

# **EC-software for CH<sub>4</sub> and N<sub>2</sub>O**

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H. Jonker  
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# EC-software for CH<sub>4</sub> and N<sub>2</sub>O

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1. ECN, Netherlands ; 2. TU Delft, Netherlands



## Outline

- Measurement site and instrumentation
- Actual data processing method
- Some future implications
- Useful references



## Measurement site and instrumentation



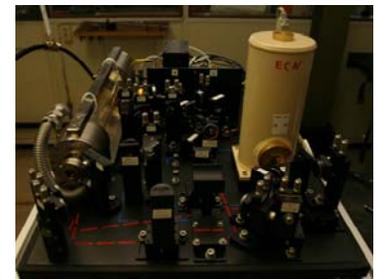
### Sonic anemometer

Wind measurements (u,v,w)

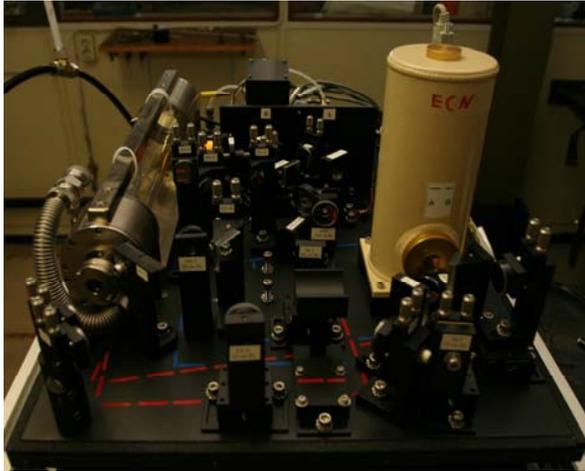
Temperature measurements (T)

### Tube connected to QCL

Concentration measurements  
(CH<sub>4</sub>, N<sub>2</sub>O)



## Measurement site and instrumentation



- Model QCL-TILDAS-76, Aerodyne Research Inc., USA
- Sampling frequency  $\sim 10\text{Hz}$
- Field software “TDL-wintel”; Aerodyne Research Inc., USA

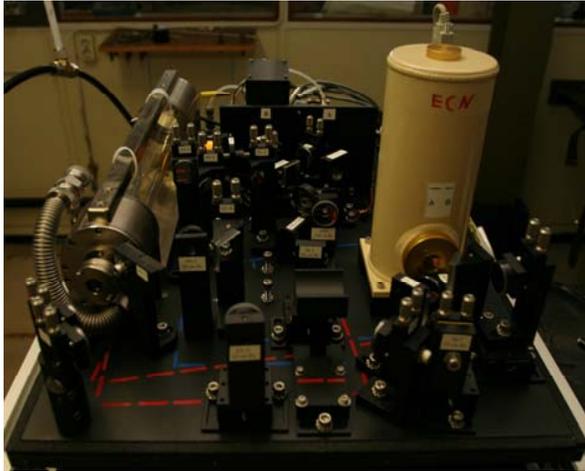


- Model R3, Gill Instruments, UK
- Sampling frequency  $20.88\text{Hz}$
- Field software “Edcor”; ECN, NL (following McMillen, 1988)

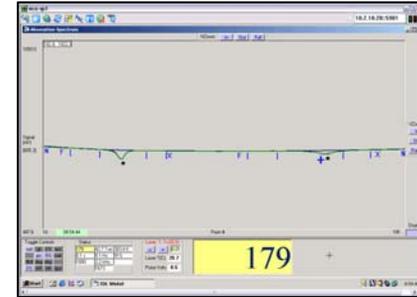


RS232

# Measurement site and instrumentation



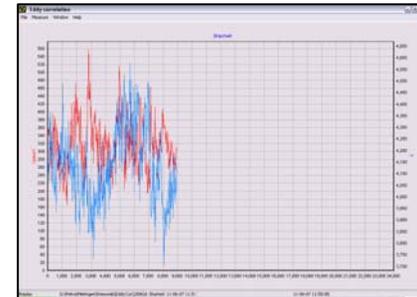
TDL-Wintel



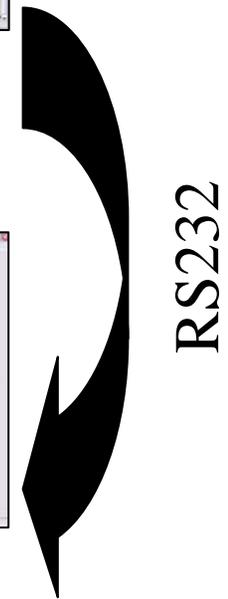
- Saving concentrations in .str
- Saving QCL-properties in .stc



Edcor

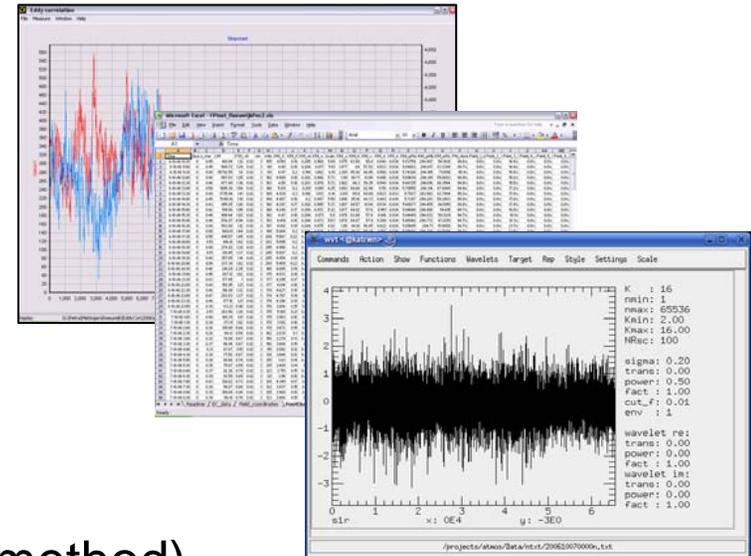


- Saving raw data in .raw
- Saving flux data in .edcor



## Actual data processing method

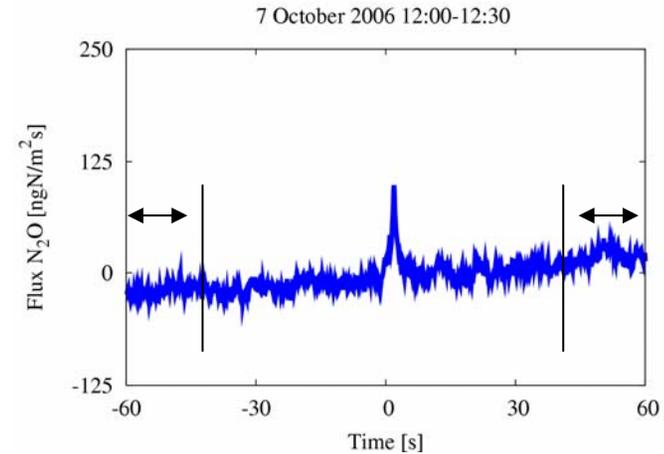
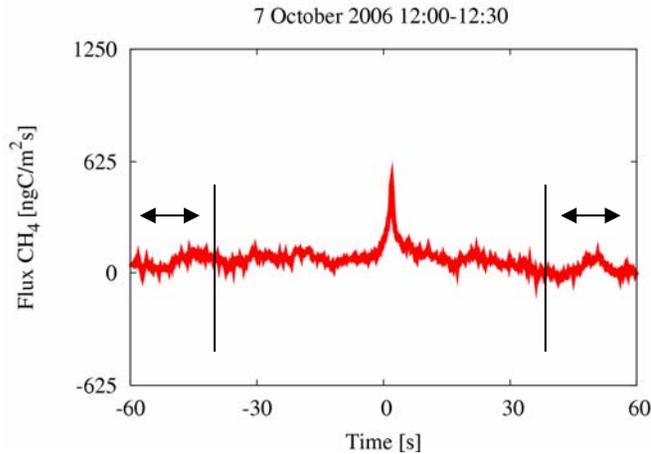
- Raw data screening (spikes removal)
- **Delay time determination**
- Running mean 120s
- Averaging time 30min
- Webb-correction
- Storage
- Steady state tests of Thomas Foken
- Footprint analysis (Kormann Meixner method)
- Calibrations



- Too time consuming
- Missing algorithms (damping,  $u^*$ , gap filling etc.)

One “complete”  
automatic  
program

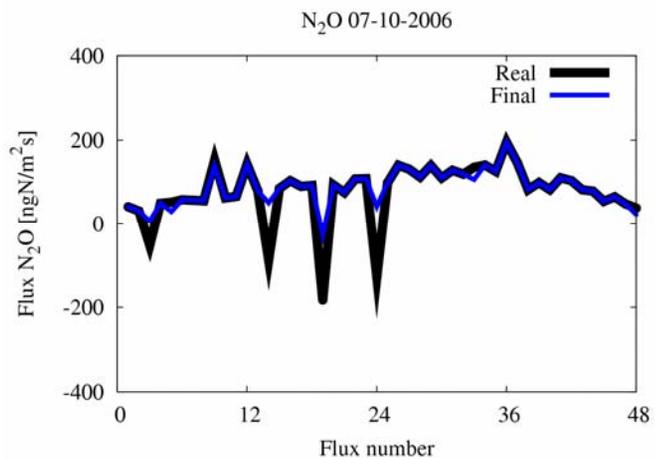
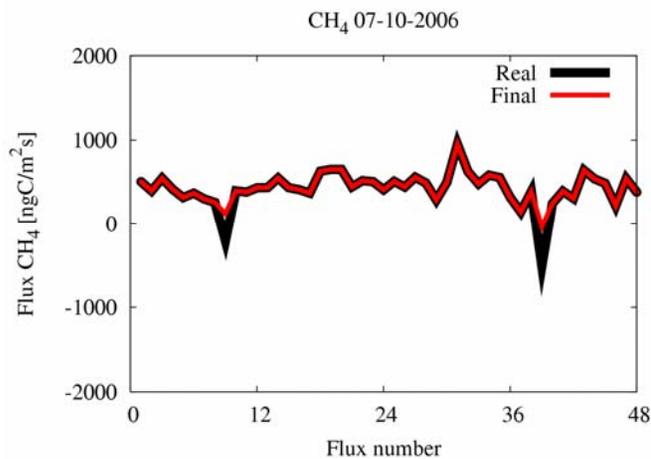
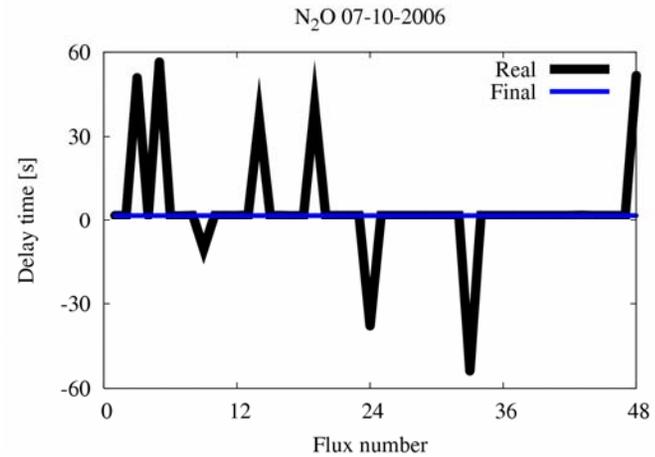
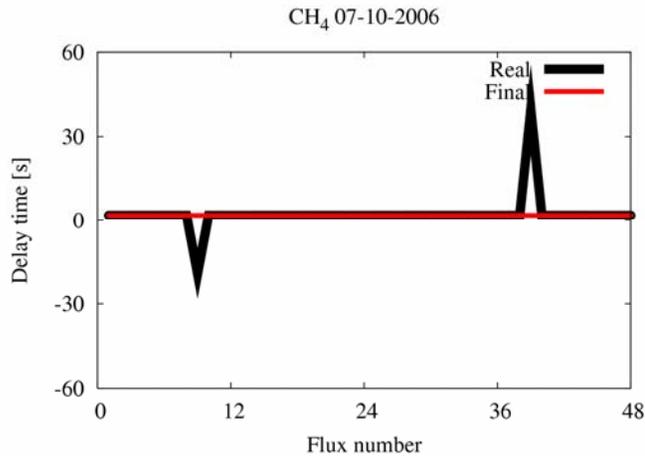
## Future implications – Delay time



- Delay time determination for each 30-min flux value
- Wienhold error determination for each 30-min flux value (Wienhold et al., 1995)

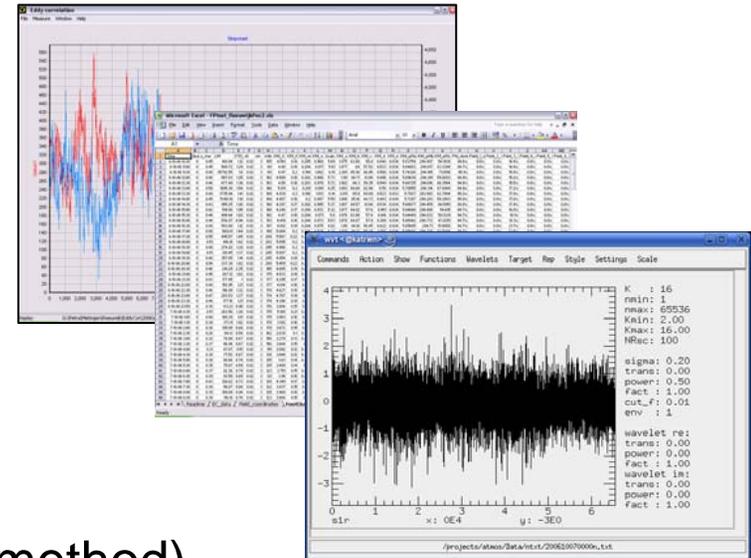
Date and time	CH <sub>4</sub> [ngC/m <sup>2</sup> s]	N <sub>2</sub> O [ngN/m <sup>2</sup> s]
7 October 2006 12:00-12:30	42 ± 40	-1 ± 10

# Future implications – Delay time



## Actual data processing method

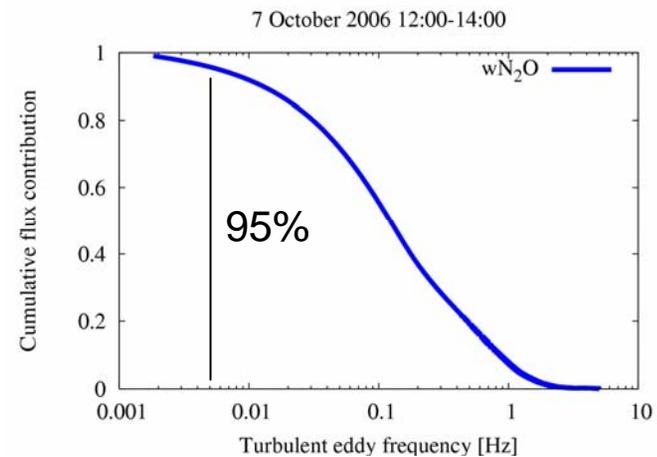
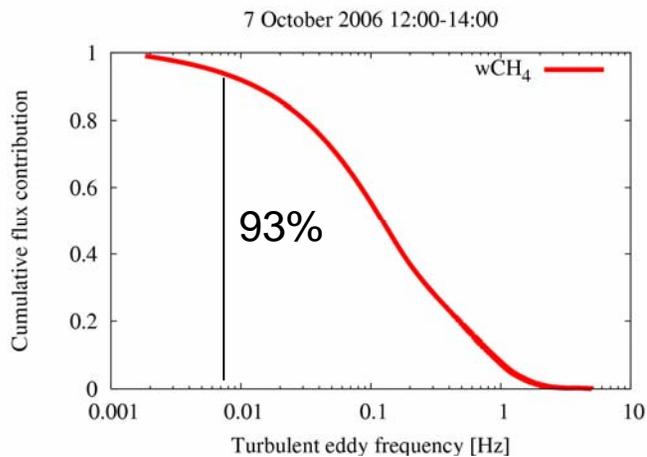
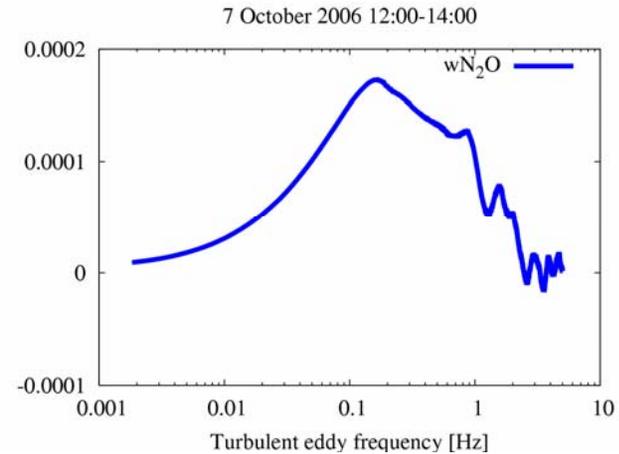
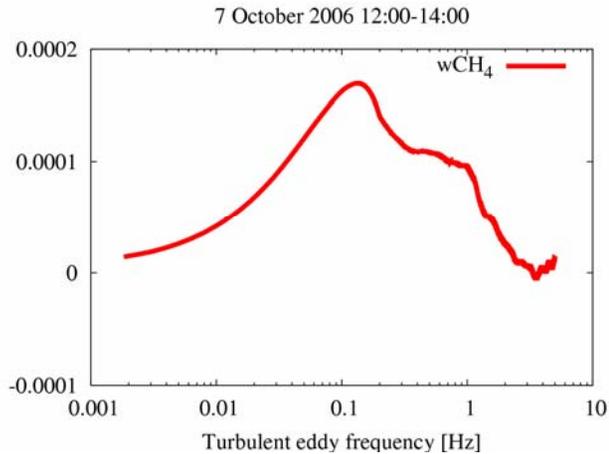
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- Missing algorithms (damping,  $u^*$ , gap filling etc.)

One “complete”  
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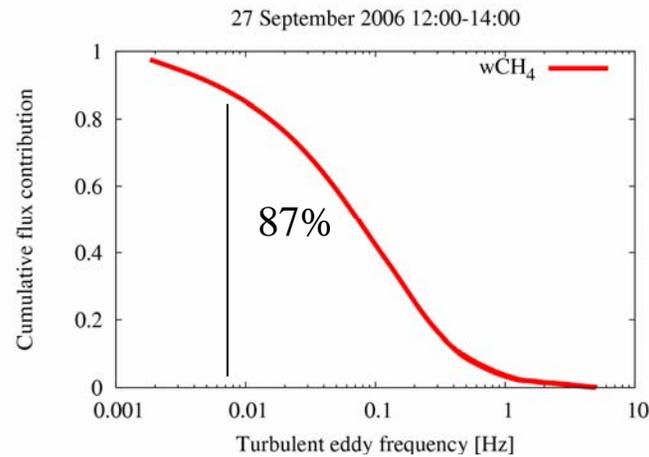
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However,

- Dependent on meteorological circumstances.



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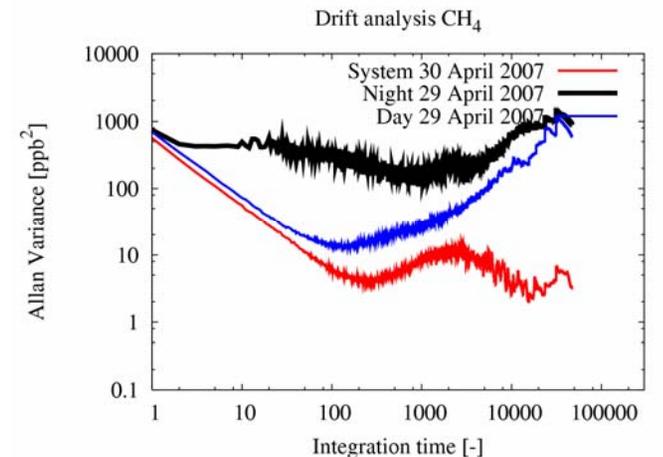
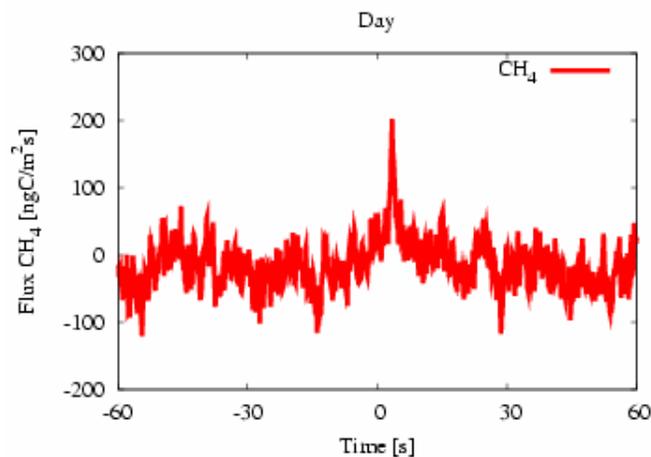
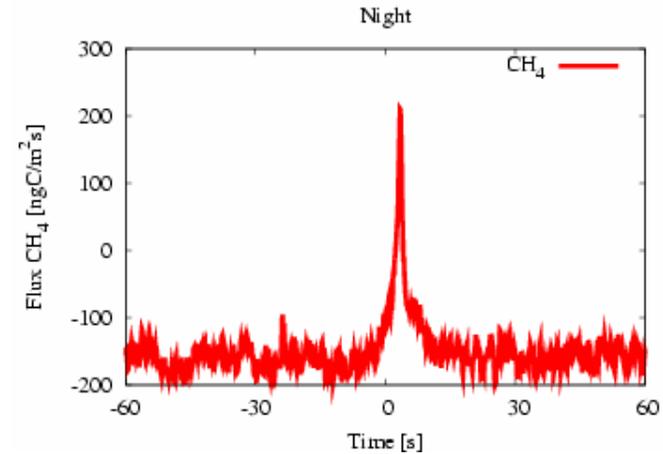
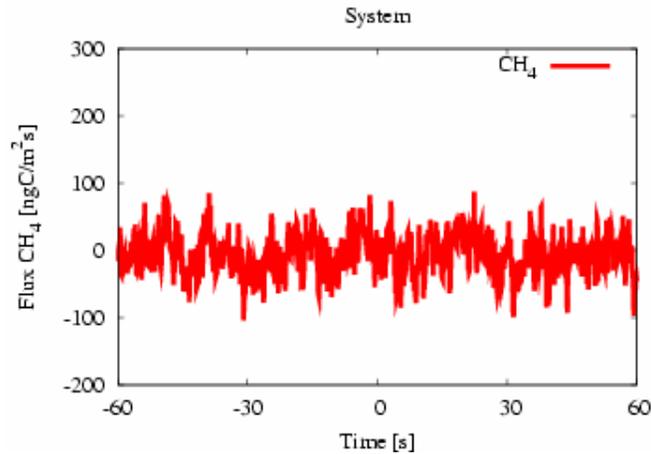


Is block averaging a serious option?

Be careful,

- Dependent on laser drift effect on flux contribution.

# Future implications – Running mean 120s



## Future implications – Running mean 120s

However,

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Is block averaging a serious option?

Be careful,

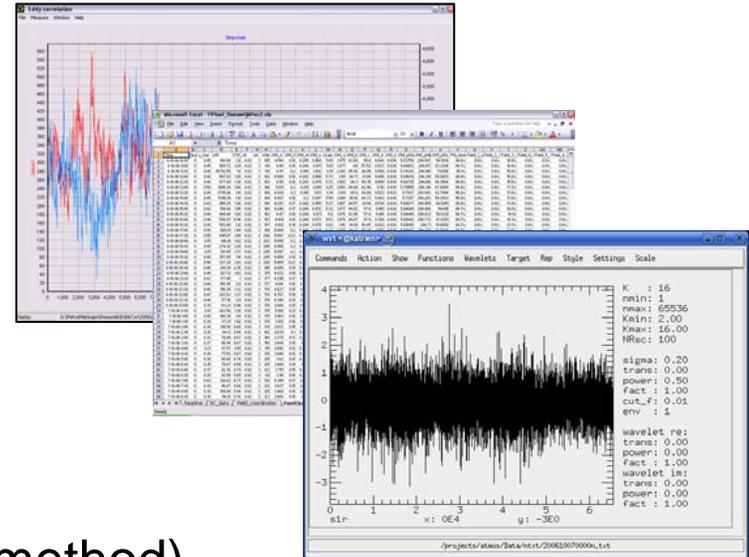
- Dependent on laser drift effect on flux contribution.



Yes!

## Actual data processing method

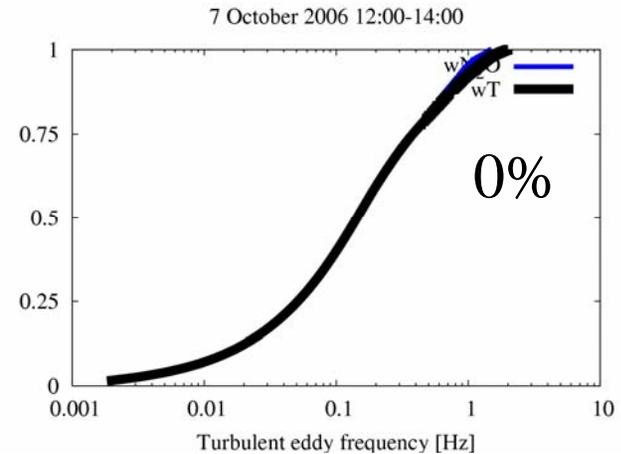
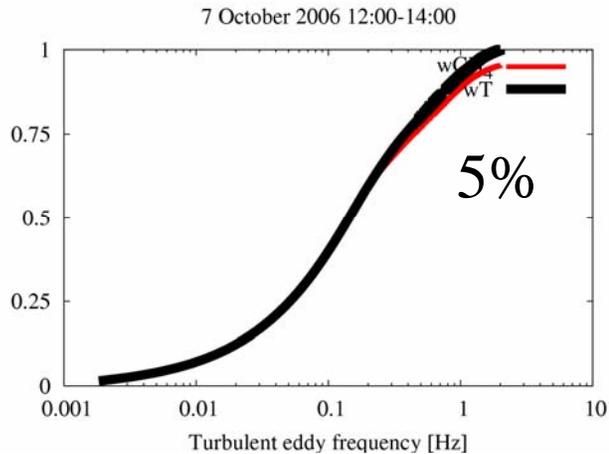
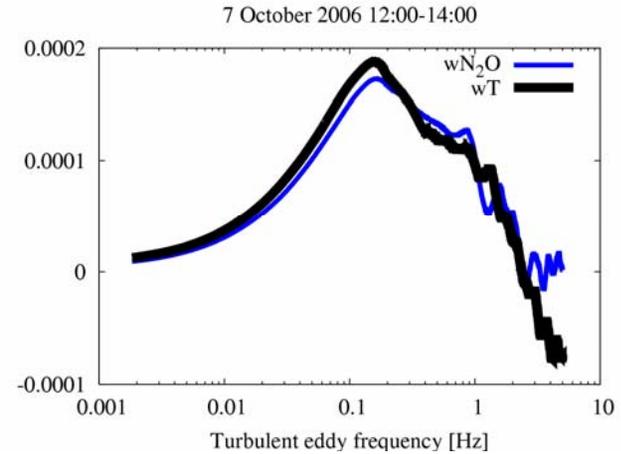
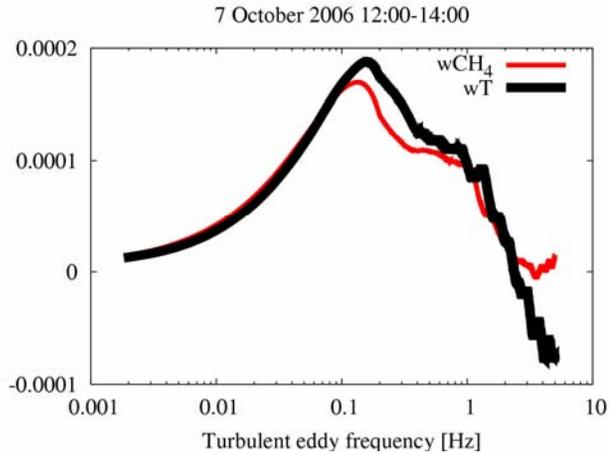
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# Future implications – Damping

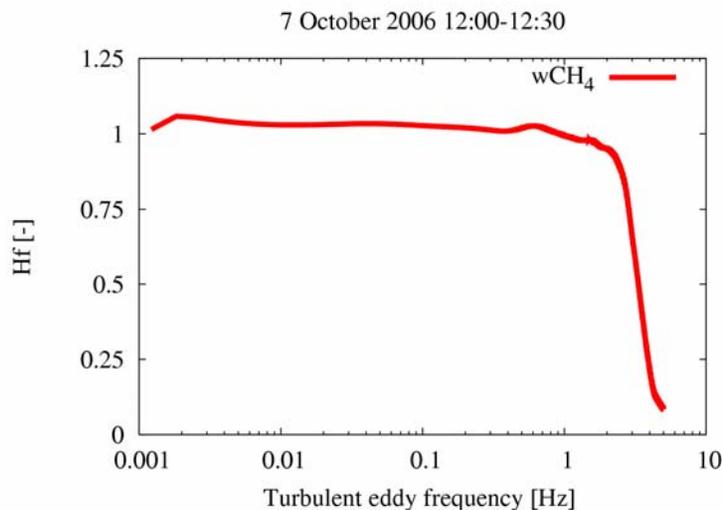


## Future implications – Damping

However,

- Dependent on meteorological circumstances.


 Is a transfer function a serious option?



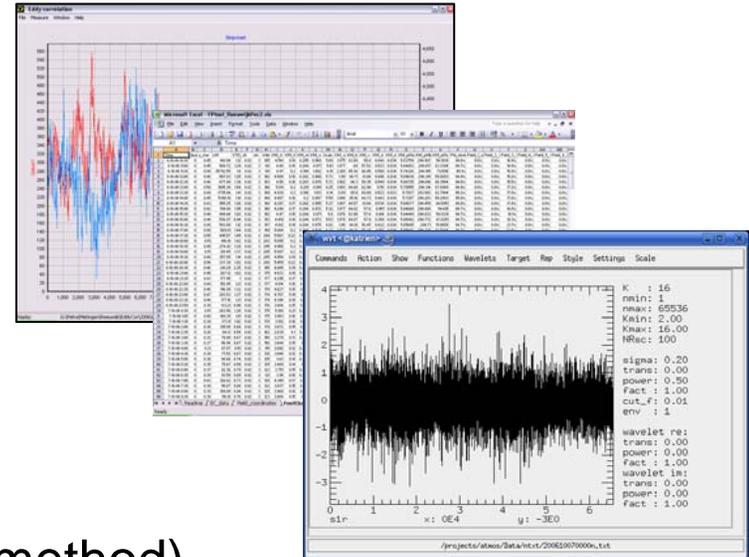
Big advantage:

- Less time consuming


 Yes!

## Actual data processing method

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## Useful references

- Allan (1966)
- Ammann et al. (2006)
- Foken and Wichura (1996)
- Jonker et al. (1999)
- Kormann et al. (2001)
- Lee et al. (2004)
- McMillen (1988)
- Webb et al. (1980)
- Wienhold et al. (1995)