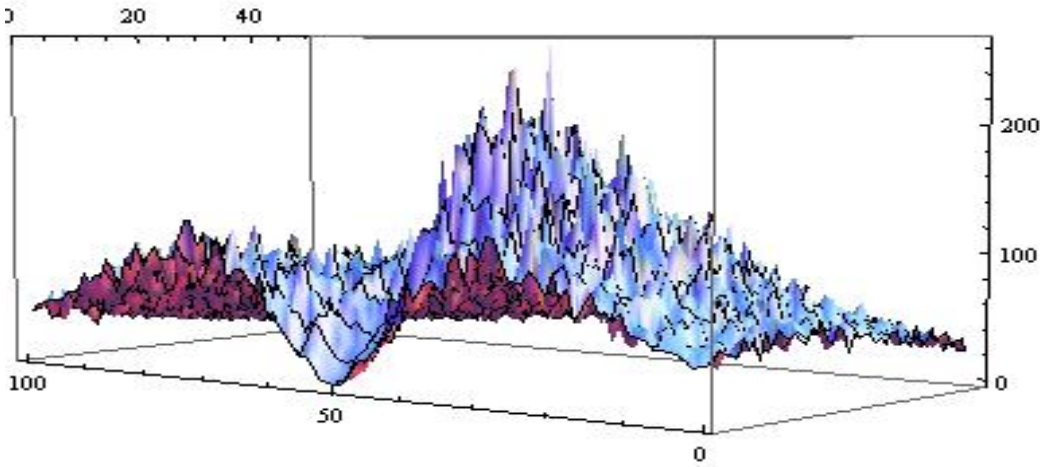


Presentation for Flow center Nov 2011

By: Martin de Maré

About the presenter

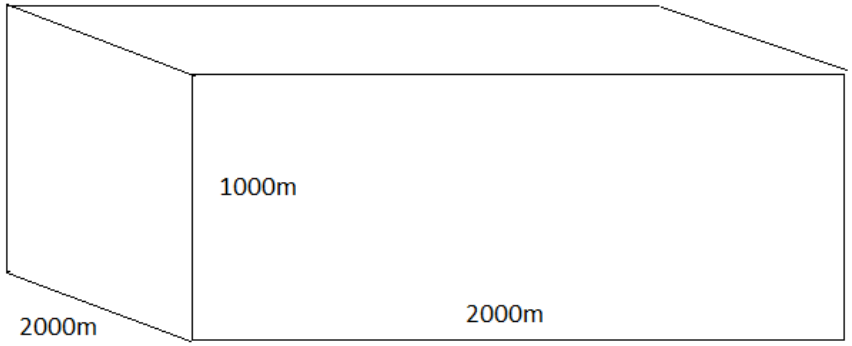
- Name: Martin de Maré
- Industrial PhD at VEA with Vestas A/S as sponsor
- Started PhD in December 2010
- Goal of project: Quantify loads and production for offshore wind turbines, focusing on the impact of different atmospheric stability conditions
- Intended strategy: Investigate and develop the Mann turbulence model and the Dynamic Wake Meandering (DWM) model
- Supervisors: Jakob Mann and Gunner Larsen

Outline of presentation

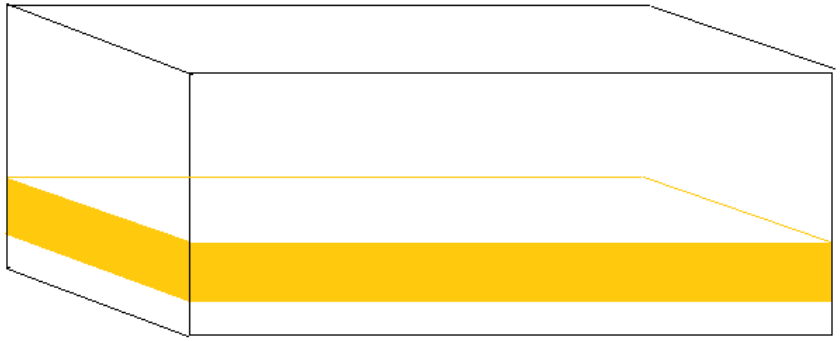
- Work so far
  - NCAR LES data
  - LIDAR length scale and turbulence

NCAR LES data

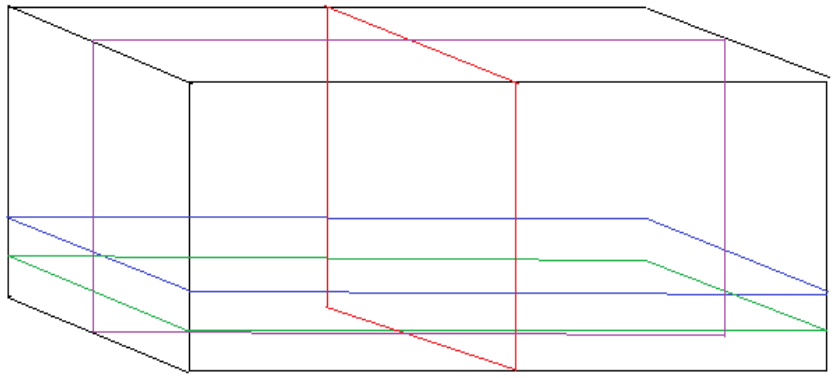
Horisontal resolution:	2-4 m
Vertical resolution:	1-2 m
Delta t:	0.2 s (for 400 s)
LES cutoff :	k = 0.5



For 3 different stability conditions
(imposed through surface heating)

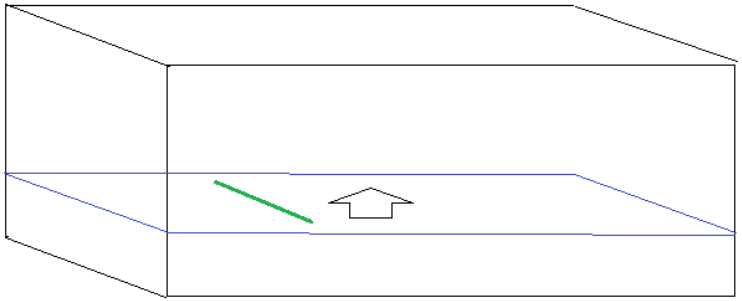


At every timestep:
- a block of 3D data is saved
- two x-y slices are saved
- one x-z slice is saved
- one y-z slice is saved

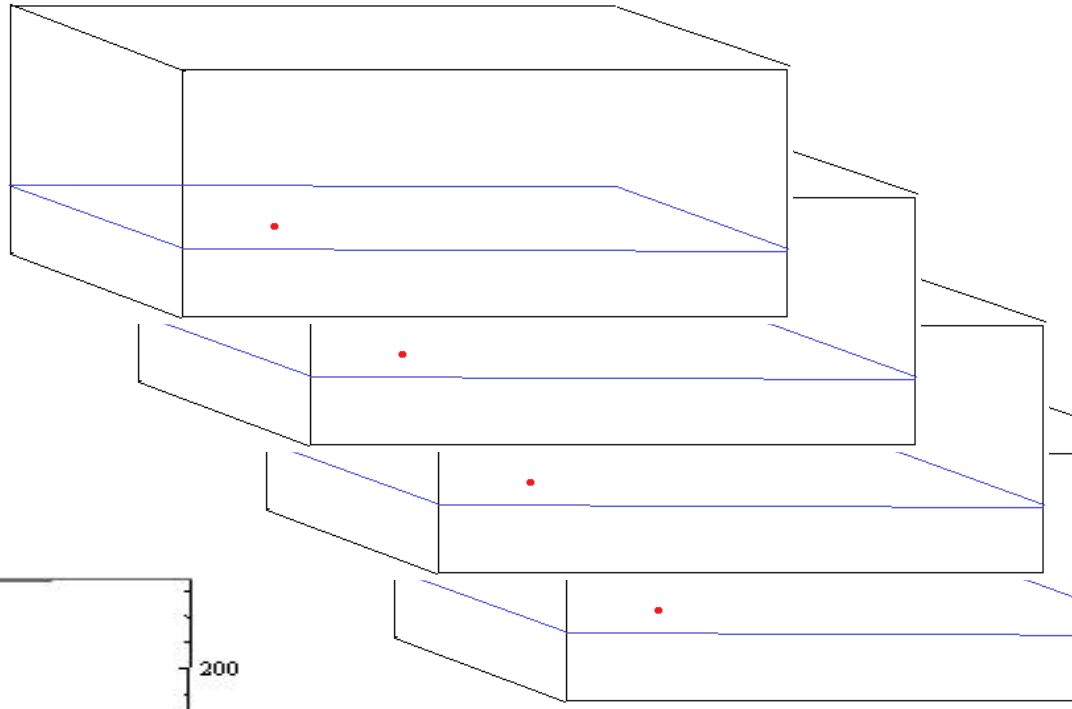


NCAR LES data: Initial analysis

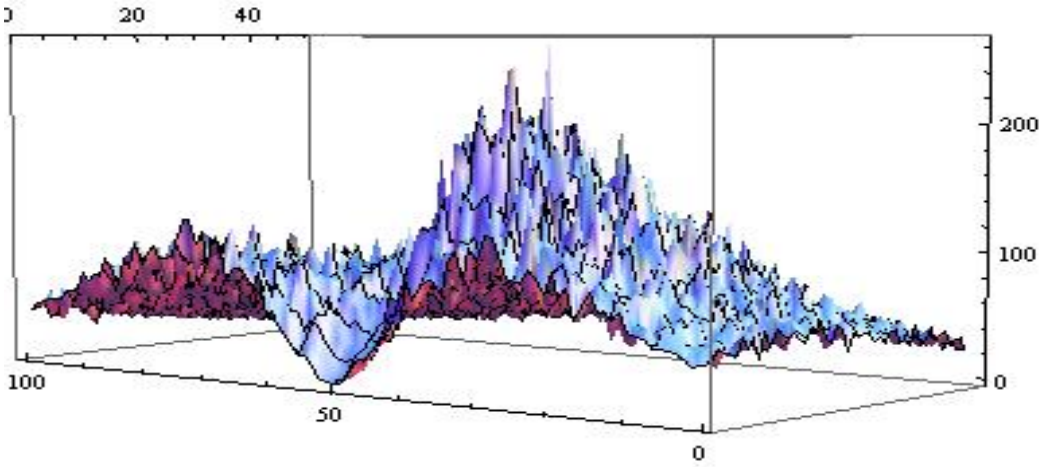
- 2D analysis comparing spectra and coherences in space and time



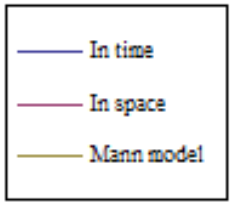
Spectra in space



Spectra in time

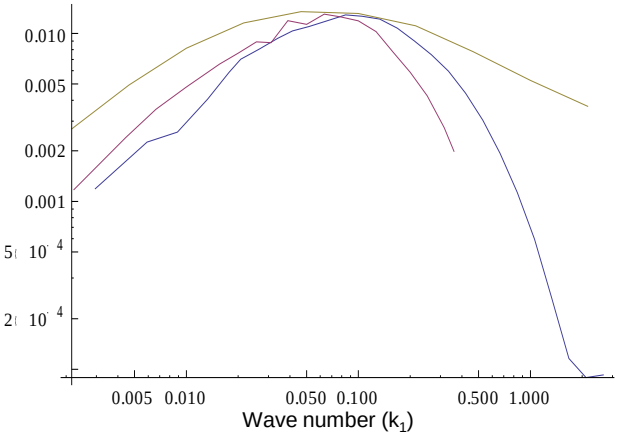


NCAR LES data: Initial results

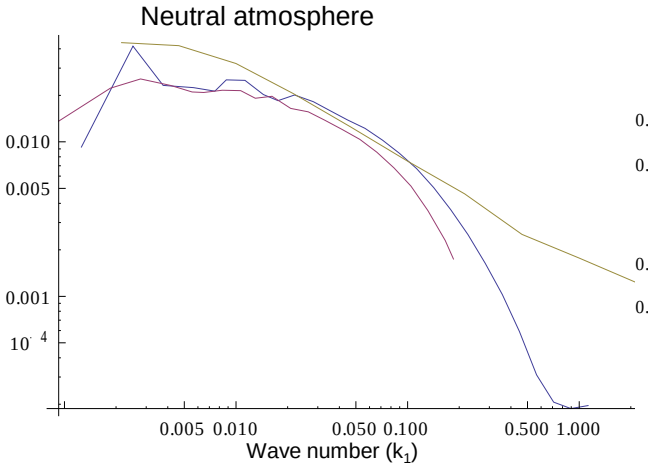


U -autospectra

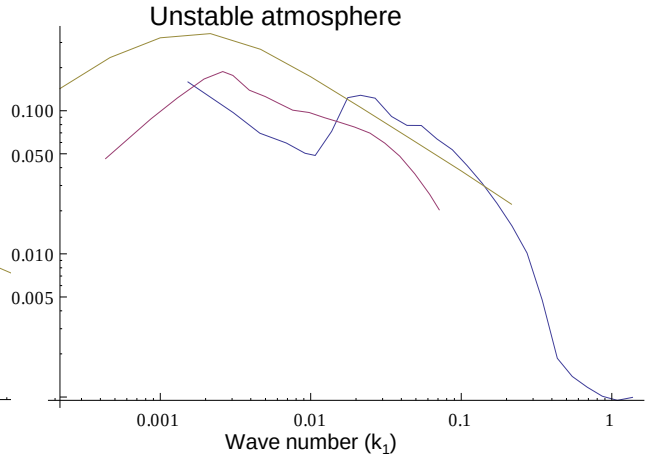
Stable atmosphere



Neutral atmosphere

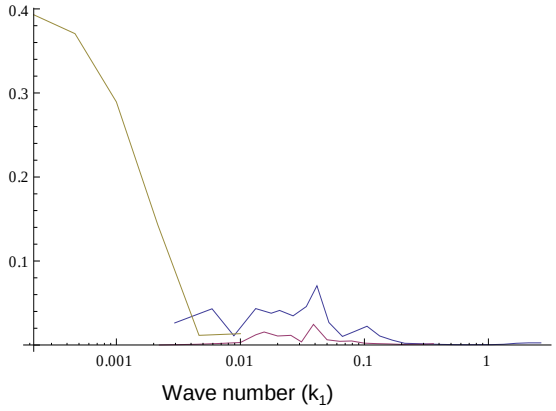


Unstable atmosphere

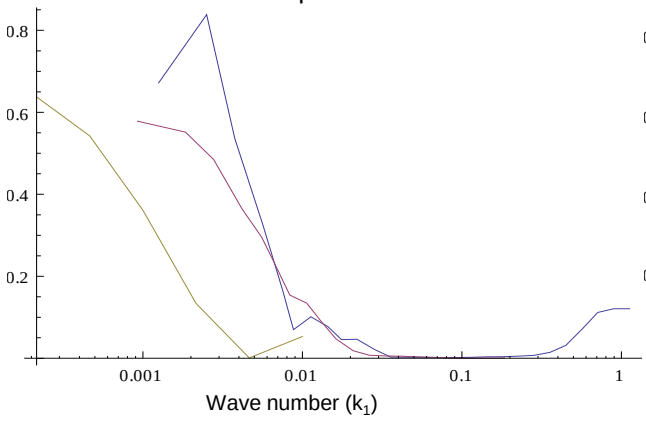


Coherence in U componets for a horisontal displacement of 100m

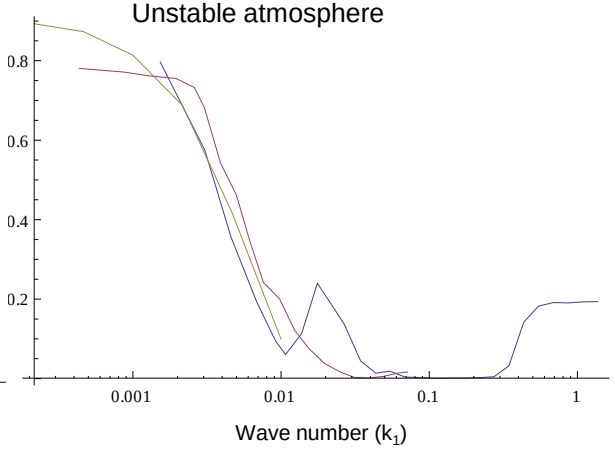
Stable atmosphere



Neutral atmosphere

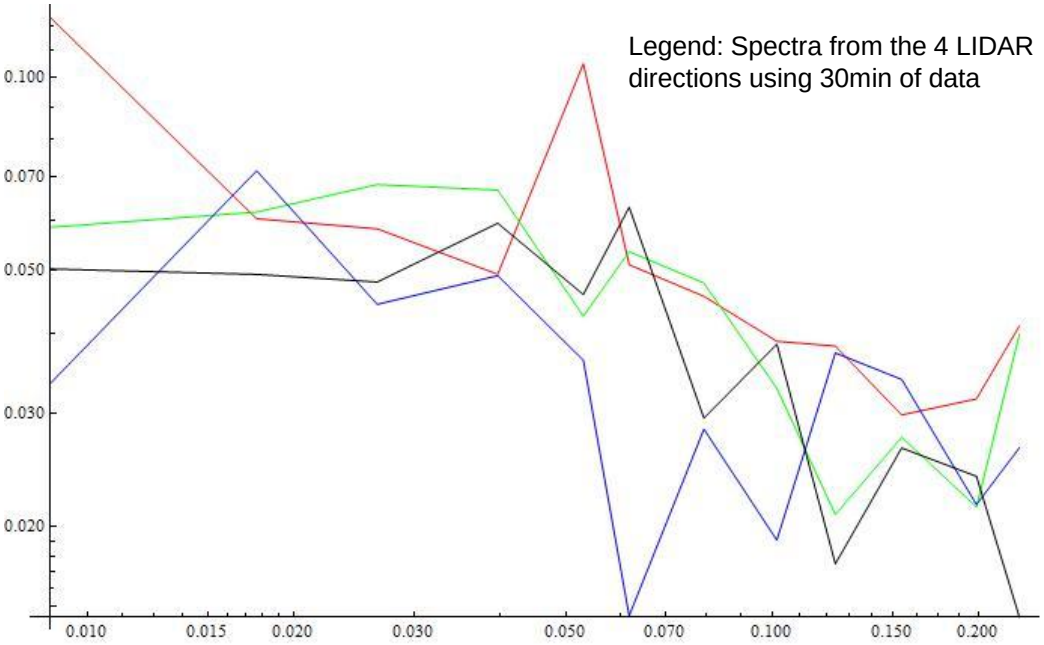


Unstable atmosphere



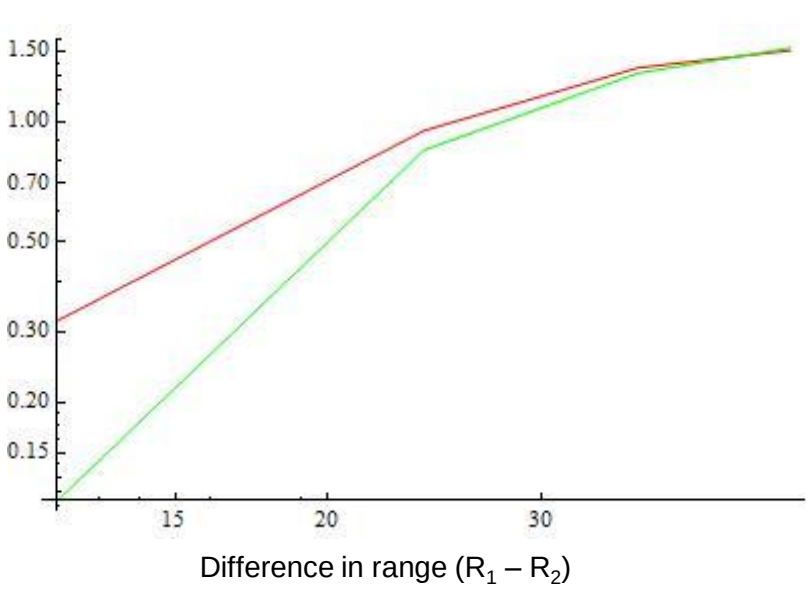
LIDAR: spectra

- Objective to fit Mann turbulence model to 30 minutes of LIDAR data

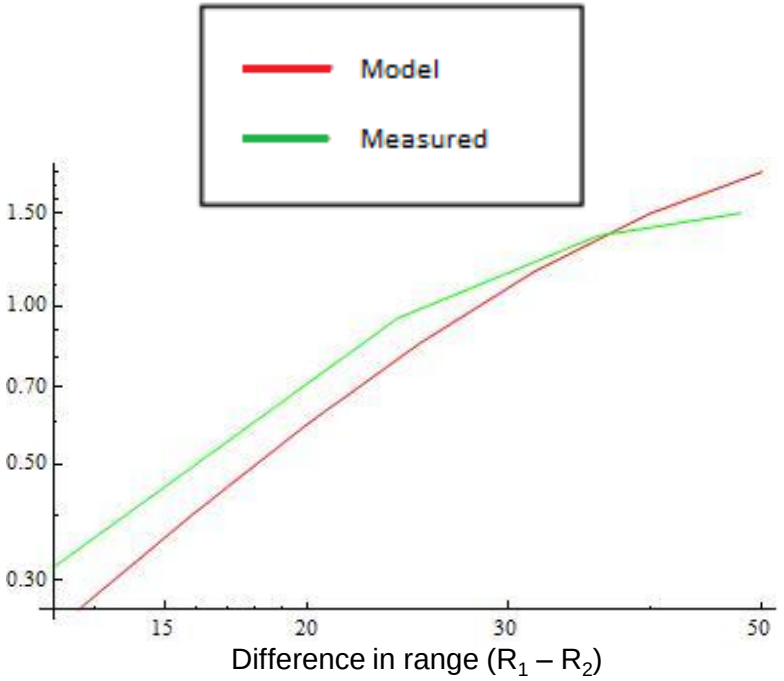


LIDAR: structure function

- Definition: $$D(R_1 - R_2) = \frac{1}{N_T}\sum_{i=1}^{N_T}(V_{Rad}(R_1) - V_{Rad}(R_2))^2 - \sigma^2_{\Delta e}(R_1 - R_2)$$



Fitting to model in
Frehlich and Cornman 2001:



Future work

- Get involved in Fuga development
- Use LIDAR data to investigate wake meandering as a function of atmospheric stability

- Planned stay at University of Colorado in of spring 2012

Thank you for your attention!

Questions?