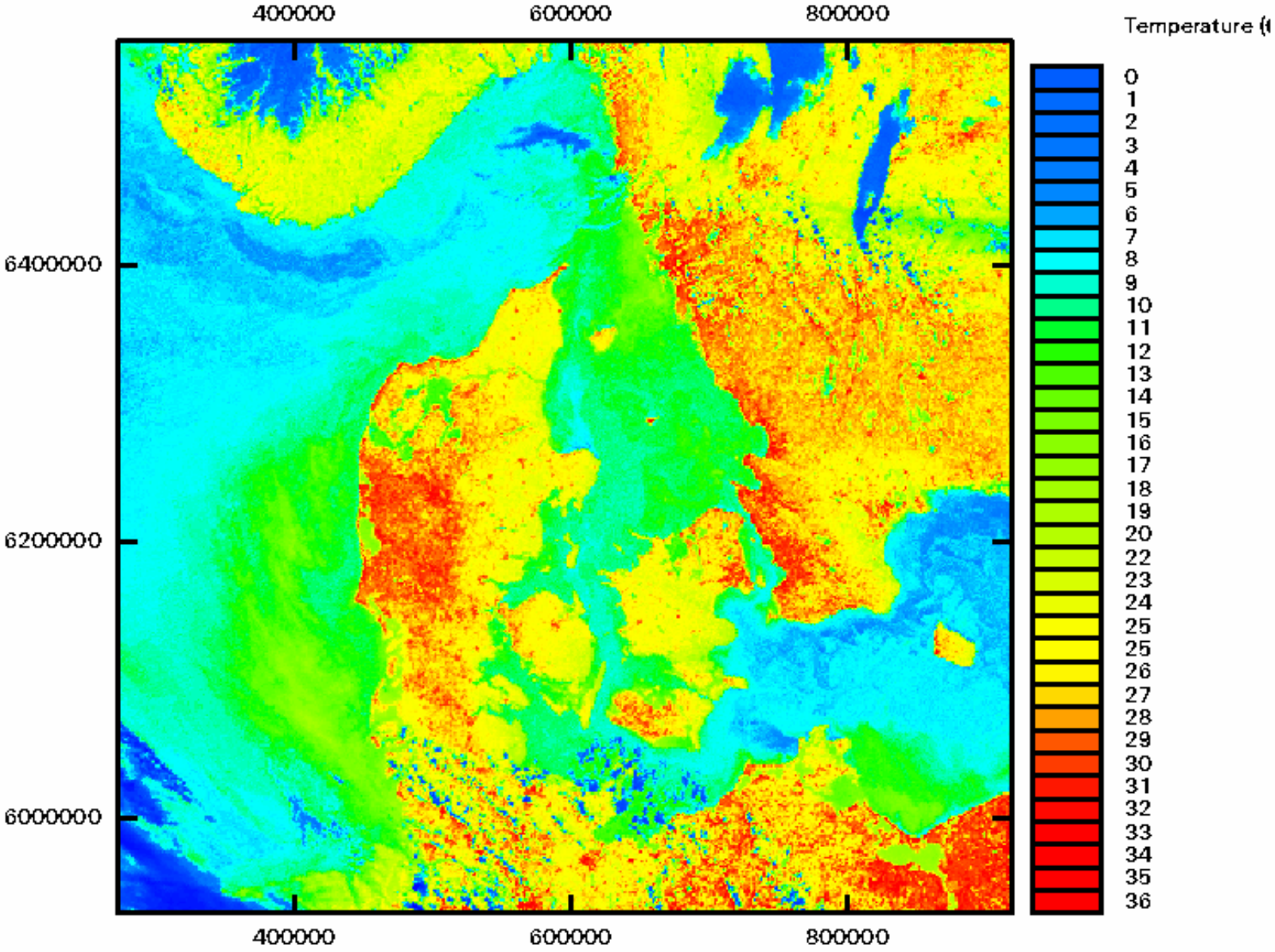
Albedo	(NOAA AVHRR)
Land- and sea surface temperatures	(NOAA AVHRR)
Vegetation	(Landsat TM, SPOT)
Land cover types	(Landsat TM, SPOT)
Roughness	(Landsat TM, SPOT)

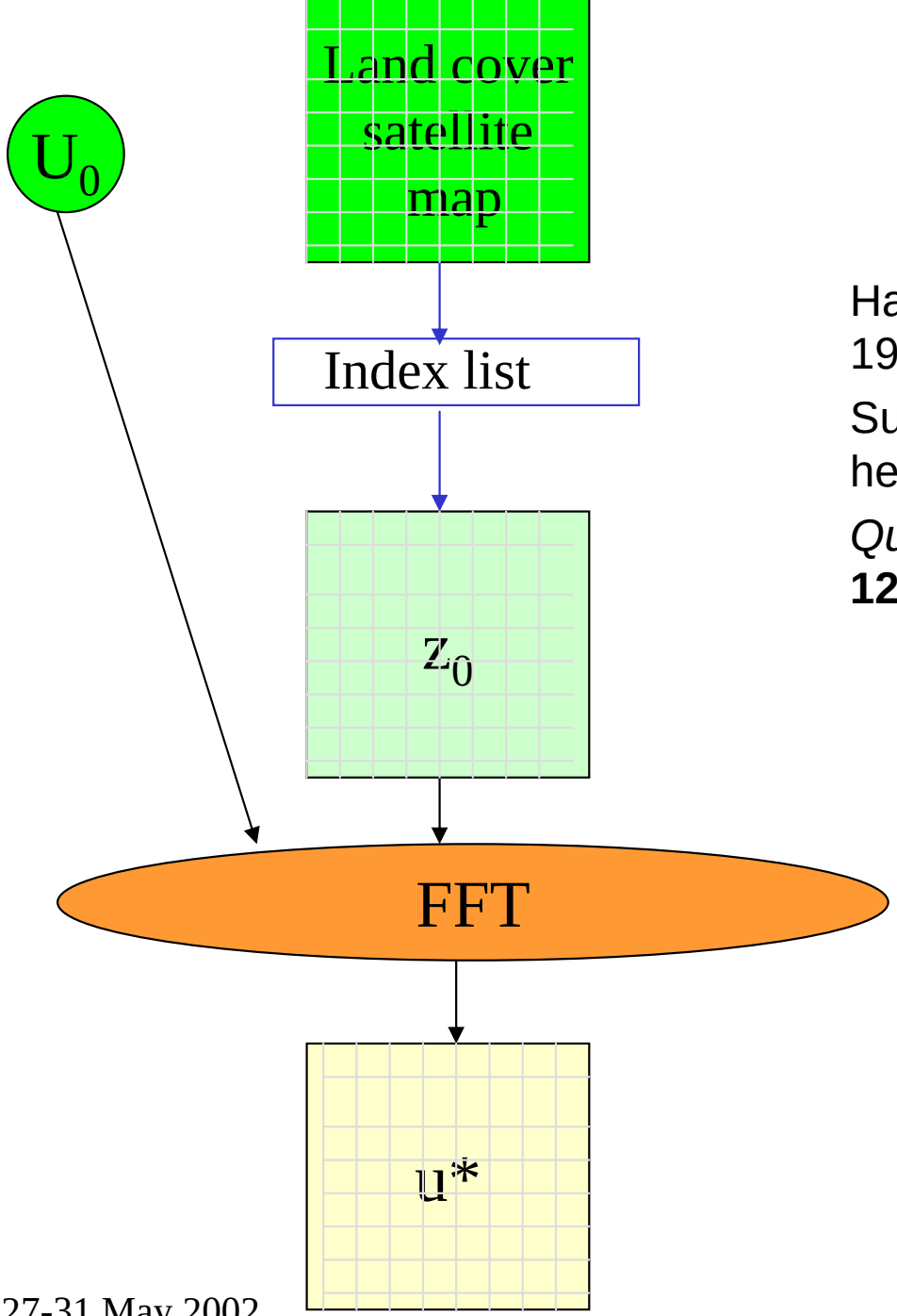
Models

Microscale aggregation model	(Risø)
HIRLAM	(DMI)
HIRHAM	(DMI)

NOAA AVHRR land and sea surface temperature map

29. April 2000

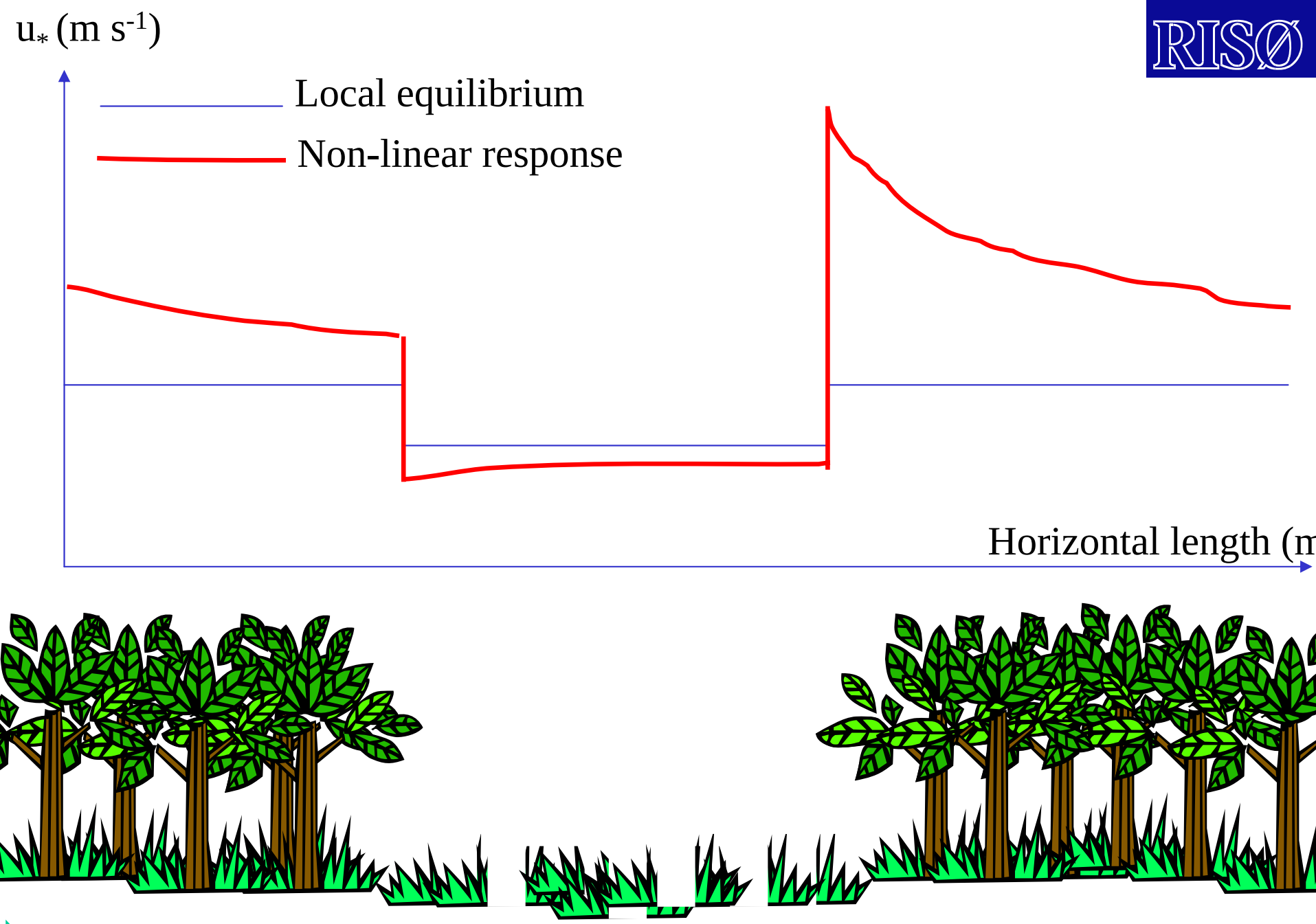




Hasager C.B. and N.O.Jensen, 1999

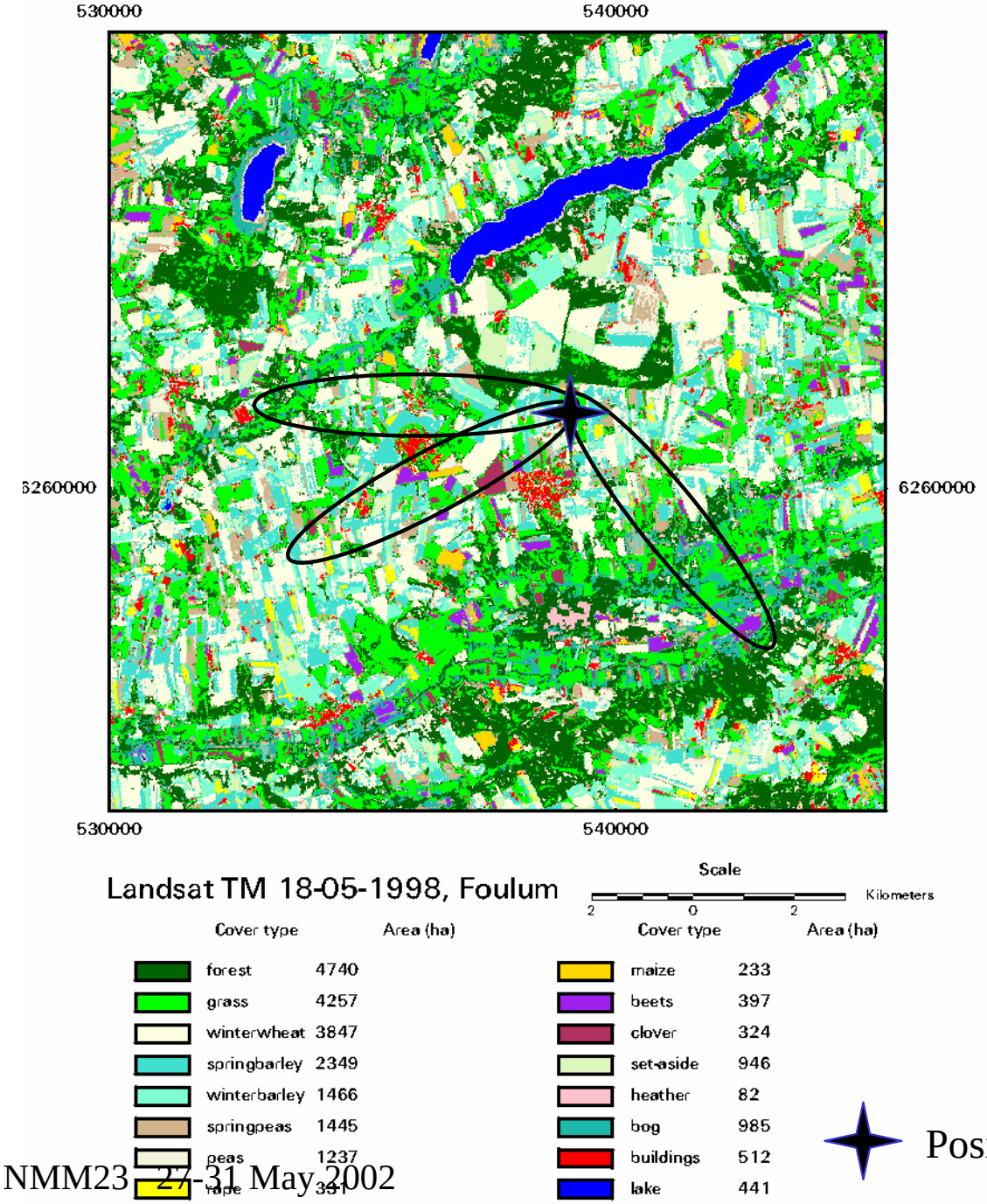
Surface flux aggregation in heterogeneous terrain

Quart. J. Royal. Meteorol. Soc. **125**, 2075-2102


u_* (m s^{-1})
Local equilibrium
Non-linear response
Horizontal length (m

$$< u_* > = \sqrt{\frac{1}{n_1 n_2} \sum_{x=1}^{n_1} \sum_{x=2}^{n_2} u_*^2(x,y)}$$

$$z_{0eff} = z / \exp\left(\frac{\kappa\, u(z)}{< u_* >}\right)$$

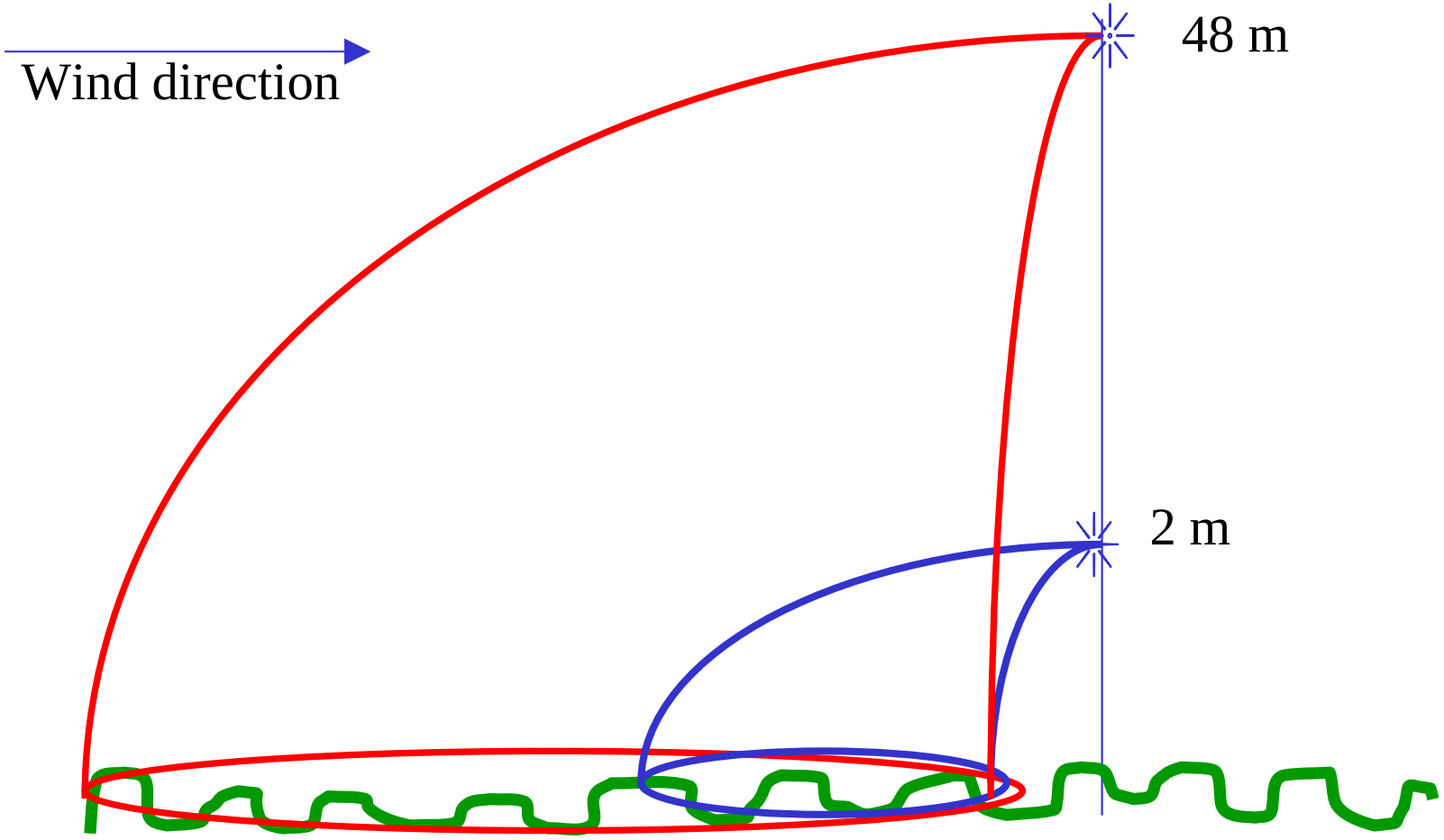


Landsat TM

Land cover map

Position of 48 m tall meteorology mast

Mast observations relate to a given footprint



Areal Information System (AIS) http://www.dmu.dk/ais

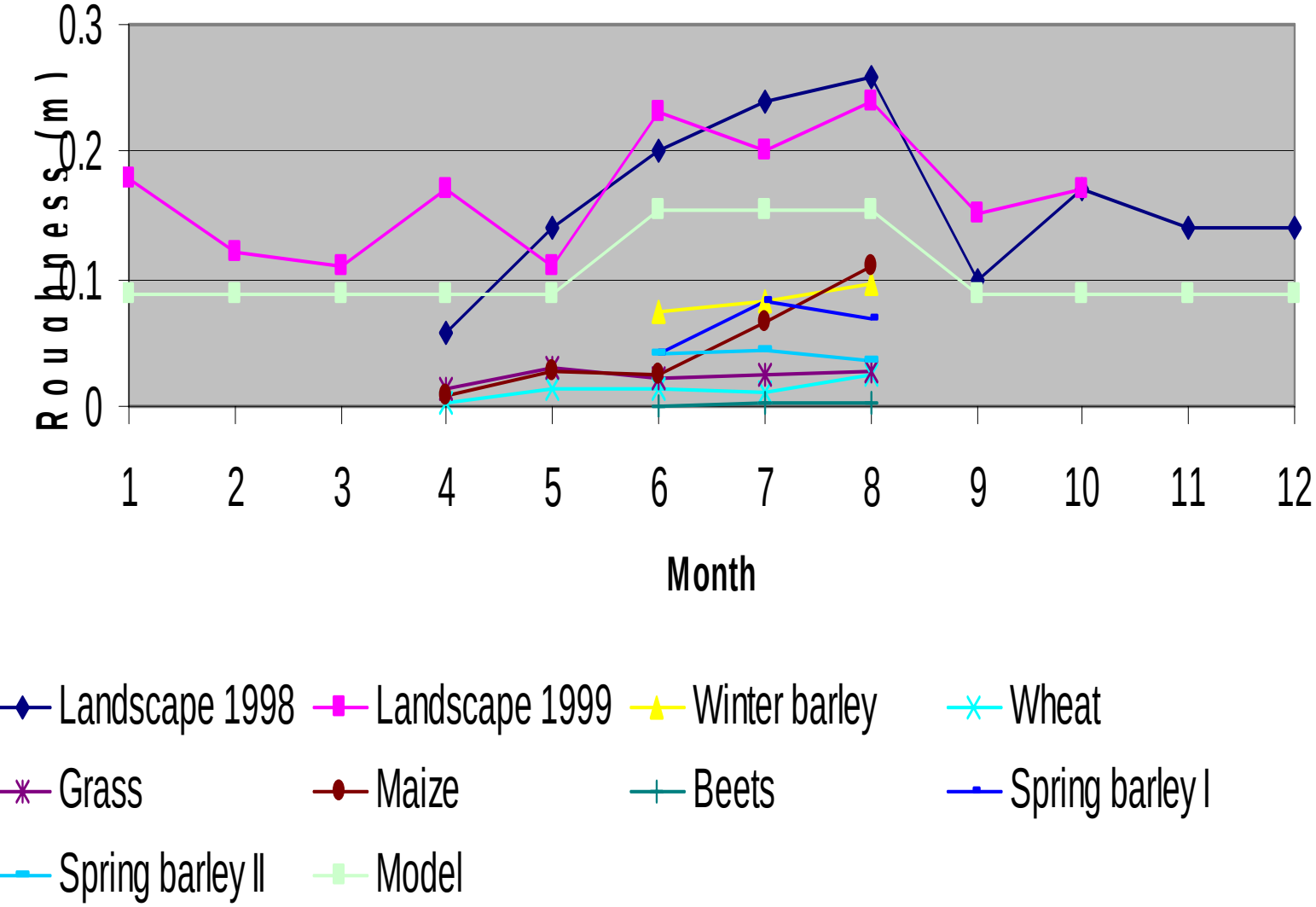
RISØ

Land cover type	Roughness
Water	0.001
Sand	0.03
Marsh	0.08
Grass heath	0.08
Permanent short grass	0.03
Grazing	0.08
Meadow	0.08
Bush/grass heath	1
Bush/heather	1
Bush/forest	1.8
Deciduous forest	1.8
Coniferous forest	1.8
Meadow	0.08
Agriculture	0.05
Discontinuous urban	0.5
Continuous urban	1.2
Beech forest	1.8
Young forest	1.8
Spruce plantation	1.8
Mixed forest	1.8
Mountain pine	1.8
Oak forest	1.8
Lark forest	1.8
Clearing	0.3
Sparse coniferous	1.8
Heather	0.08
Peat bog	0.08
Set-aside	0.08
Juniper heath	0.08
Heathland	0.08
Agriculture/grassland	0.05

25 m pixel resolution

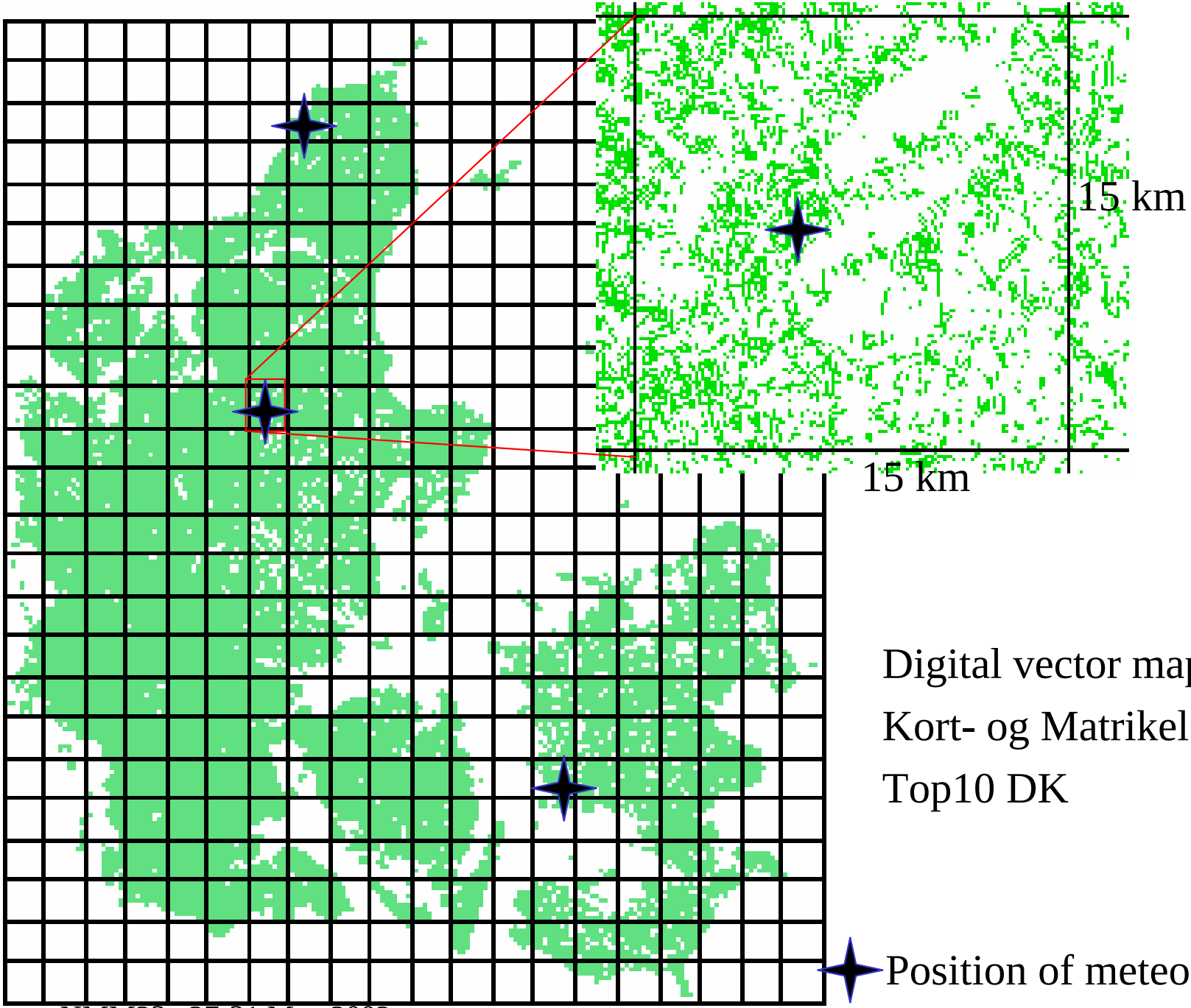
Position of tall meteorology masts

Foulum



One 48.0 m tall m

Seven short masts



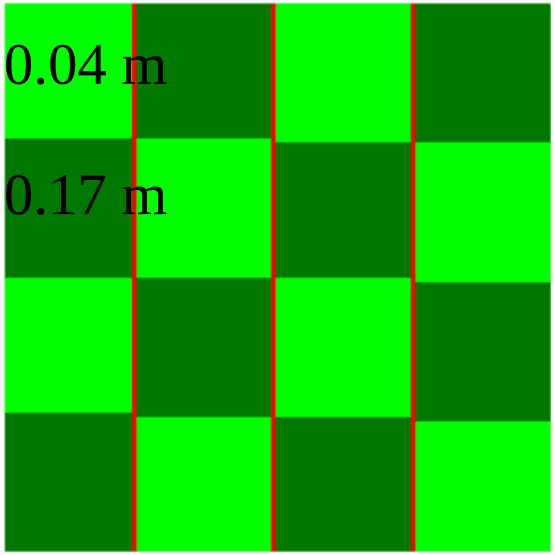
Digital vector map from
Kort- og Matrikelstyrelsen
Top10 DK

Position of meteorology mas

Sensitivity to hedges in checkerboard terrain

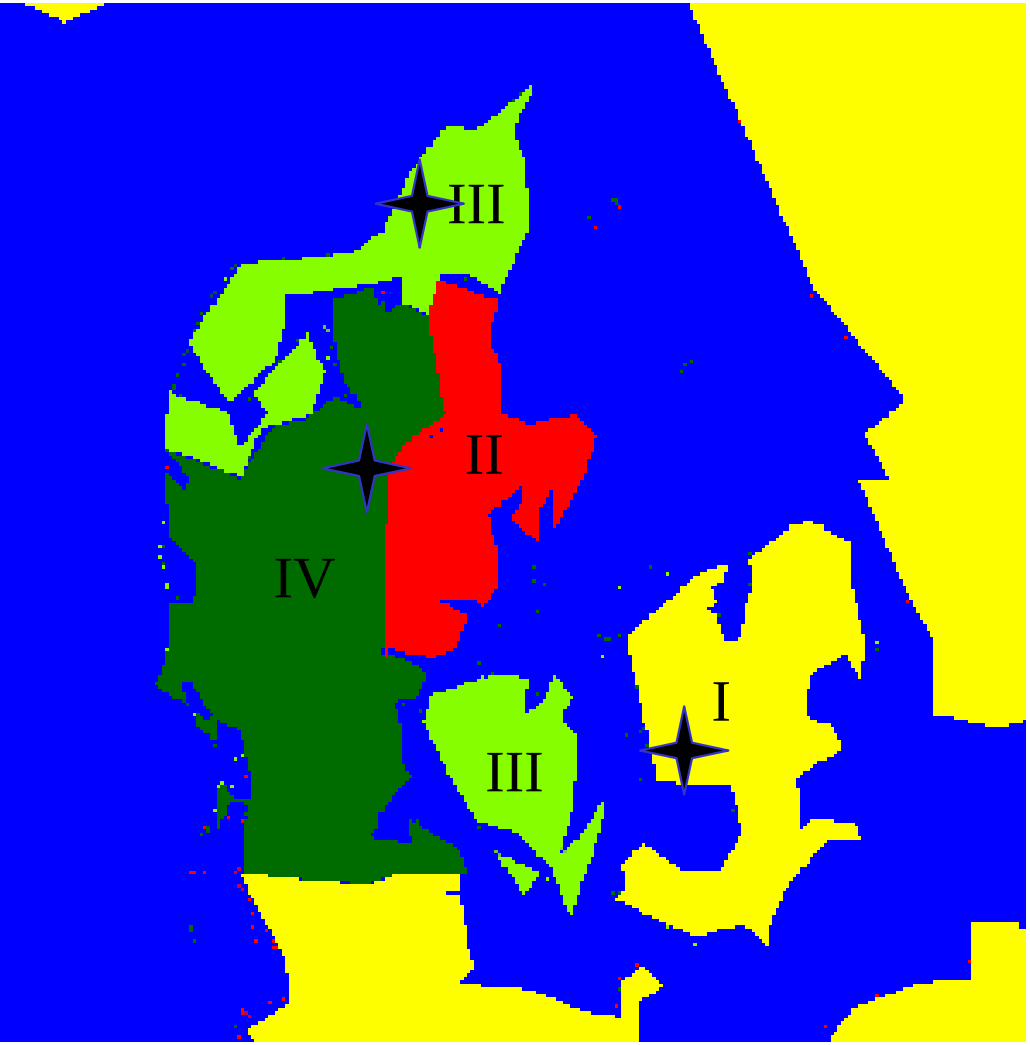
	Distance of hedges (m)	1	1.5	2
z0_eff	320	0.109	0.116	0.122
z0_eff	640	0.109	0.115	0.122
Added roughness	320	0.027	0.034	0.04
Added roughness	640	0.027	0.033	0.04

Synthetic data



Average log z_0 = 0.082 m

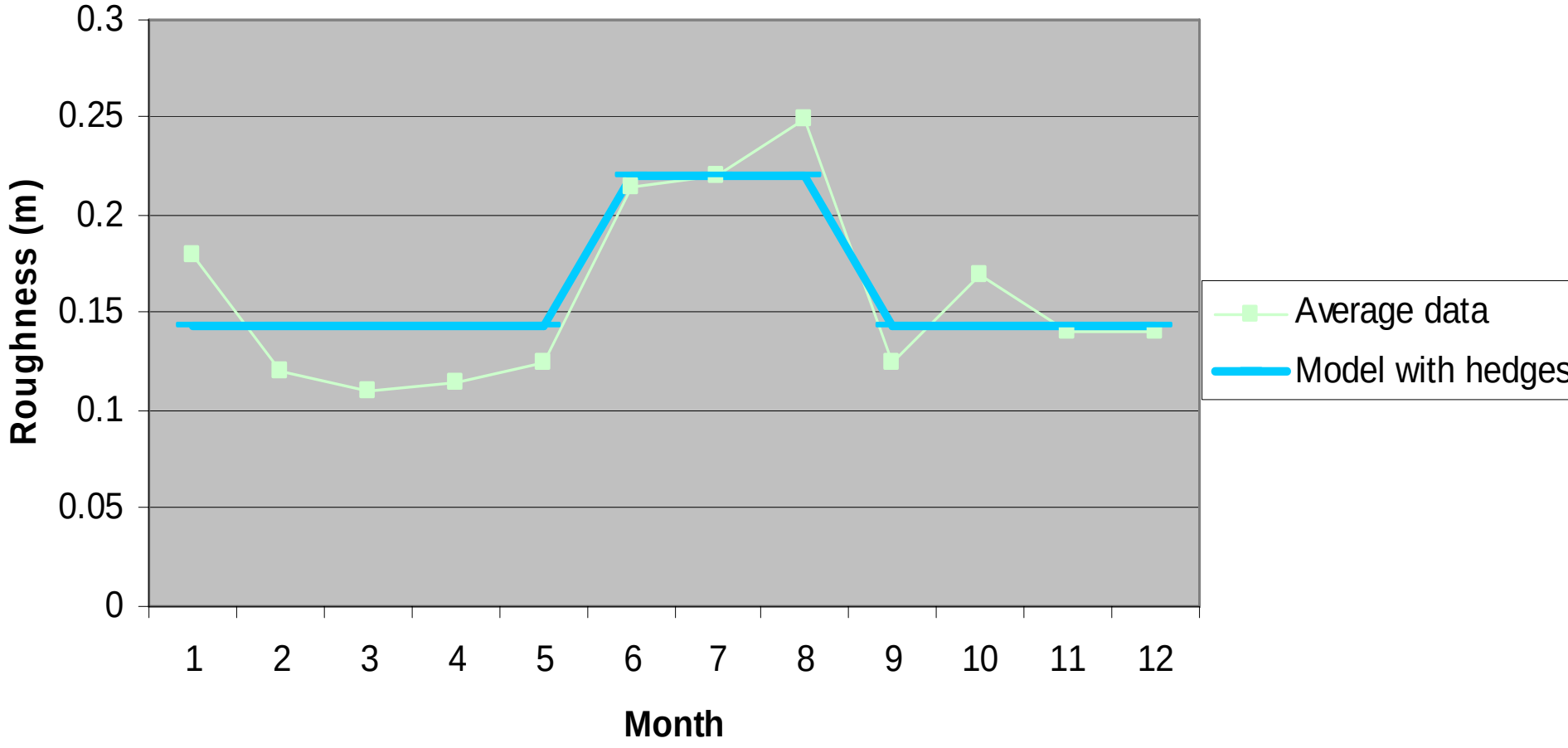
Regions of different hedge density in Denmark

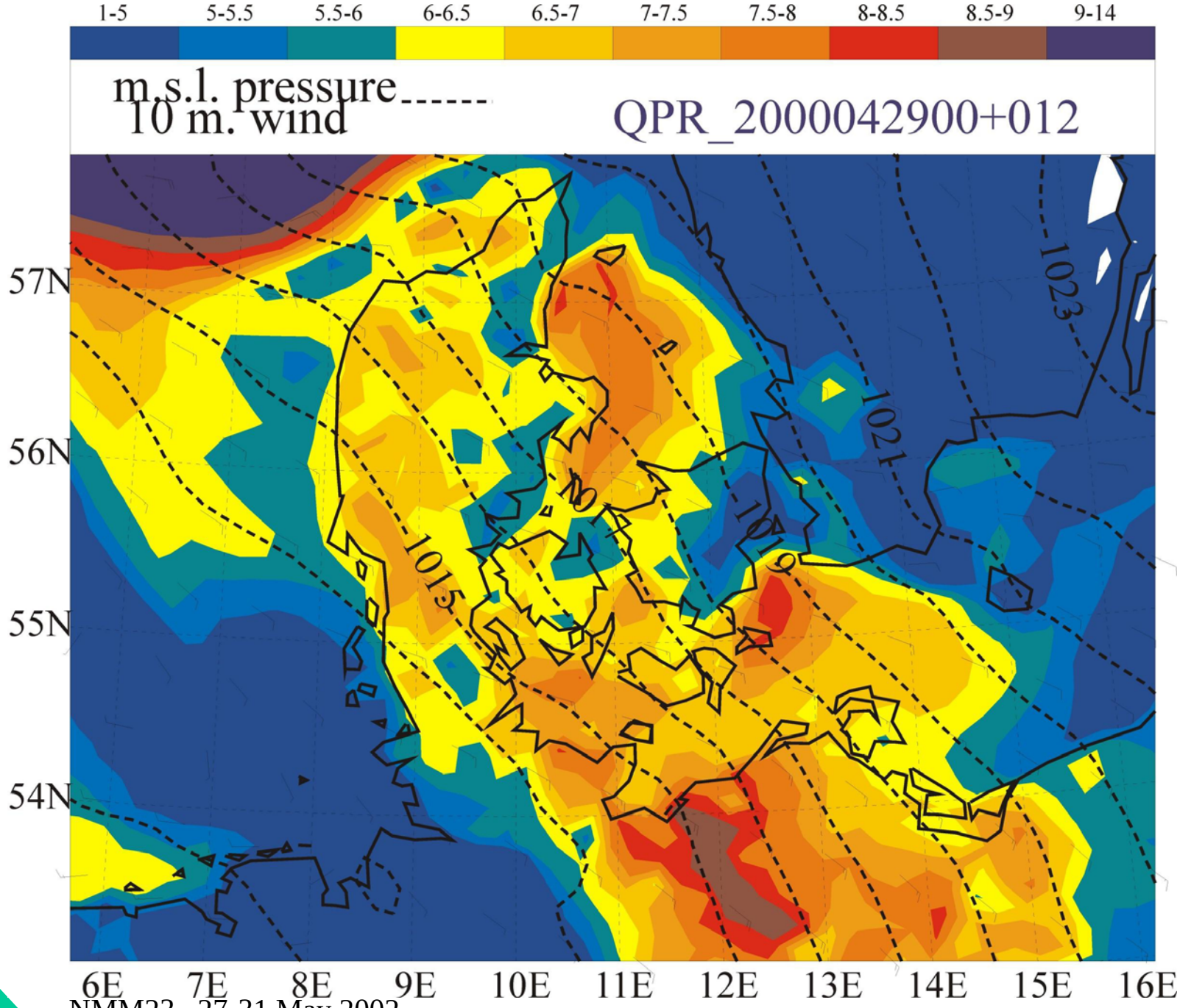


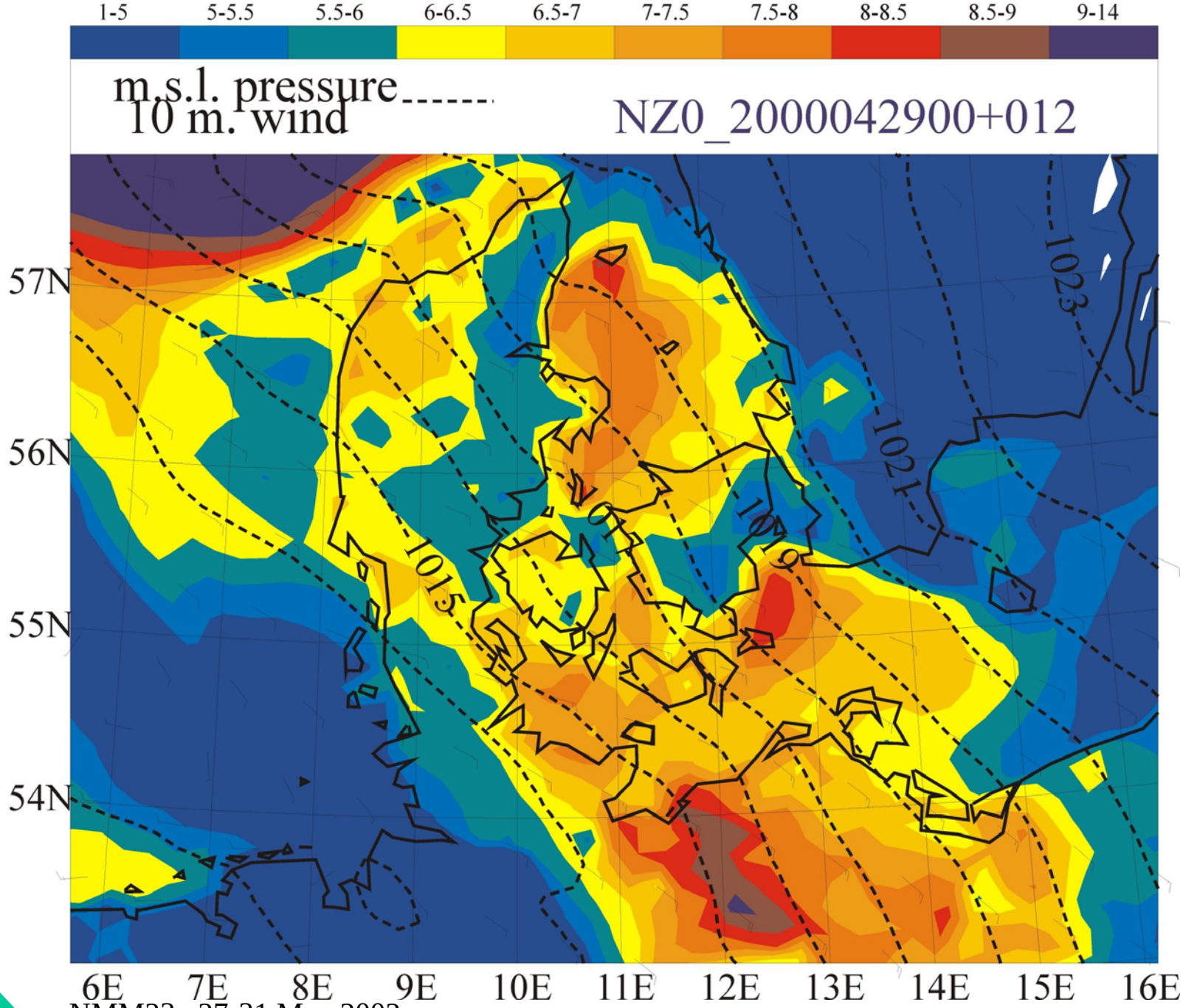
Region	Distance (m)	Roughness summer (m)	Roughness winter (m)
I	841	0.050	0.040
II	650	0.053	0.043
III	423	0.056	0.046
IV	296	0.060	0.050

Position of meteorology masts

Foulum


0.3
0.25
0.2
0.15
0.1
0.05
0
Roughness (m)
1
2
3
4
5
6
7
8
9
10
11
12
Month
Average data
Model with hedges


1-5
5-5.5
5.5-6
6-6.5
6.5-7
7-7.5
7.5-8
8-8.5
8.5-9
9-14
m.s.l. pressure------
10 m. wind
QPR_2000042900+012
1023
1021
1019
1015
57N
56N
55N
54N
6E
7E
8E
9E
10E
11E
12E
13E
14E
15E
16E


1-5
5-5.5
5.5-6
6-6.5
6.5-7
7-7.5
7.5-8
8-8.5
8.5-9
9-14
m.s.l. pressure
10 m. wind
NZ0_2000042900+012
1023
1021
1019
1017
1015
57N
56N
55N
54N
6E
7E
8E
9E
10E
11E
12E
13E
14E
15E
16E

RESULTS

- ***Roughness map:***

HIRLAM in spring has a bias of +0.5 m/s over land and –0.2 m/s over sea

The new roughness map improve wind speed in HIRLAM

- ***Satellite-based sea surface temparature map as opposed to climatological mean map:***

Improve the land-sea breeze circulation and it's spatial extent in HIRLAM

- ***Satellite-based land albedo map as opposed to climatological mean map:***

In HIRLAM not significant, but likely important in HIRHAM (much more radiation balance calculation and sensitivity)

FUTURE DEVELOPMENTS

- Directional roughness for HIRLAM
- New z_{0t} model