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Presentation of some previous work with connections to BLLAST

Doctoral student in Uppsala Sweden, finished 19 April 2013. working mainly with LES and field measurements of influence from ocean waves on Atmospheric boundary layer

I start a post-doc position in Lannemezan, France at Laboratoire d'Aérologie on October 1:st

Outline:

- Scalar flux loss due to sensor displacement
- Initial evaluation of a GRAW radiosounding system
- Multiresolution flux analysis and discussion on scale interaction

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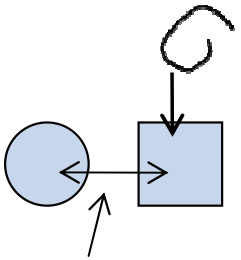
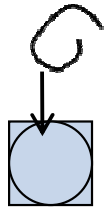
Eddy covariance method to determine scalar fluxes



$$F_c = \overline{w' \rho_c'}$$



w is the vertical component of the wind
ρ_c is the mass density of some scalar c

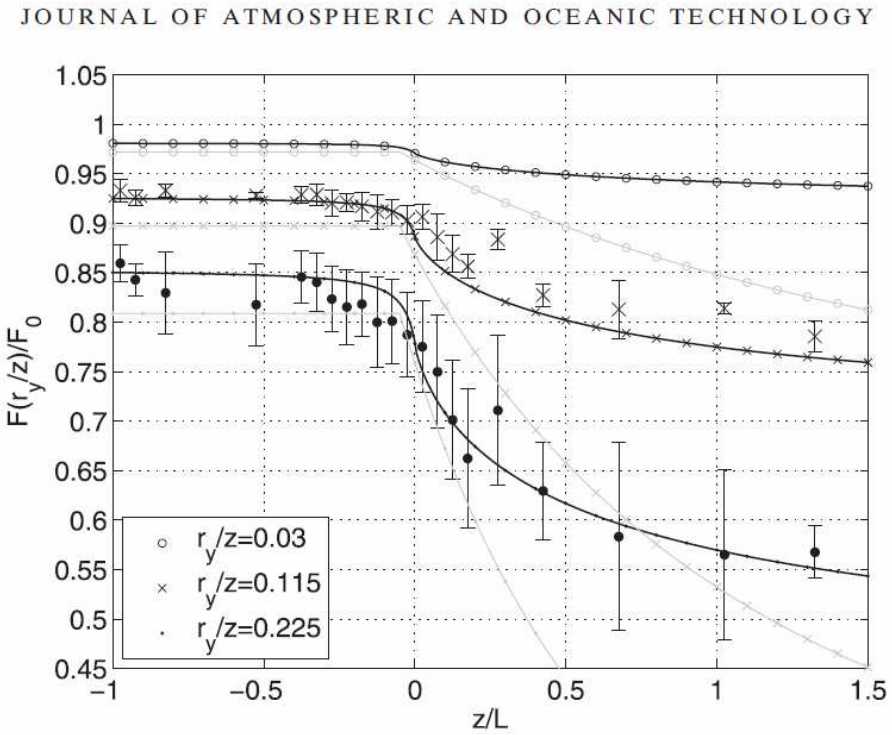
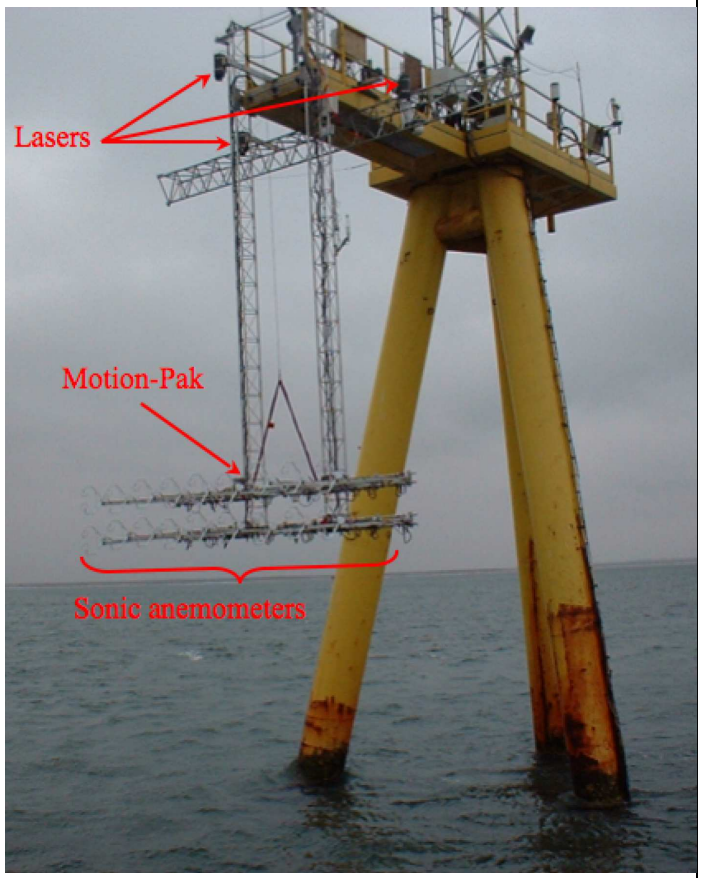


FIG. 4. Estimated and bin-averaged crosswind flux loss for different values of r_y/z (thick markers with error bars). Error bars represent one standard deviation from bin-averaged values for half-hours with r_y/z in the intervals 0.08–0.15 and 0.15–0.30, respectively. The thick black lines with circles, crosses, and dots correspond to Eqs. (13)–(14) for three values of r_y/z. The thinner gray lines with circles, crosses, and dots correspond to the correction function proposed by Horst and Lenschow (2009) for the same values of r_y/z.



Nilsson et al. 2010

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In the context of BLLAST: lots of very nice measurements with different sensor configurations

- Need for correction in stable stratification? Horst and Lenschow (2009)

- Possibility to study reason for vertical assymetry? Why is flux loss with scalar sensor placed below the velocity sensor less?

SkinFlow mast
University of Utah & Wageningen University

MicroSite
University of Bergen

Valimev tower
Laboratoire d'Aérologie

Corn
Météo-France

Moor
Météo-France

Grass
Forschungszentrum Jülich & Bonn University

Edge
Wageningen University

Forest mast
University of Utah & Wageningen University

Wheat
University of Bonn

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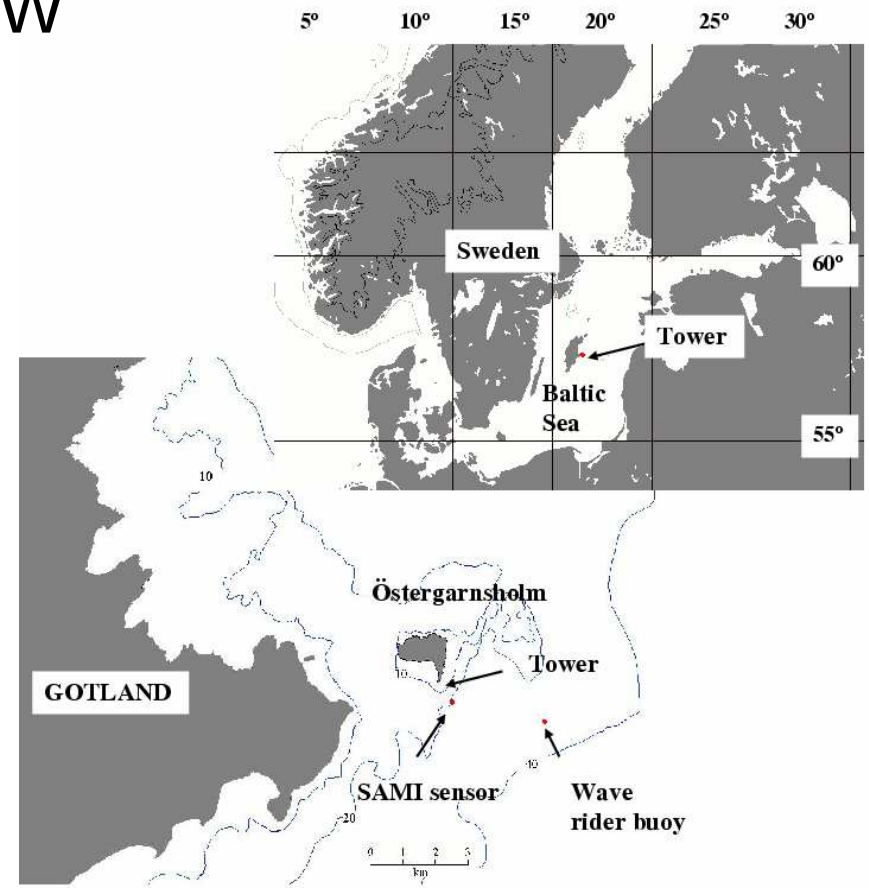
Initial evaluation of a GRAW radiosounding system

- One field week 28th June to 2nd July 2010

- 16 radiosondes were launched + standard soundings at Gotland two times a day.

- Total of 48 theodolite trackings including double trackings



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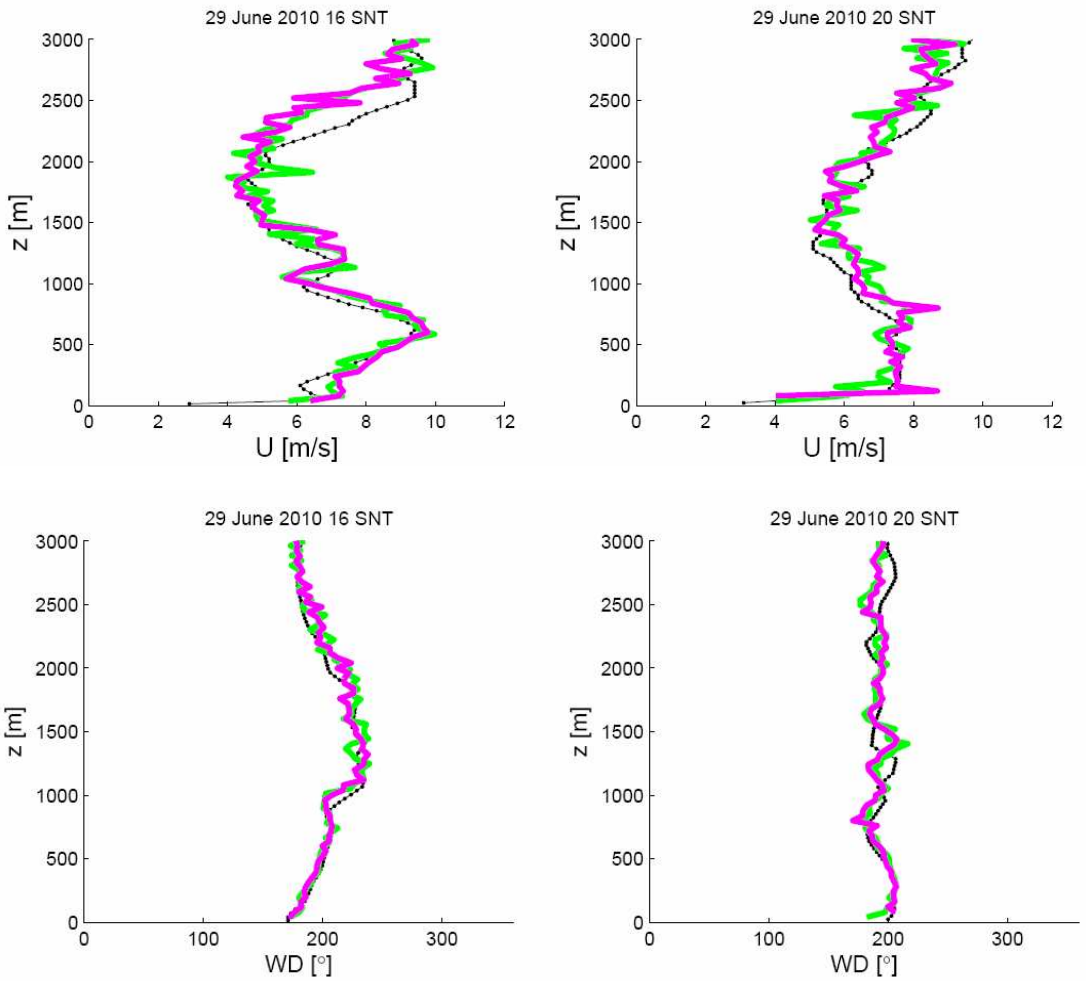
GRAW worked well for U and WD

Bias in average rising speed for the ABL of about 0.2 m/s?

Uncertainty in the comparison was large



Nilsson et al. 2013 written report

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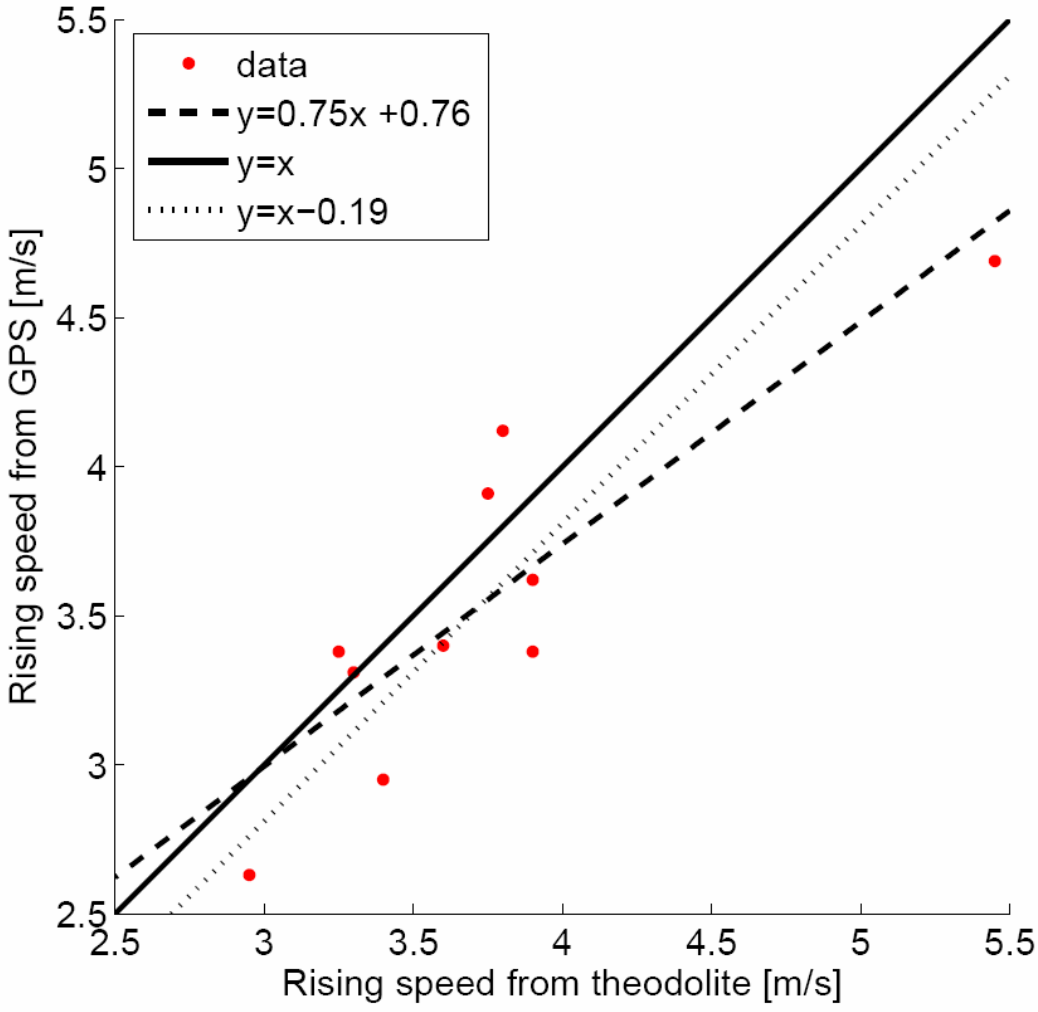

Nilsson et al. 2013
written report

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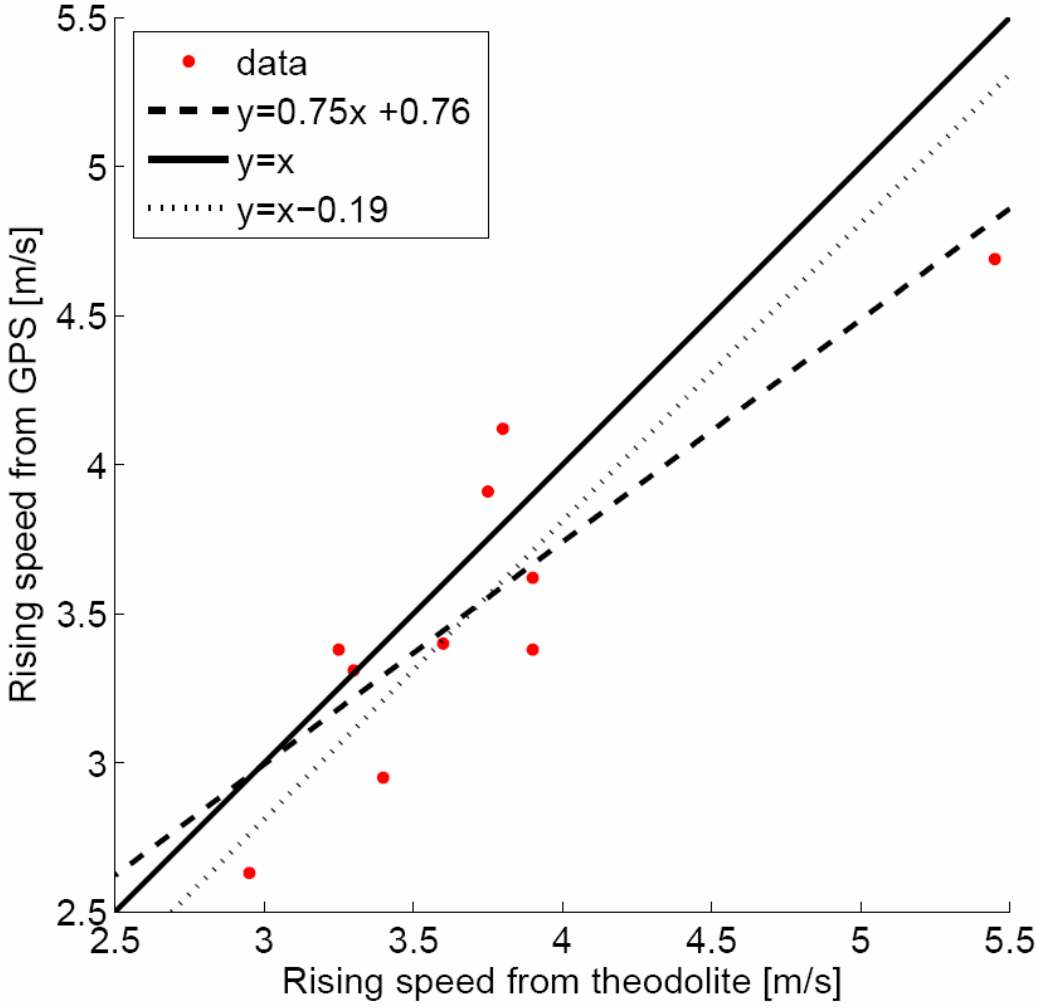
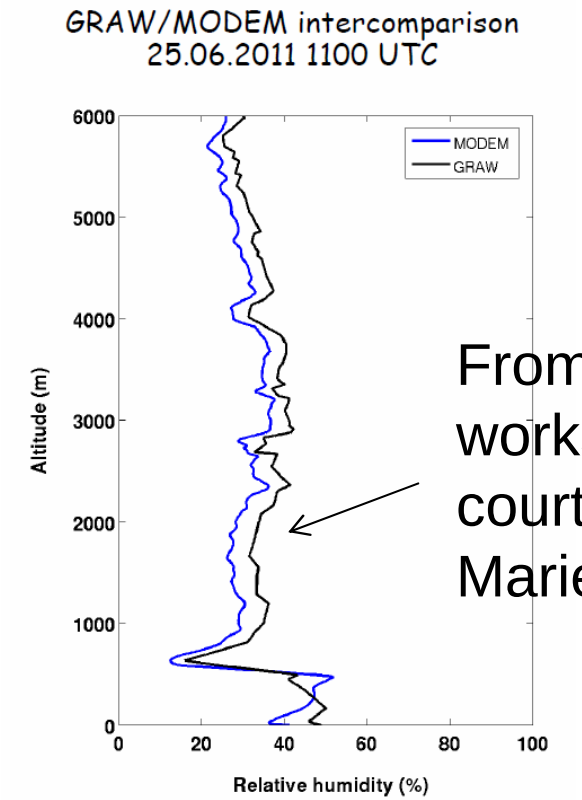
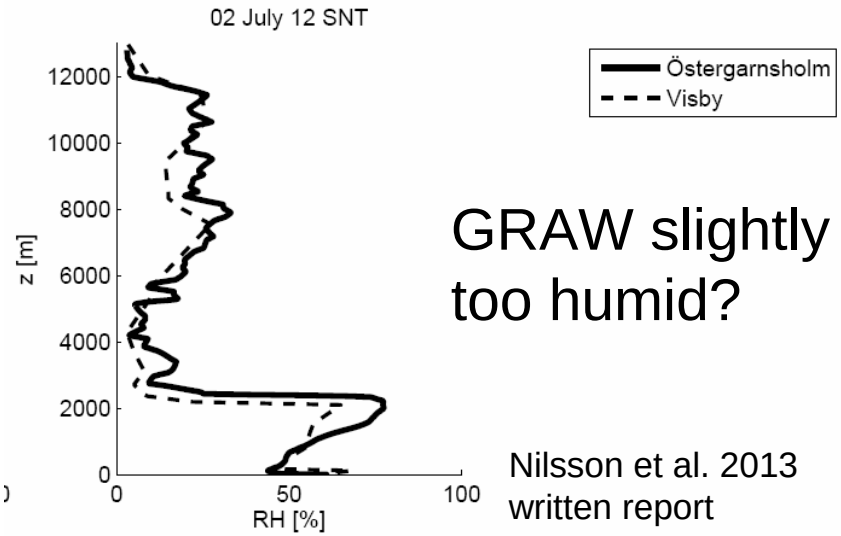




From Firenze workshop courtesy of Marie Lothon



GRAW slightly too humid?

Nilsson et al. 2013 written report

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Multiresolution analysis of eddy-fluxes

- MR analysis involves averaging data over different averaging lengths.

- Fluctuations in horizontal and vertical wind combine to give vertical momentum 'fluxes'

- We assessed the amount of variability in a timeseries of turbulent flux

$$w'\phi'(i) = (w_i - \overline{w_i})(\phi_i - \overline{\phi_i})$$

on different scales with respect to vertical wind and 'advected' variable

- Investigation of correlation between different scales is also possible (ongoing discussions with Larry Mahrt)

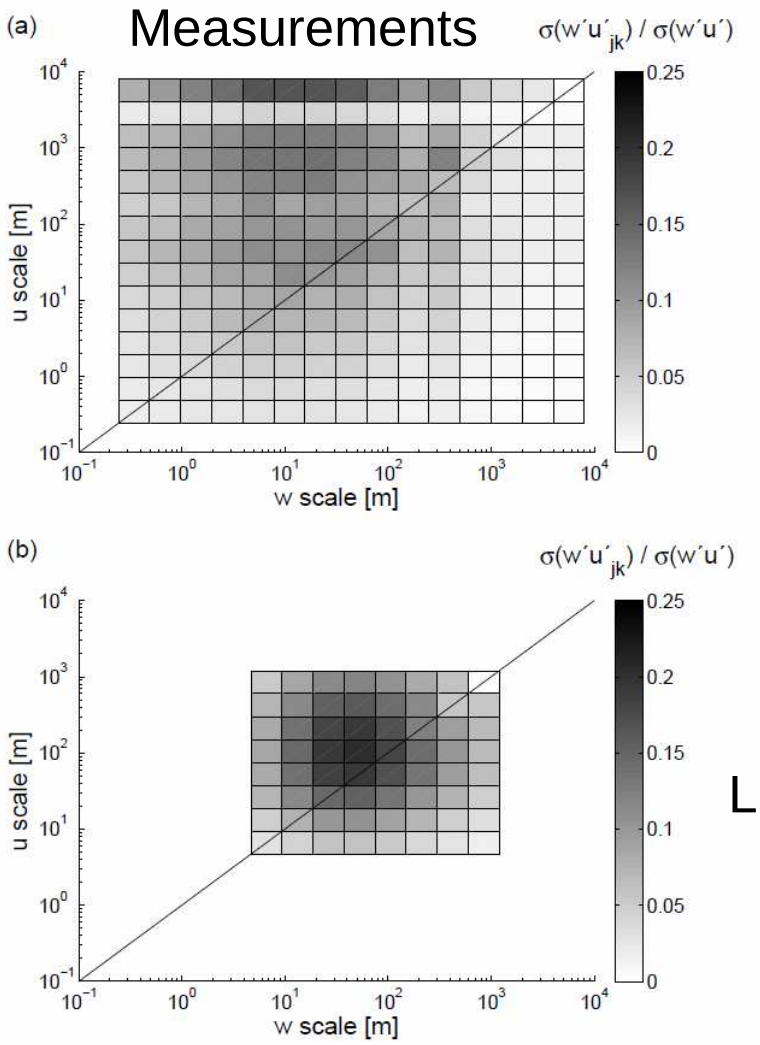

Figure 4. The standard deviation of the $w'u'(i,j,k)$ decompositioned time series for each combination of the scales j and k is shown normalized by the standard deviation of the total flux time series $w'u'(i)$. In (a) a case with measurements taken at 14 m and neutral stratification is shown, and in (b) LES results at 14 m above the surface for case ZN1 are shown.

Nilsson et al. (In revision)

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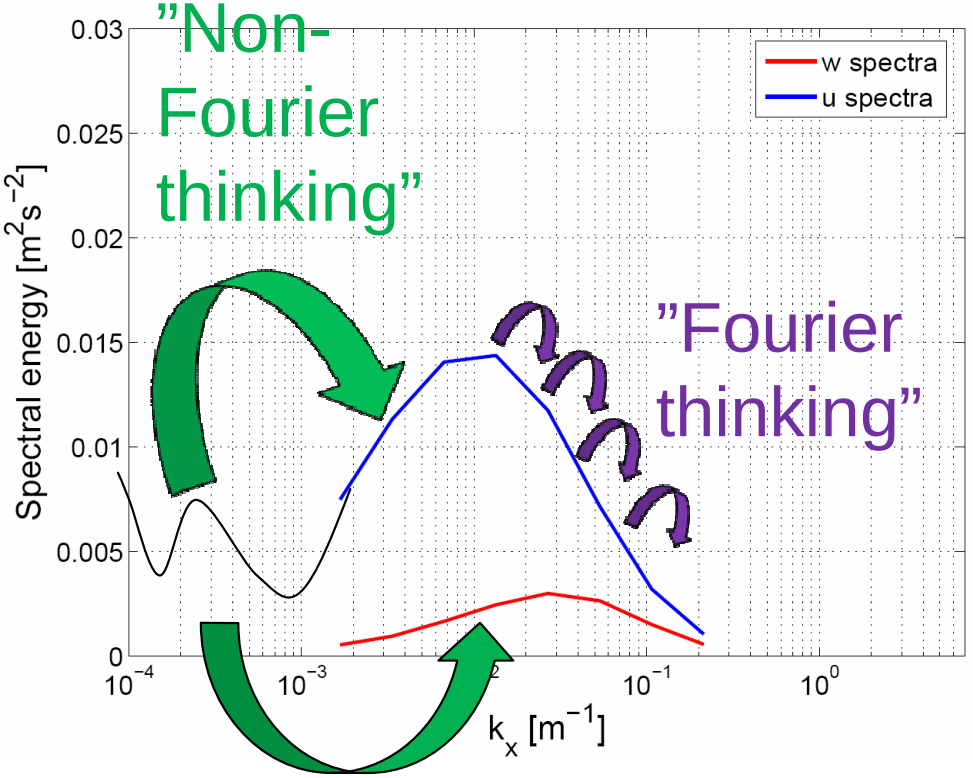
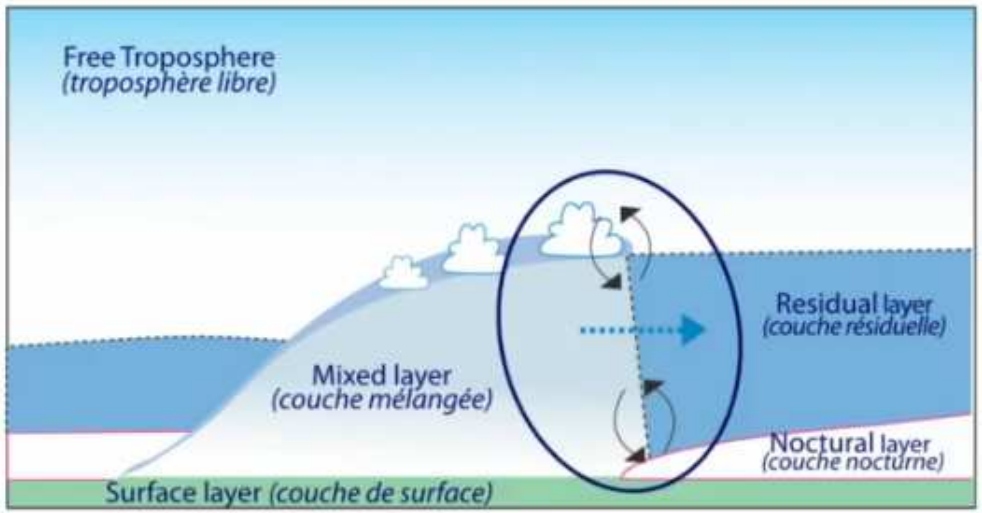
Multiresolution analysis of eddy-fluxes

- Investigation of correlation between different scales is also possible (ongoing discussions with Larry Mahrt)
- We are interested in the interaction between scales
- For instance between submeso or meso-scale motions (large scale) and turbulence (small scale)
- Can large-scale motions modulate turbulence on small-scales directly? without spectral cascade?
- Transitioning periods an example? When we may expect several governing time-scales?





Multiresolution analysis of eddy-fluxes

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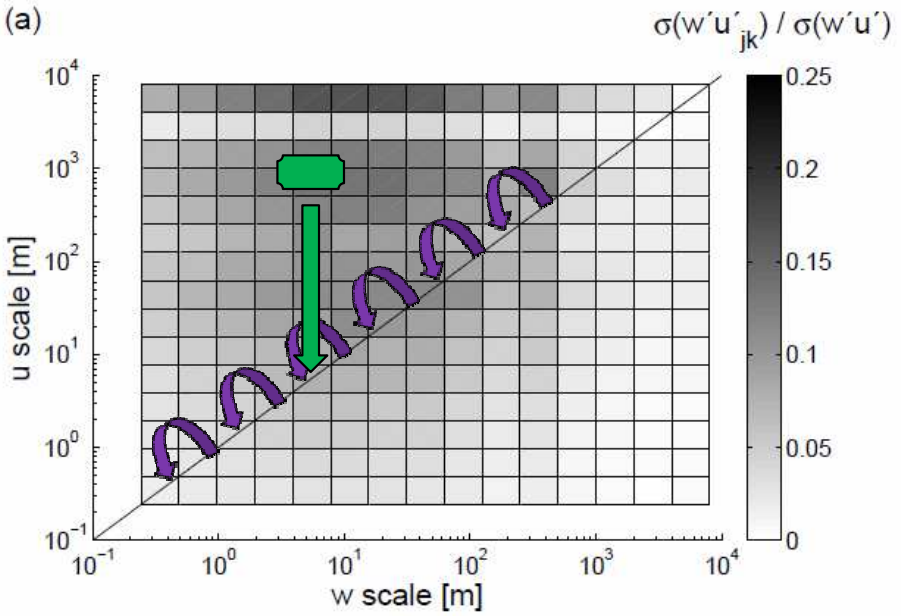
Possible to investigate the correlation between horizontal wind fluctuations (ordinate axis) and vertical wind variance (abscissa) on different scales



Imagine for instance that a period of increased wind speed taking place over a long time scale initiates turbulent vertical wind motions on mainly smaller scale

This could then also generate increased time-averaged fluxes on this smaller scale

Without going through a spectral transfer

Some work remains
We are looking for nice data with scale interactions to analyse. **Do you have it?**

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BLLAST Post-doc 2013-2015

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Fluxes?

What was he talking about?

Scales?

GRAW humidity and rising speed bias?

Thank you!
Questions?

Fourier and Multiresolution?