

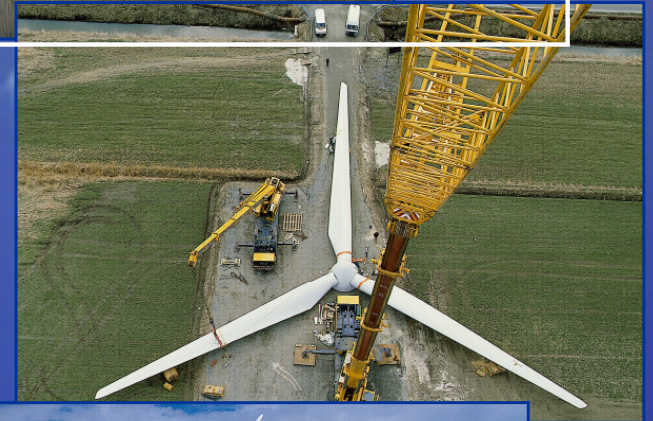
WindSim User Meeting 2008

Coupling WindSim with meso scale systems  
The GWS<sup>®</sup> Micro Windmapping System

**AL**



*Optimieren  
Rechnen  
Planen*



Dipl. Inf. Carsten Albrecht

**AL-PRO**

## Overview:

Introducing possibilities of coupling model systems

### The GWS<sup>®</sup> Micro Approach

- ✓ Introducing the Global Windmapping Service GWS<sup>®</sup>
- ✓ GWS<sup>®</sup> Micro, WindSim and mesoscale windstatistics
- ✓ Samples – Validation

### The WP 300 Approach

- ✓ Introducing the project
- ✓ WindSim and mesoscale fields
- ✓ State
- ✓ Outlook

# Presentation AL-PRO

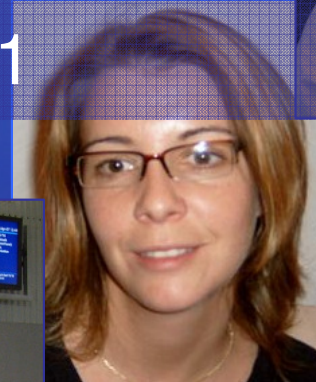
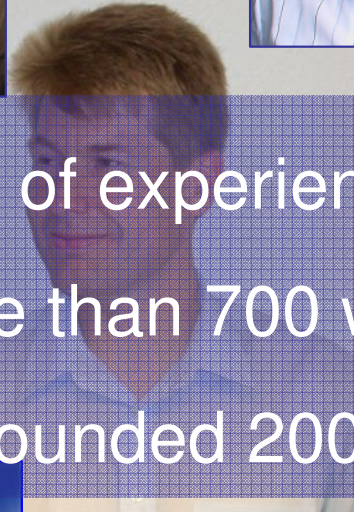
## Presentation AL-PRO



More than 35 years of experience in wind business

Consulting in more than 700 wind farm projects

Founded 2001



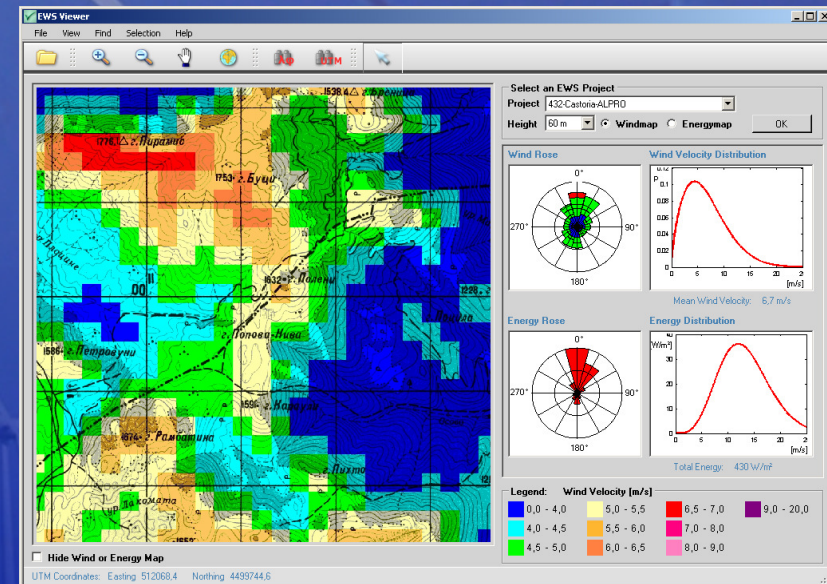
# Summary Summary

## Summary

- ✓ Improved methods of windfield evaluation have been developed
- ✓ Shifting timeseries
- ✓ Clustering
- ✓ Turbulence shift
- ✓ Improved weighting of several masts (distance, height a.g.l., height a.s.l., user customized)
- ✓ Windmapping based on several masts
- ✓ Coupling to meso-scale results
- ✓ European Windmapping Service

## Outlook, wishes

- ☹ Including temperature/stability
- ☹ Including coriolis force
- ☹ More stability of the solver – convergence!
- ☹ Fixing bug in large forest simulation



THANK YOU !!!

# Possibilities of coupling

## Possibilities of coupling

### Alternative 1: Nesting

#### 1a: 2 way nesting

1aa: Time dependent

1ab: Steady state (clustering)

#### 1b: 1 way nesting

1ba: Time dependent

1bb: Steady state (clustering)

- + Sophisticated combination of the advantages of the two systems
- Deep knowledge and access to both systems necessary
- Both systems must run at the same time (depending on type)

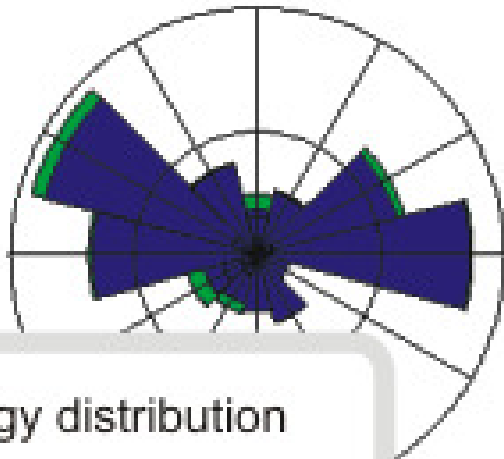
### Alternative 2: Typical cases

1. Run cases independent from meso-scale model

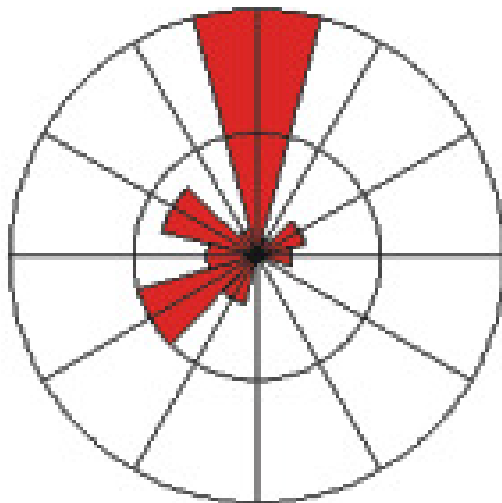
2. Scale against meso scale model output

- + No direct access to each model needed
- + No need to run models simultaneously
- Simplified approach

Wind distribution



Energy distribution



## The Global Windmapping Service GWS® of AL-PRO

- ✓ Windmaps almost world wide.
- ✓ Mesoscale calculations on a 2 x 2 km grid (standard).
- ✓ Microscale Simulation on a 200 x 200 m grid (standard).
- ✓ Computer cluster with 80 CPU Kernels (State March 2008) for mesoscale computations.
- ✓ 32 CPU Kernels and 80 GB RAM for WindSim microscale computations.
- ✓ Maps and data immediately accessible via webshop.
- ✓ Any map world wide available via Priority Service.
- ✓ [www.gws-alpro.com](http://www.gws-alpro.com)

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Global Windmapping Service - Windows Internet Explorer

http://www.gws-alpro.com/

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Global Windmapping Service

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**GWS**<sup>®</sup>  
global windmapping service

GWS is a service of **ALV**  
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Maps

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SELECT WINDNODE

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Password forgotten?  
register as new customer?

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**Global Windmapping Service (GWS)**

- Preparation of regional wind maps almost worldwide.
- Digital and printed wind maps
- Mesoscale wind maps in a resolution of 2x2 km
- Average wind velocity and wind power density in 60 m and 120 m a.g.l. as standard
- Quick supply and delivery
- Software GWS-Viewer

Products & services:

**GWS**<sup>®</sup> MESO BASIC

**GWS**<sup>®</sup> MESO PREMIUM

**GWS**<sup>®</sup> PRIORITY SERVICE

**GWS**<sup>®</sup> WINDNODE

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GeoMOOSE - Windows Internet Explorer

http://www.gws-alpro.com/geomoose/index.html

Google

Global Windmapping Service - MAP FINDER

Zoom In Zoom Out Pan Full Extent Map Info Select Map

Jump To: [dropdown]

Map Layers Information

**MAP LAYERS**

- Grid
- Countries

R Map is ready for purchase  
S Map is scheduled for preparation and can be ordered  
PS Map can be ordered using the Priority Service  
L Map is locked due to a Priority Service [\[More Info\]](#)

Copyright © The GeoMOOSE Project- All Rights Reserved. X,Y: 24.38,44.79

Scale 1: [Date] 123 Go! Moose Powered

Fertig

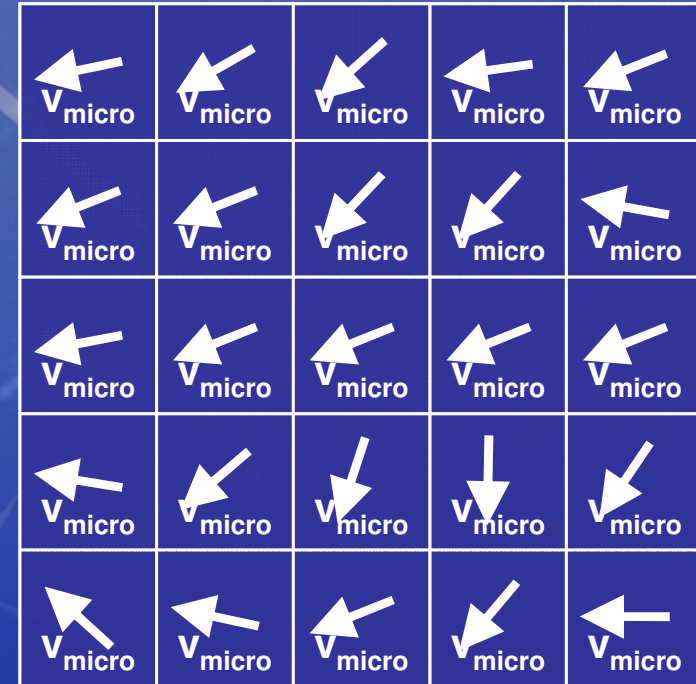


# The GWS<sup>®</sup> MICRO solution

## The GWS<sup>®</sup> MICRO solution

Meso-Scale Model

WindSim



$$v_{meso} = \bar{v}_{micro}$$

# The GWS<sup>®</sup> MICRO solution

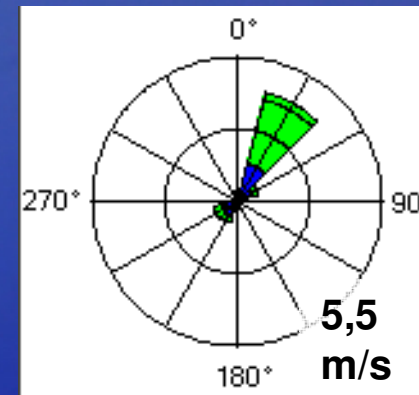
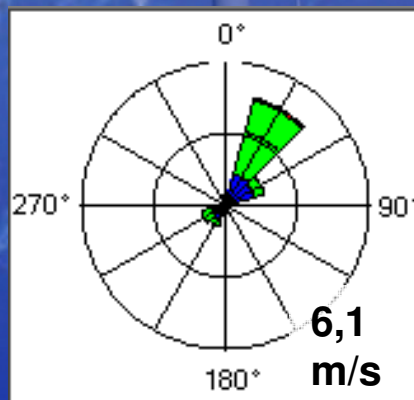
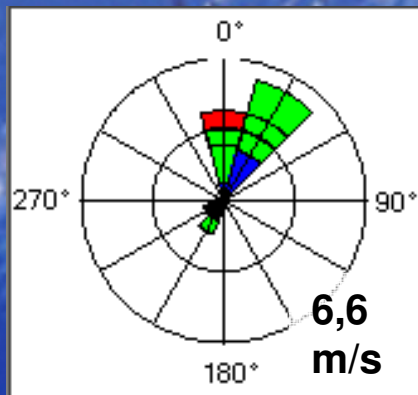
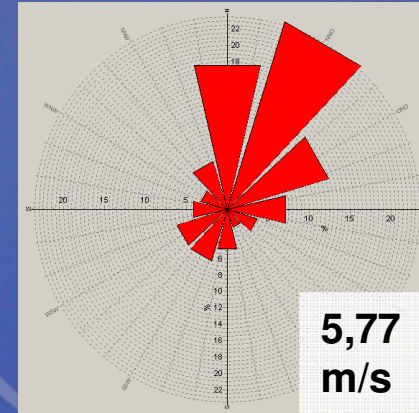
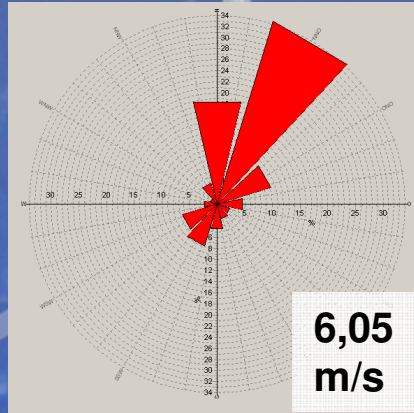
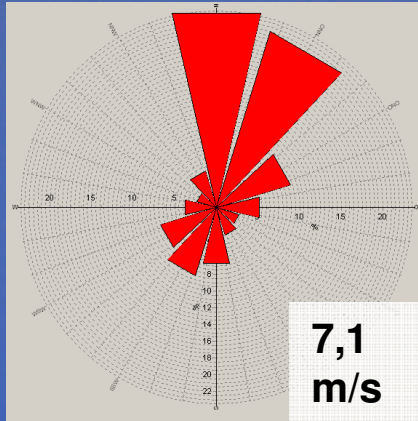
## The GWS<sup>®</sup> MICRO solution

### Features and characteristics of GWS<sup>®</sup> MICRO

- ✓ Based on the GWS<sup>®</sup> MESO Database.
- ✓ Almost worldwide available.
- ✓ No model coupling needed.
- ✓ Additional Wind Data can be included to improve result quality.
- ✓ Advanced weighting system to include local measurements.
- ✓ Quick (~4 weeks for one map).

# Sample cases

## Sample cases



# The DBU windprofile 300 project

## The DBU Windprofile 3000 project

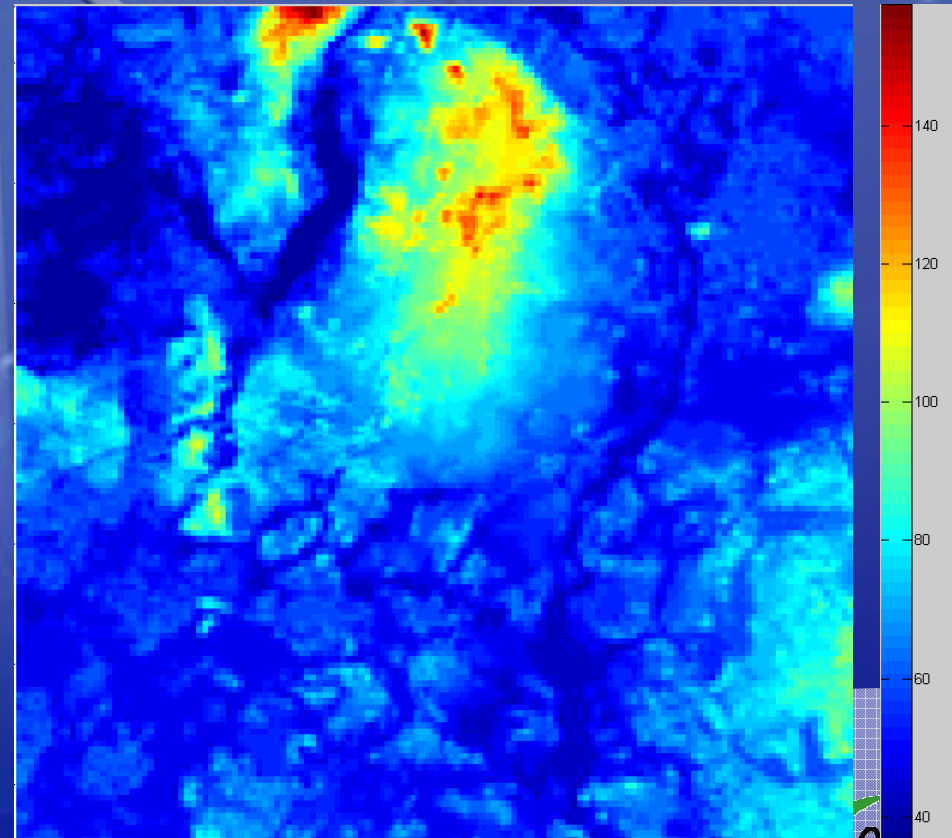
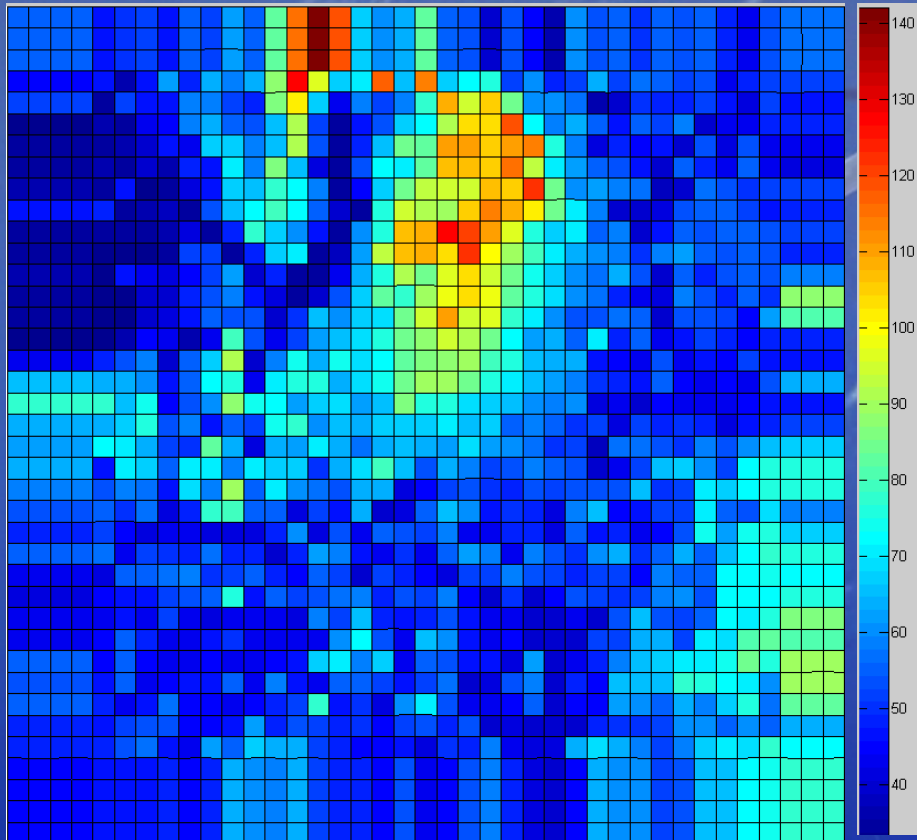
### The project:

- ✓ Four Companies involved: ANEMOS GmbH, Wind + Regen, WindSim, AL-PRO
- ✓ Compute wind fields, compare against measured data (up to 200 m)
- ✓ 4 Sites (offshore, flat terrain, flat forested terrain, complex terrain).
- ✓ Cluster NCAR/NCEP reanalysis data (200 to 300 cases to run).
- ✓ Run mesoscale models Metras and mc2.
- ✓ Run WindSim with results of meso scale simulations as initial state.
- ✓ Extract results at location of measurement.
- ✓ Compare against measurement in the same period.

# Meso- and Microscale field plots

## Meso- and Microscale field plots

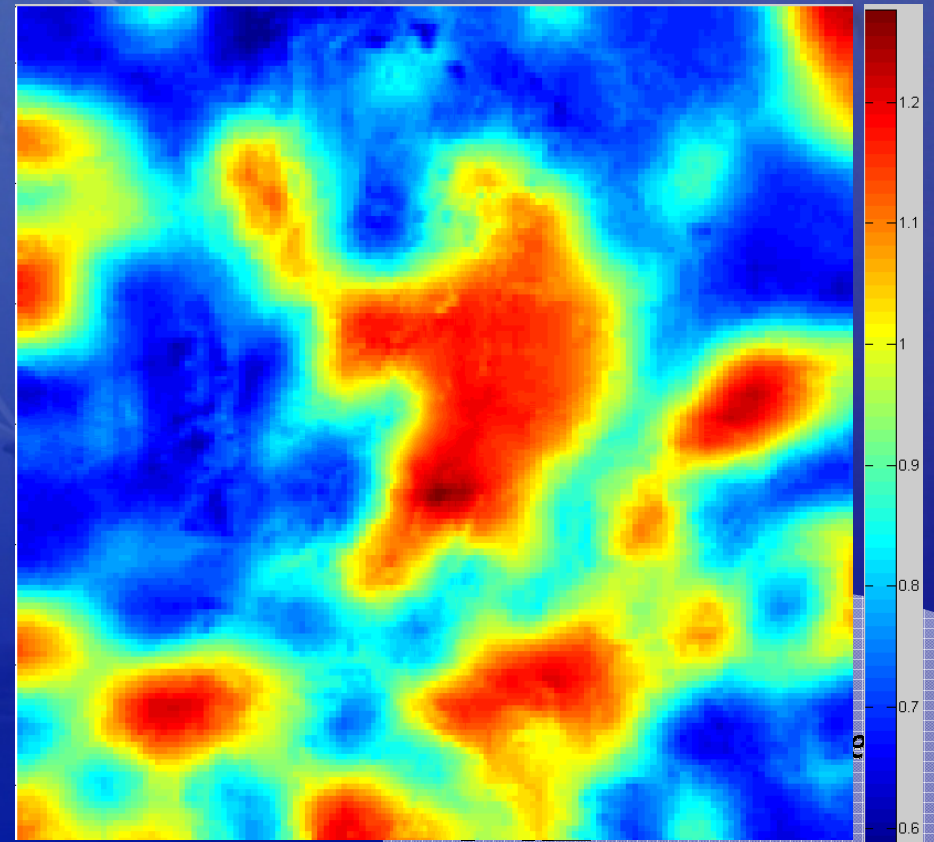
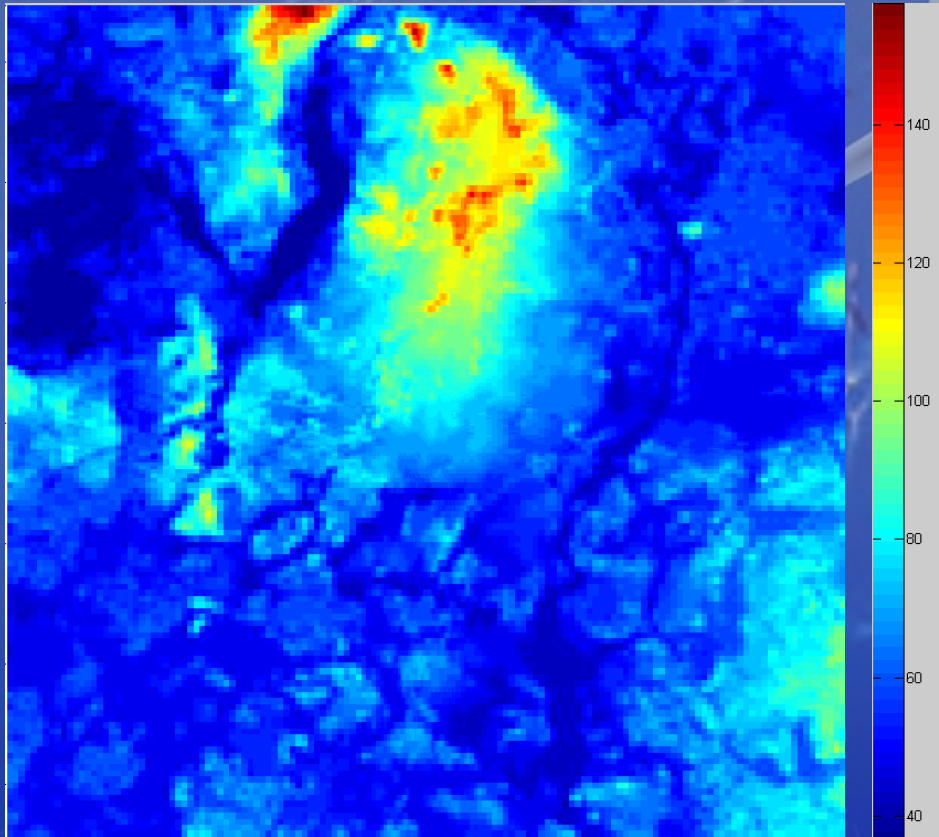
Surface



# Meso- and Microscale field plots

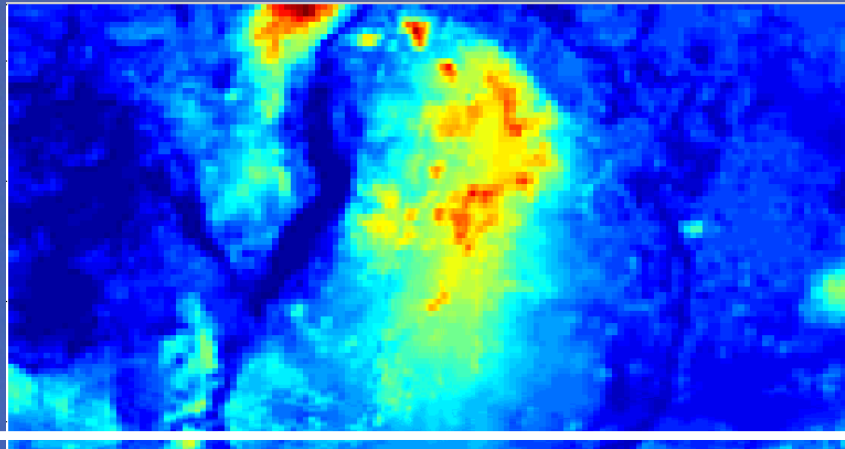
## Meso- and Microscale field plots

Windspeed u component

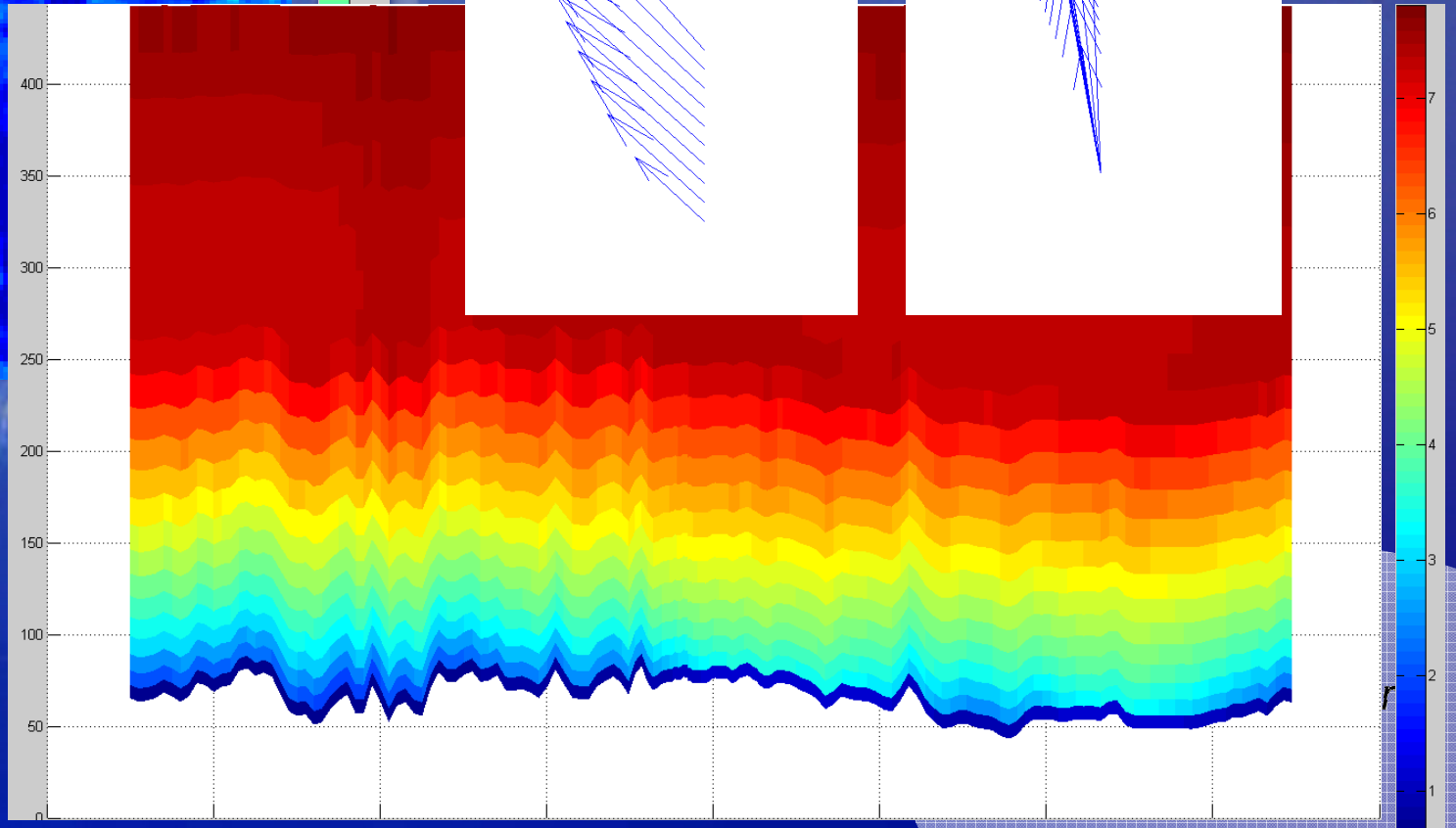
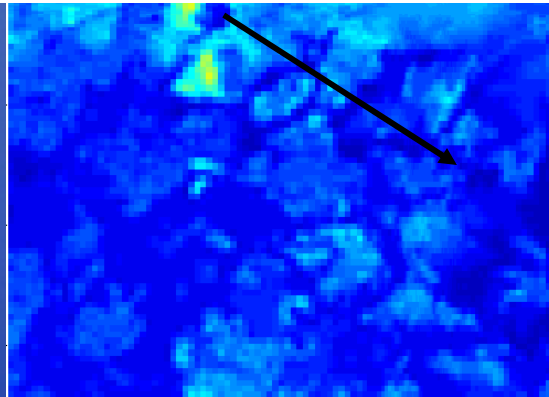


# Meso- and Microscale field plots

## Meso- and Microscale field plots



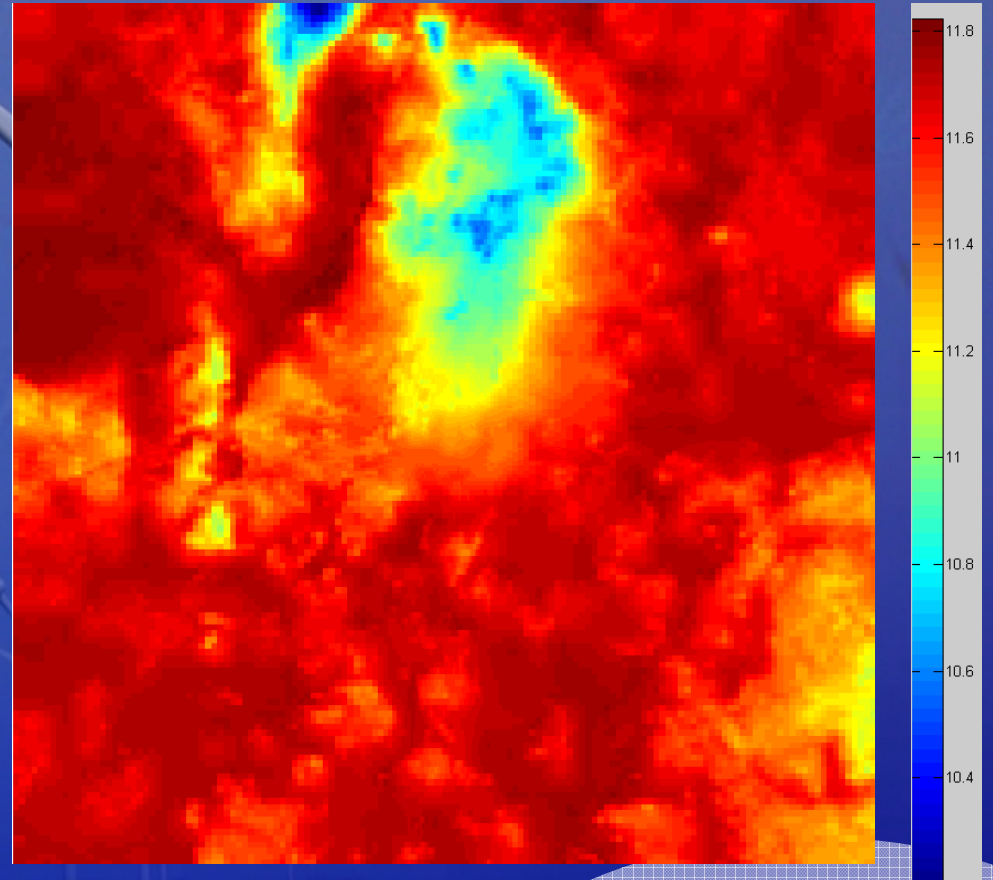
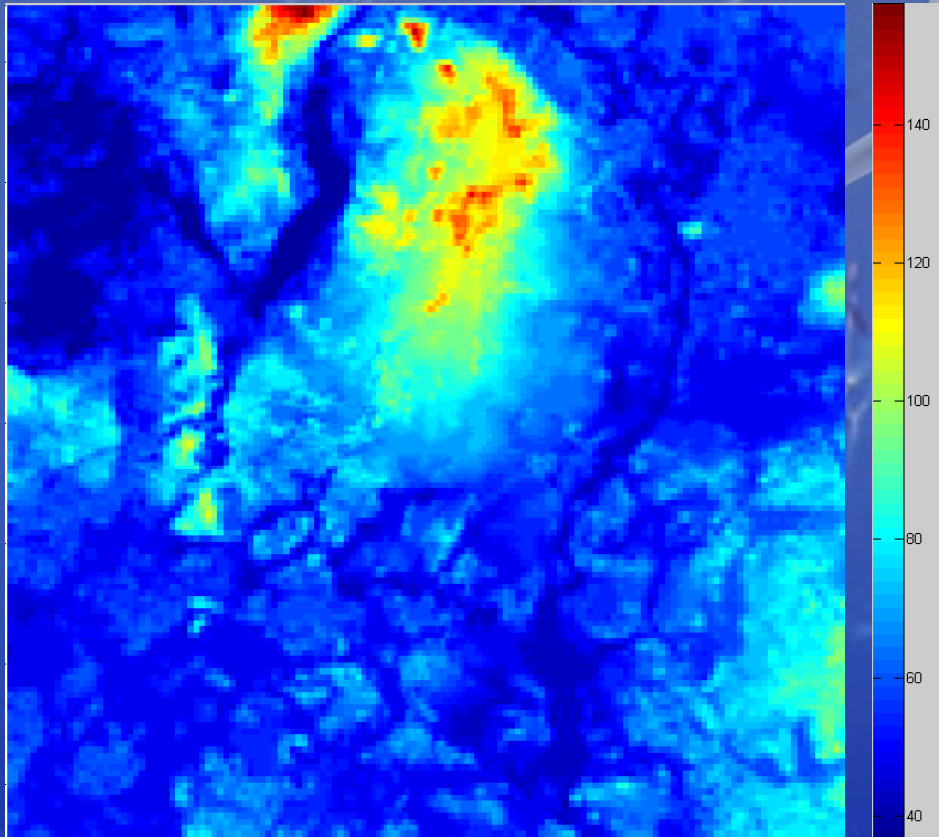
Windspeed u component vertical



# Meso- and Microscale field plots

## Meso- and Microscale field plots

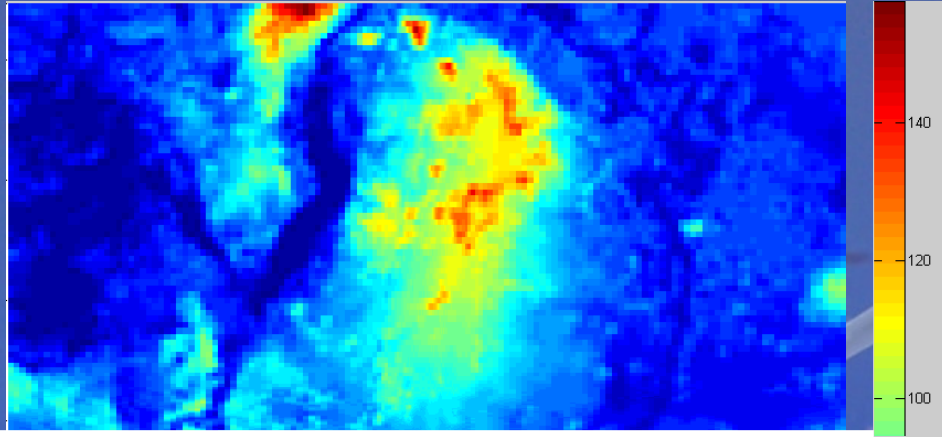
Temperature



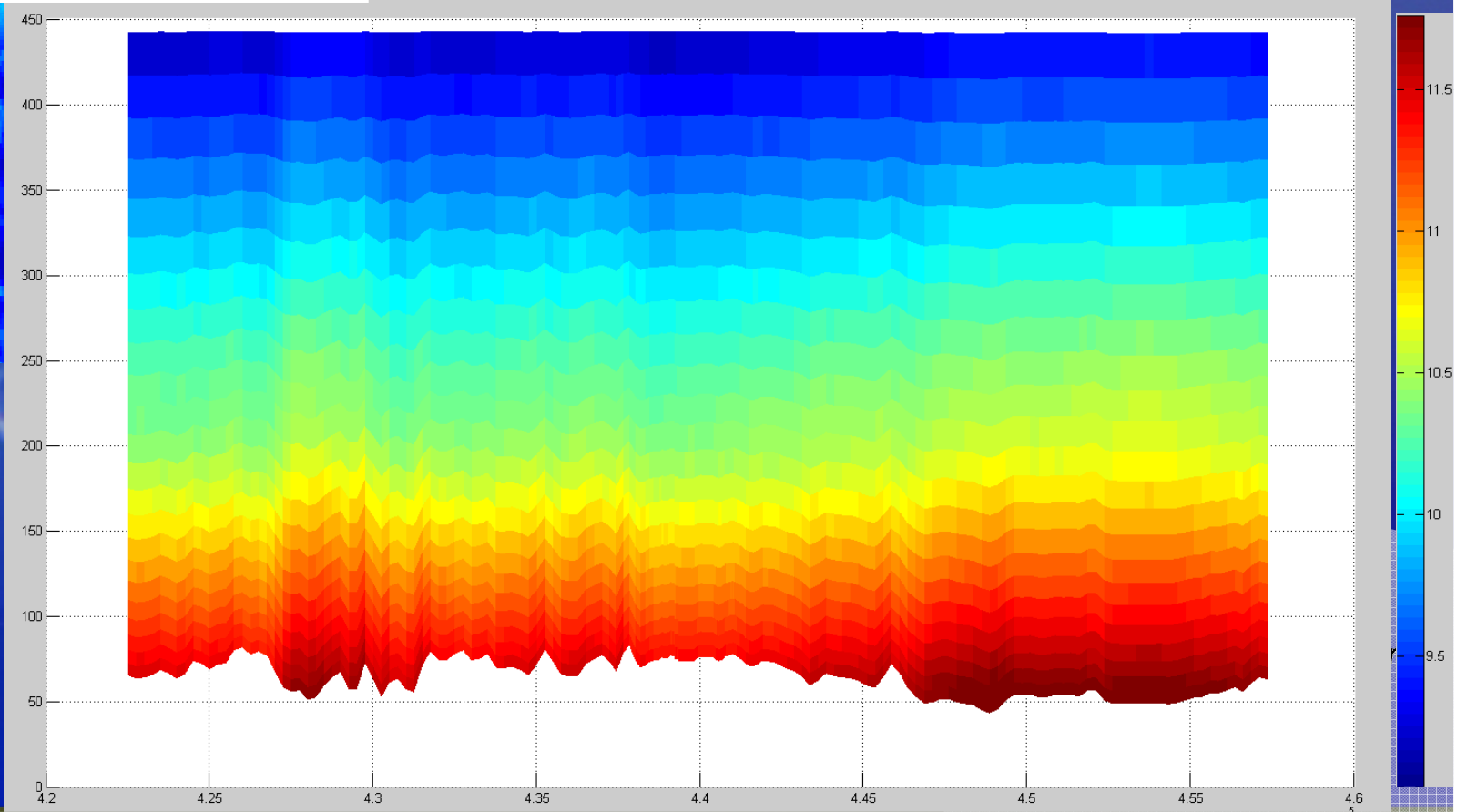
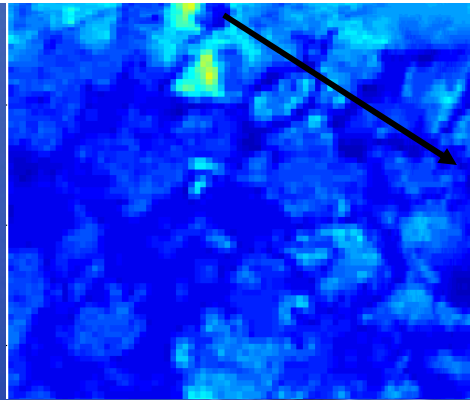


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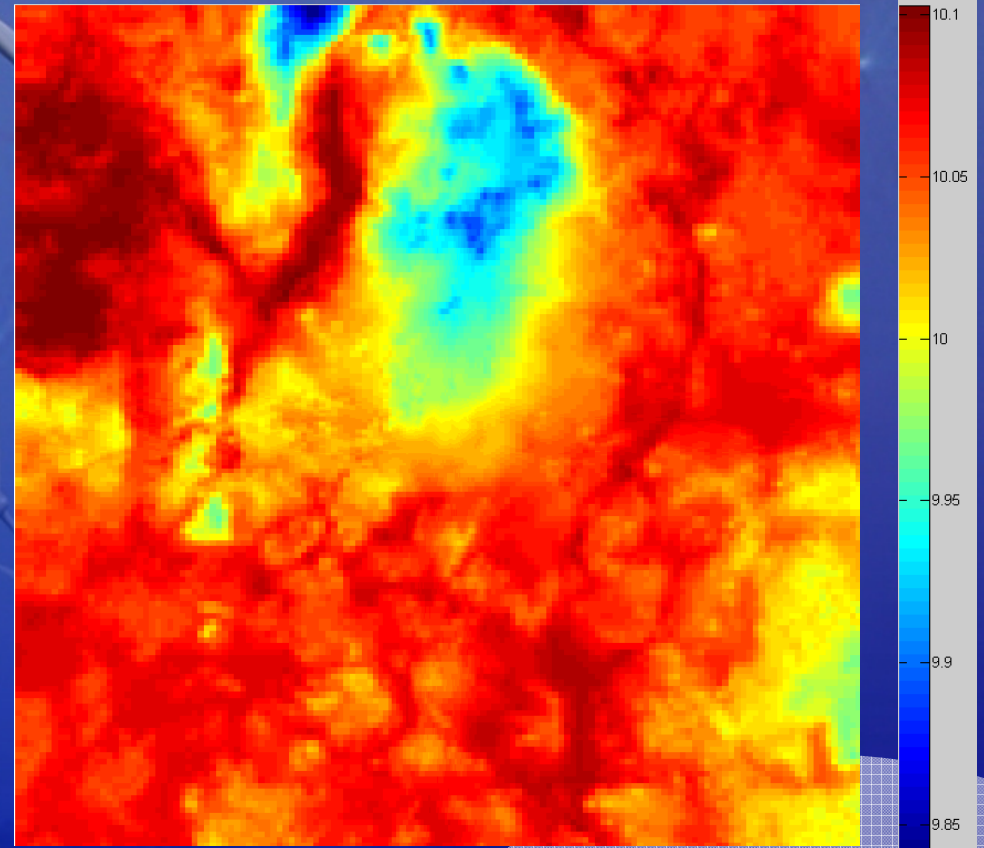
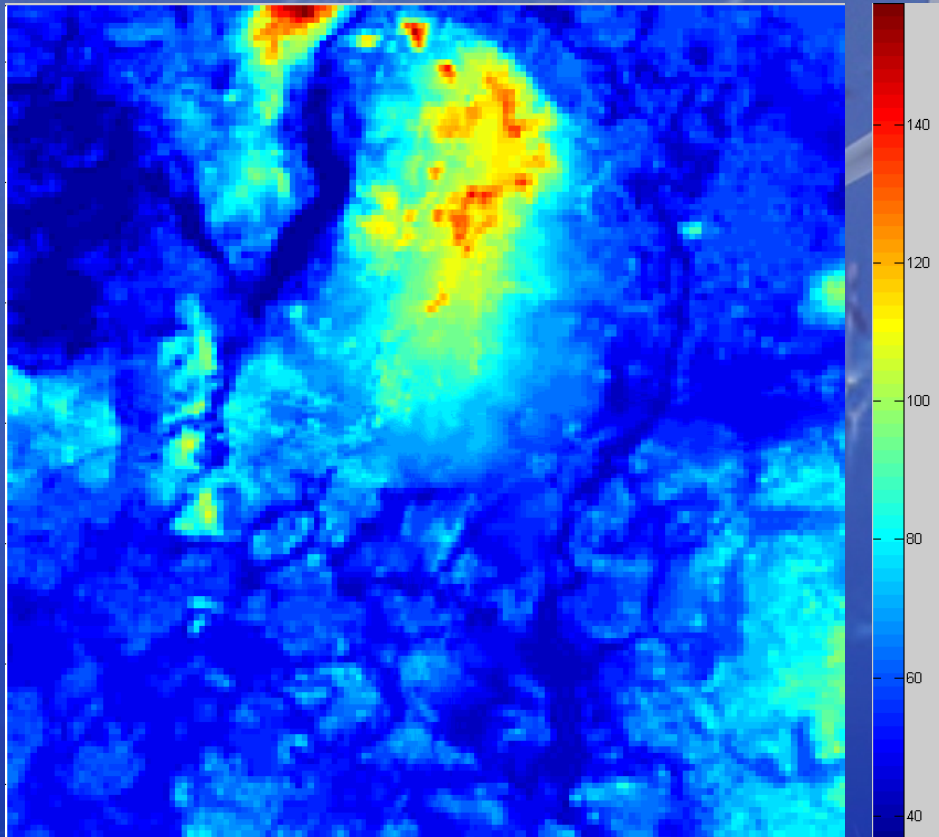
Temperature vertical



# Meso- and Microscale field plots

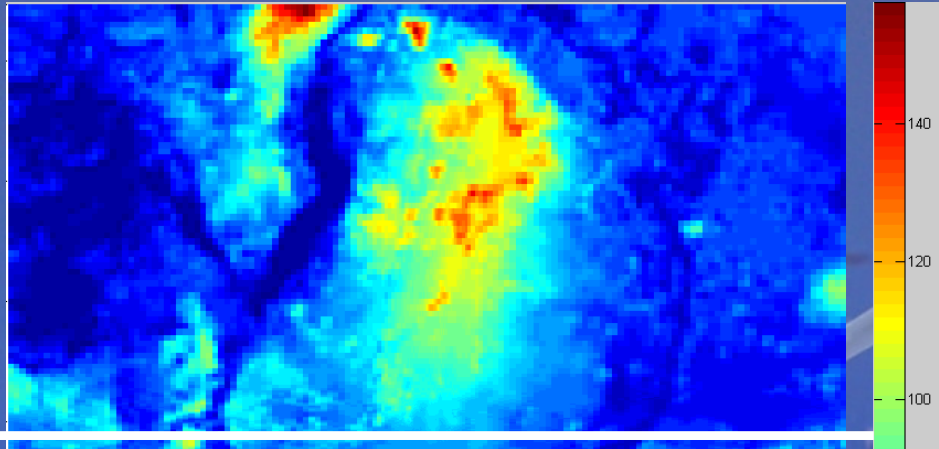
## Meso- and Microscale field plots

Pressure

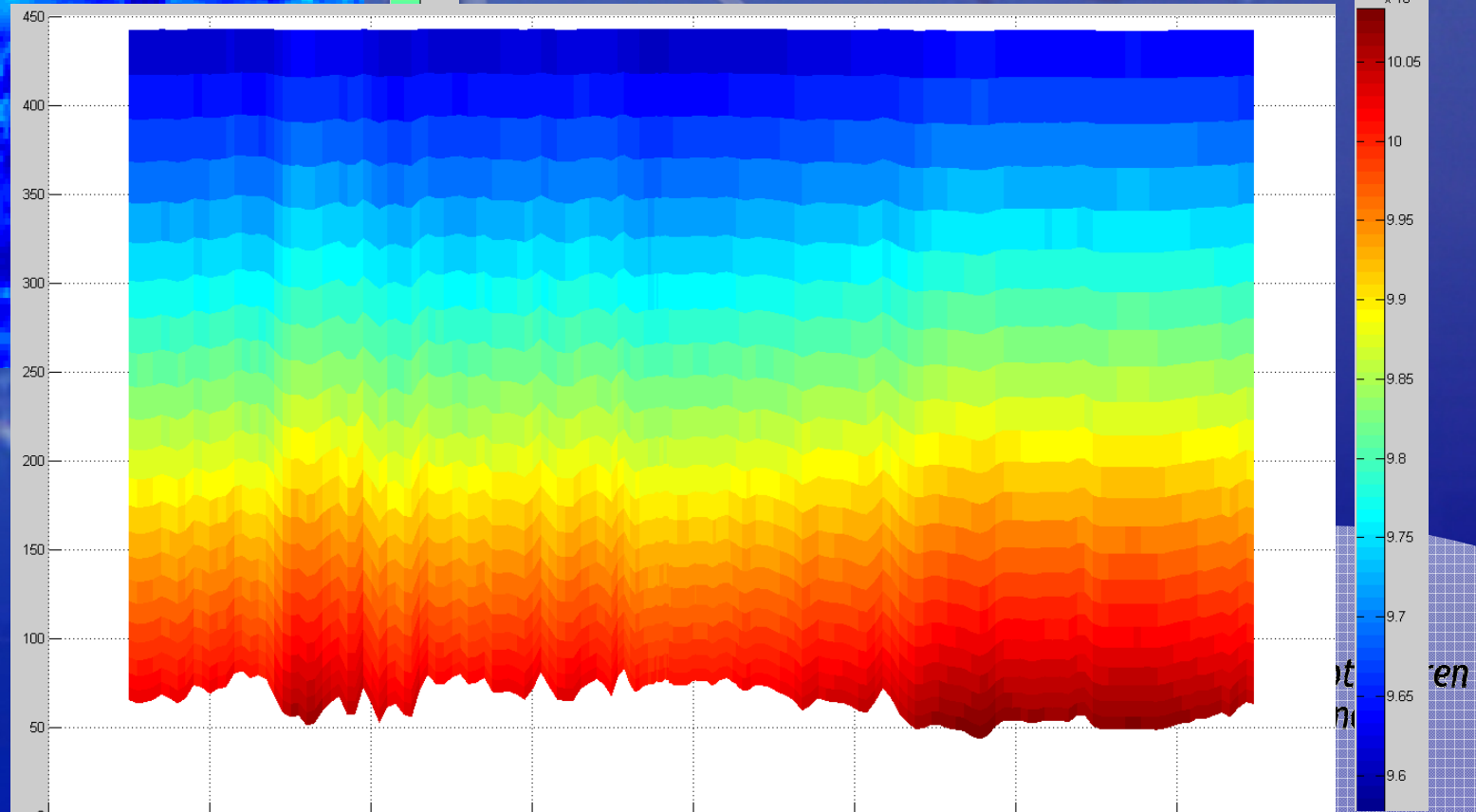
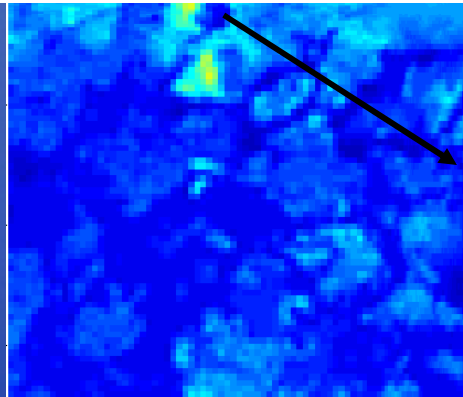


# Meso- and Microscale field plots

## Meso- and Microscale field plots



Pressure vertical



## Brief summary:

- ✓ Coupling mesoscale models with WindSim has been realized with the GWS<sup>®</sup> MICRO approach.
- ✓ With the GWS<sup>®</sup> MICRO wind maps a commercial product is available.
- ✓ Very promising results
- ✓ Project Wind Profiles to 300m currently in progress.
- ✓ Temperature and Coriolis included in WindSim (almost).

## Outlook

- ✓ 1 way nesting of meso scale models and WindSim.
- ✓ 3rd quarter 2008: Coupling to Metras and mc2 will be realized.
- ✓ Next year: Interface to any meso scale model will be available.

Thank you for your attention!!!