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SSWAP

Turbulent forest flux measurements and comparison with ERA-interim

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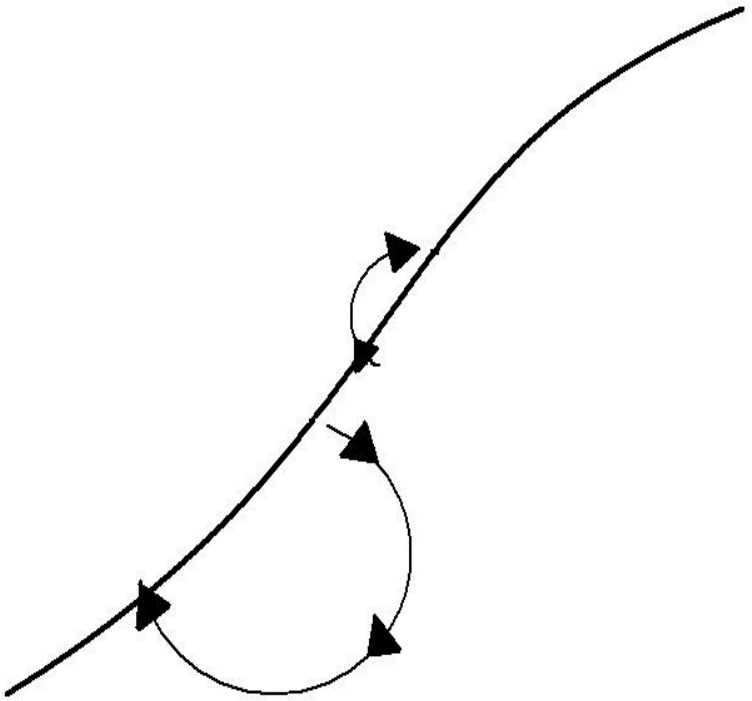
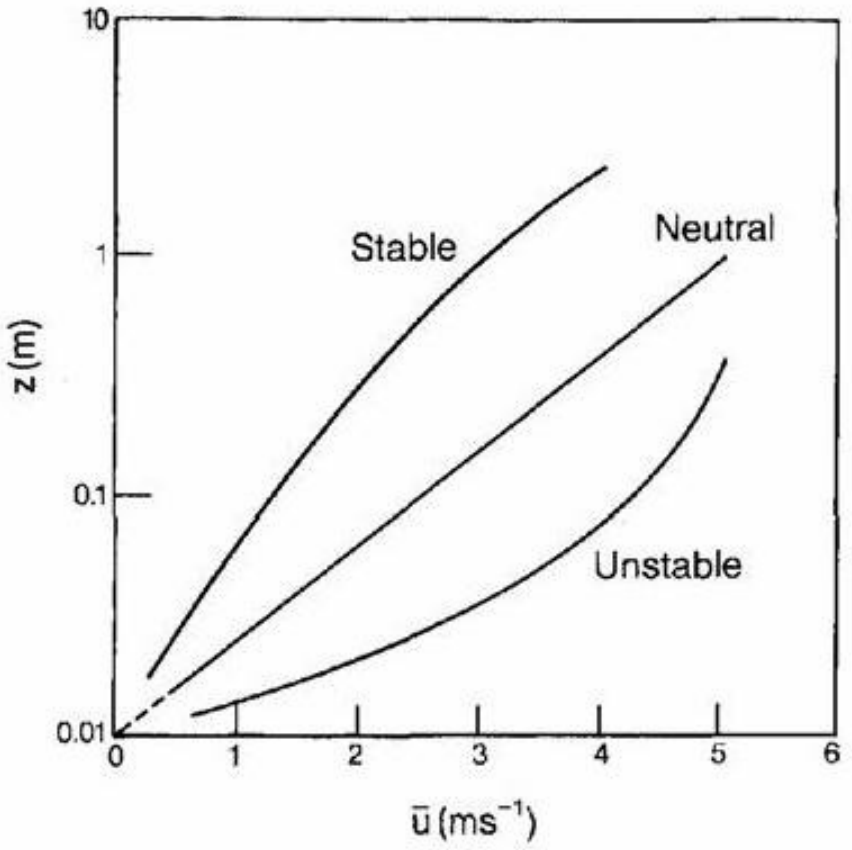
Fluxes driven by turbulence



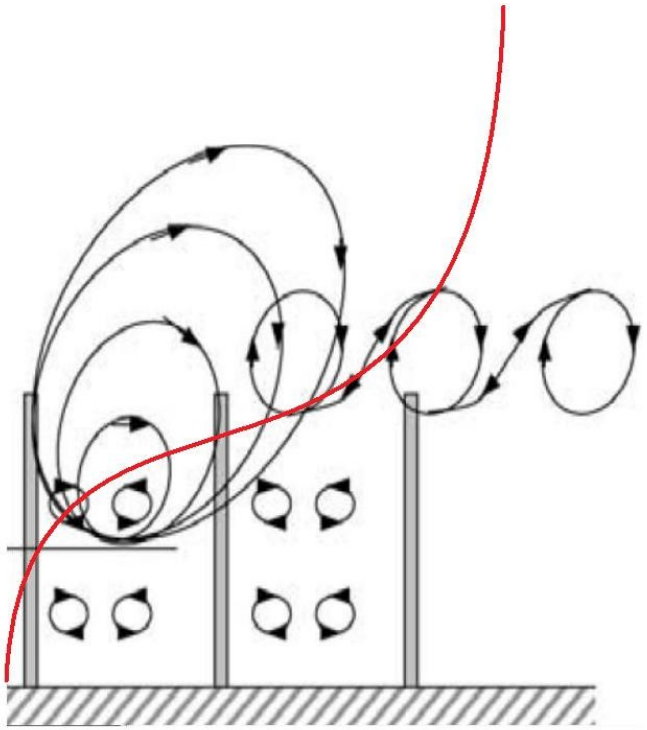
- K-theory
- Relates flux to the profile
- Requires homogeneous and stationary conditions

Fluxes driven by turbulence



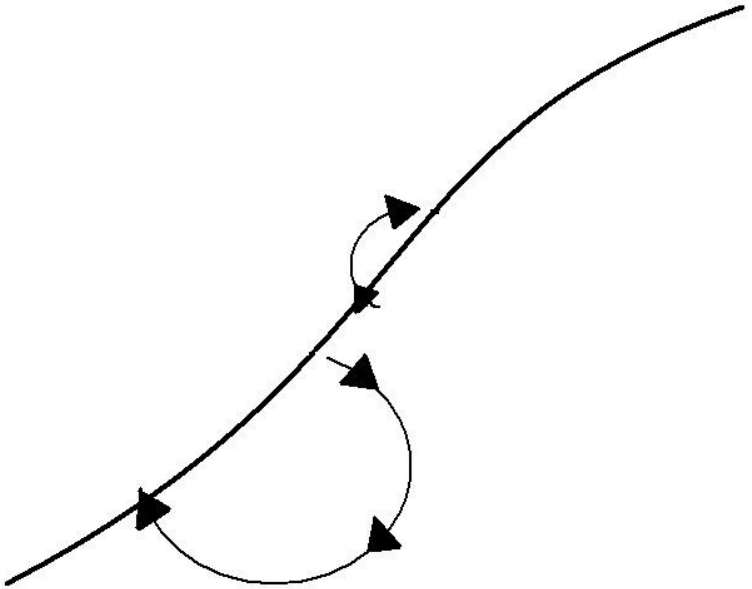
- Neutral flat boundary layer – logarithmic profile
- Stability changes the profile
- Can be accounted for with Monin-Obukhov similarity theory or similar

Forest turbulence



- In a forest the situation is more complex
- Different types of eddies
- Inflection point in the velocity profile
- MOST is known to break down over forests

Eddy covariance technique

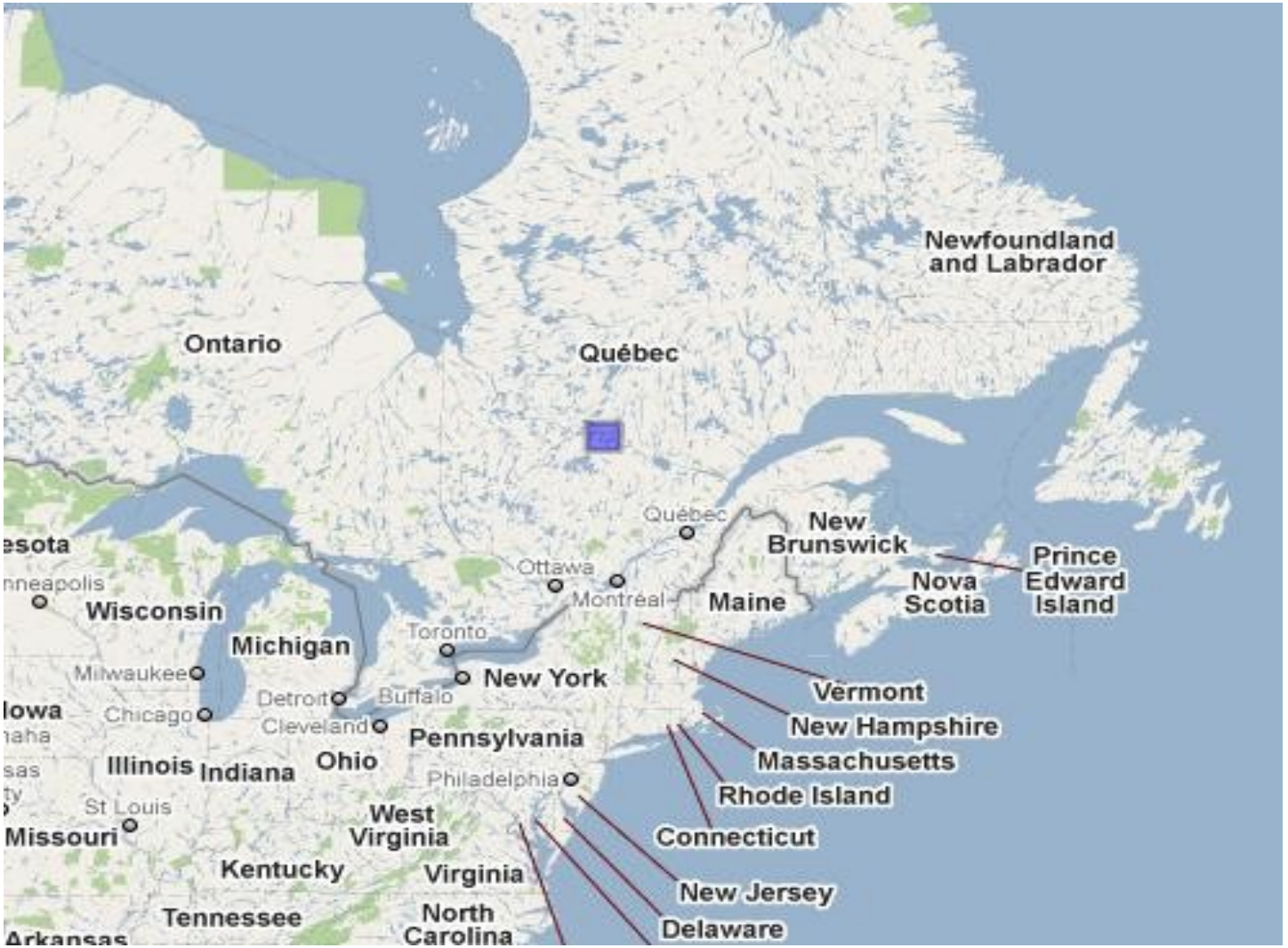


- Measuring the covariance
- Need high frequency measurements to avoid aliasing effects
- Need homogeneous conditions – no horizontal transport

The site

- Mixed woodland and lakes
- Gridbox is 80x80km
- Corresponds to T255
- Data from 2003-06-01 to 2004-07-31 has been processed

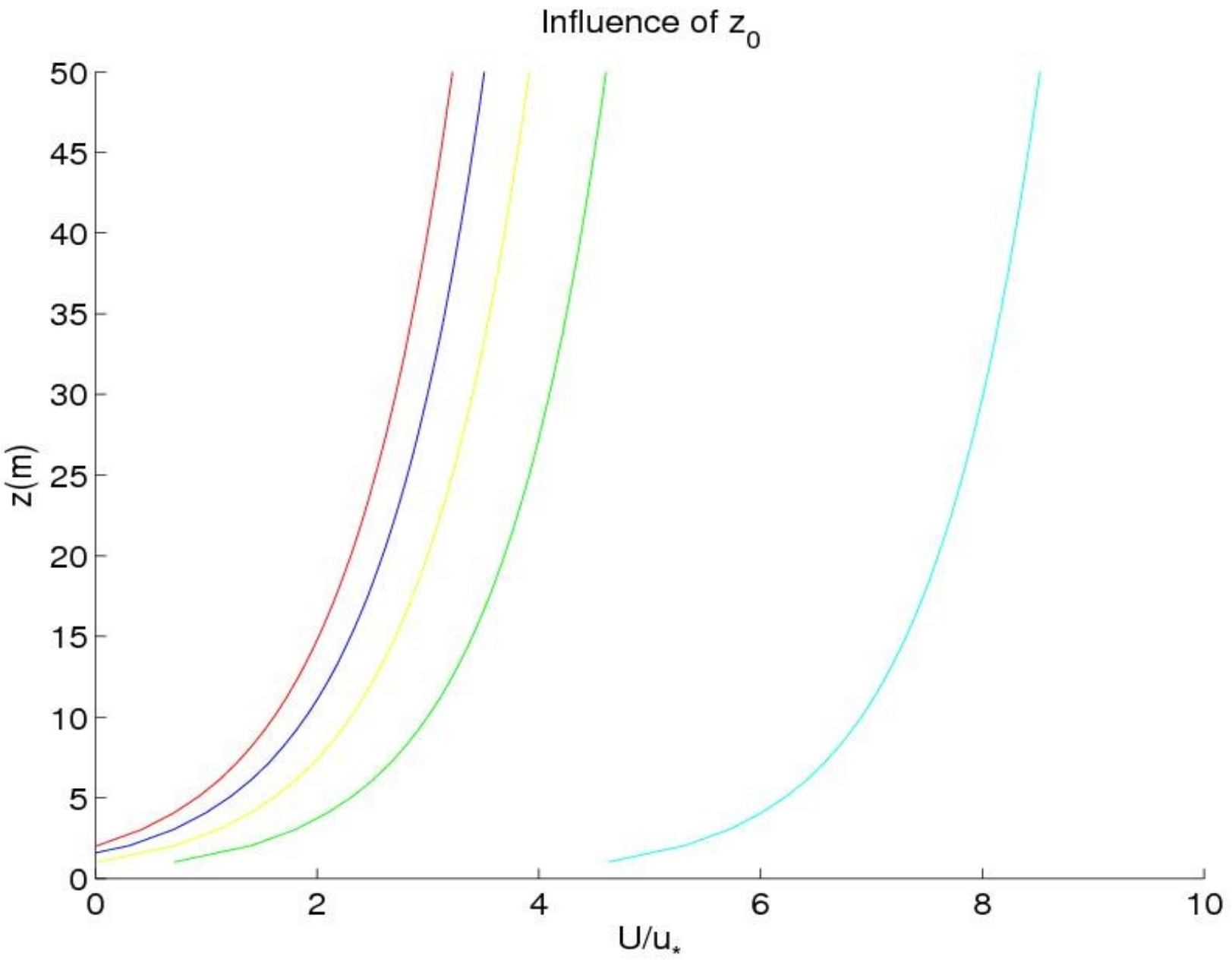
Large view of gridbox



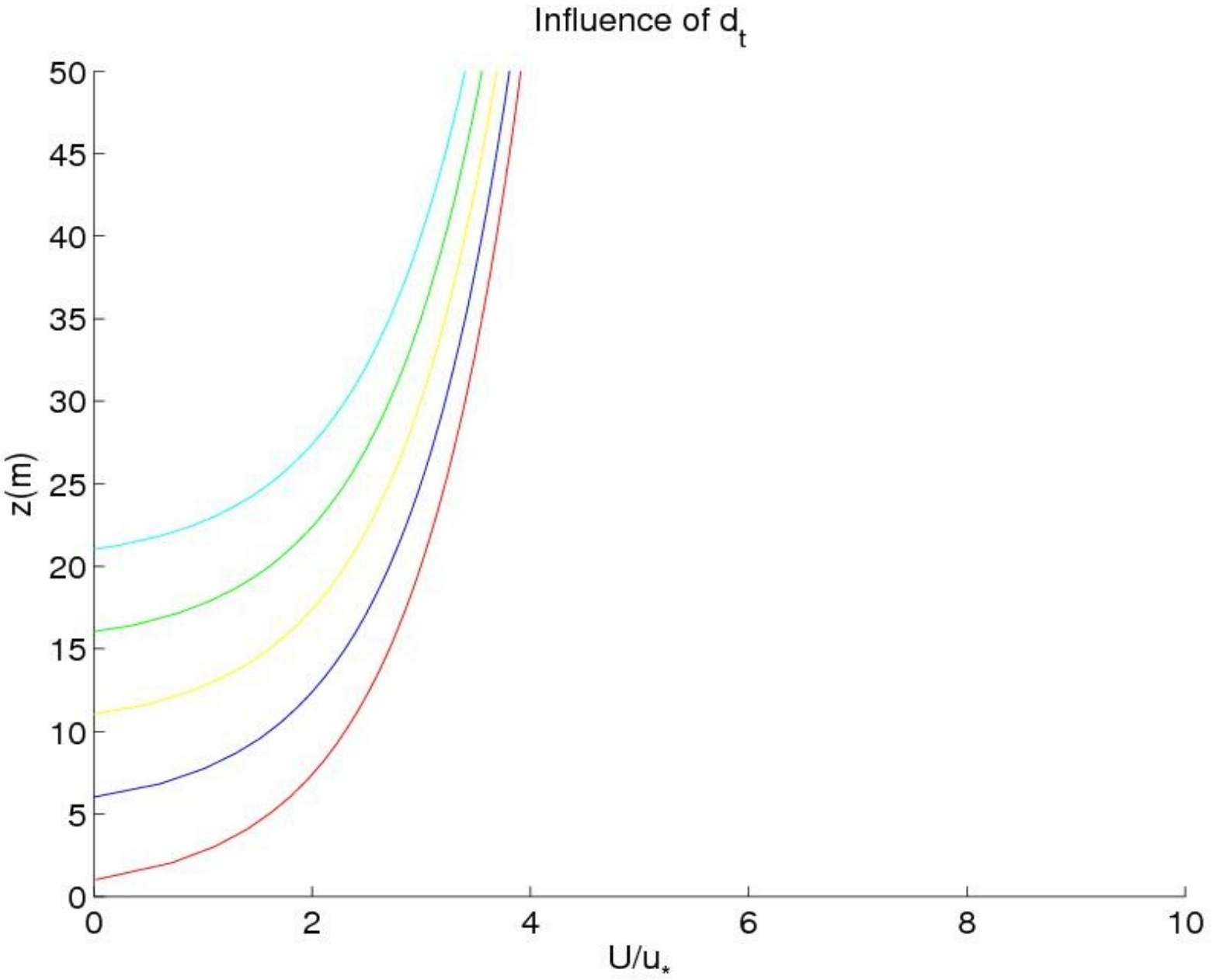
What does the model see?

The shape of the surface layer profile can be changed by altering the roughness length and zero plane displacement

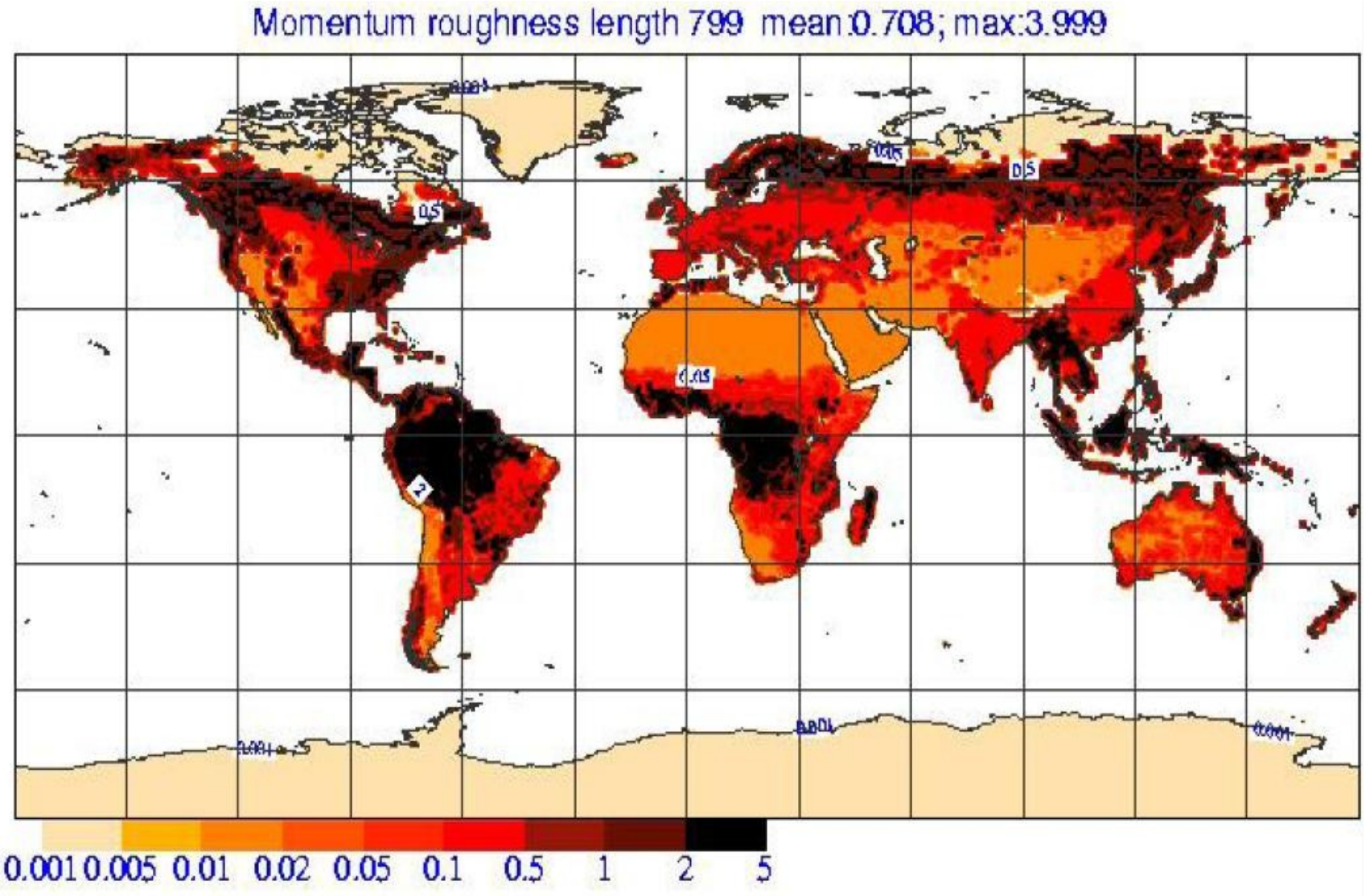
Values of z_0 ranging from 2 to 0.01



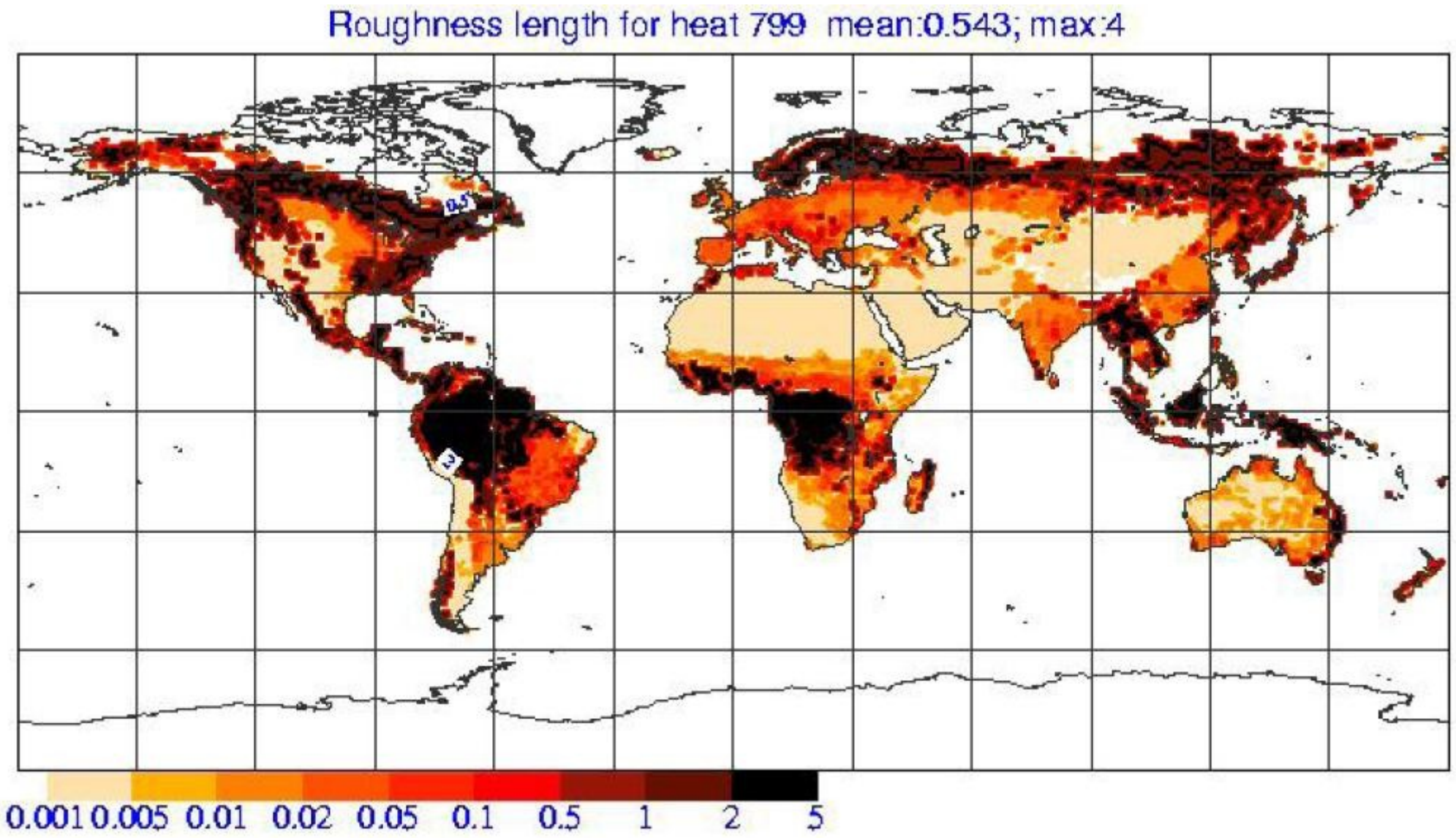
Values of d_t ranging from 0 to 20



Z_{0m} in ECMWF


Momentum roughness length 799 mean:0.708; max:3.999
0.001 0.005 0.01 0.02 0.05 0.1 0.5 1 2 5

Z_{0H} in ECMWF


Roughness length for heat 799 mean:0.543; max:4
0.001 0.005 0.01 0.02 0.05 0.1 0.5 1 2 5

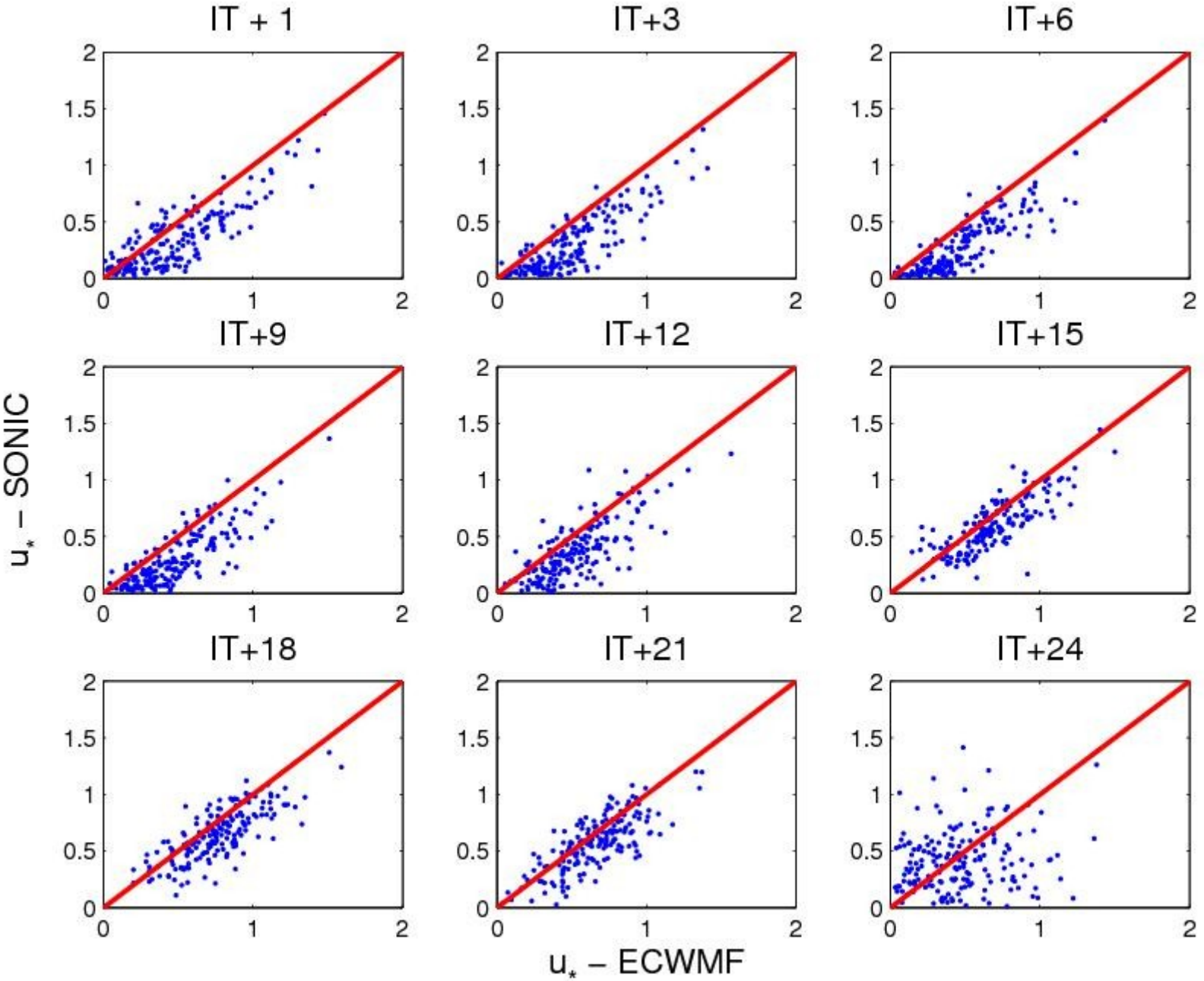
Index	Vegetation type	H/L veg	z_{0m}	z_{0h}
1	Crops, mixed farming	L	0.150	0.015
2	Short grass	L	0.020	0.002
3	Evergreen needleleaf trees	H	2.000	2.000
4	Deciduous needleleaf trees	H	2.000	2.000
5	Deciduous broadleaf trees	H	2.000	2.000
6	Evergreen broadleaf trees	H	4.000	4.000
7	Tall grass	L	0.100	0.010
8	Desert	–	0.013	$1.3\ 10^{-3}$
9	Tundra	L	0.050	0.005
10	Irrigated crops	L	0.150	0.015
11	Semidesert	L	0.050	0.005
12	Ice caps and glaciers	–	$1.3\ 10^{-3}$	$1.3\ 10^{-4}$
13	Bogs and marshes	L	0.050	0.005
14	Inland water	–	–	–
15	Ocean	–	–	–
16	Evergreen shrubs	L	0.100	0.010
17	Deciduous shrubs	L	0.100	0.010
18	Mixed forest/woodland	H	2.000	2.000
19	Interrupted forest	H	0.500	0.050
20	Water and land mixtures	L	–	–

The site

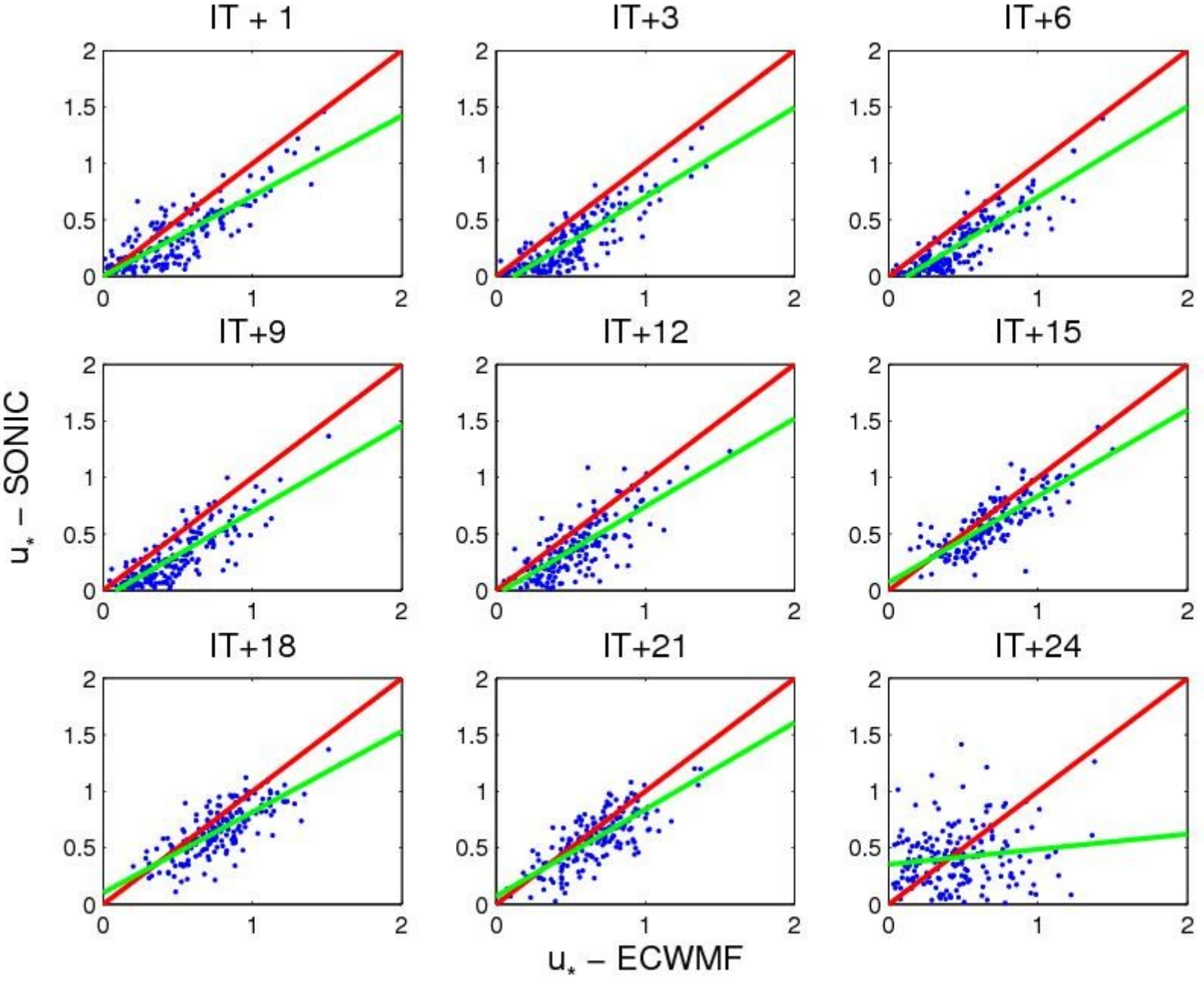
- Eddy covariance instrument deployed at 24 m
- Sampling at 10 Hz
- Tree height 13.8m
- Mostly Black spruce and some Jack pine
- Instruments used in analyzes are fine wire thermocouple (temperature) and SONIC anemometer (wind and temperature)
- Initial time for model was 00 UTC

Results

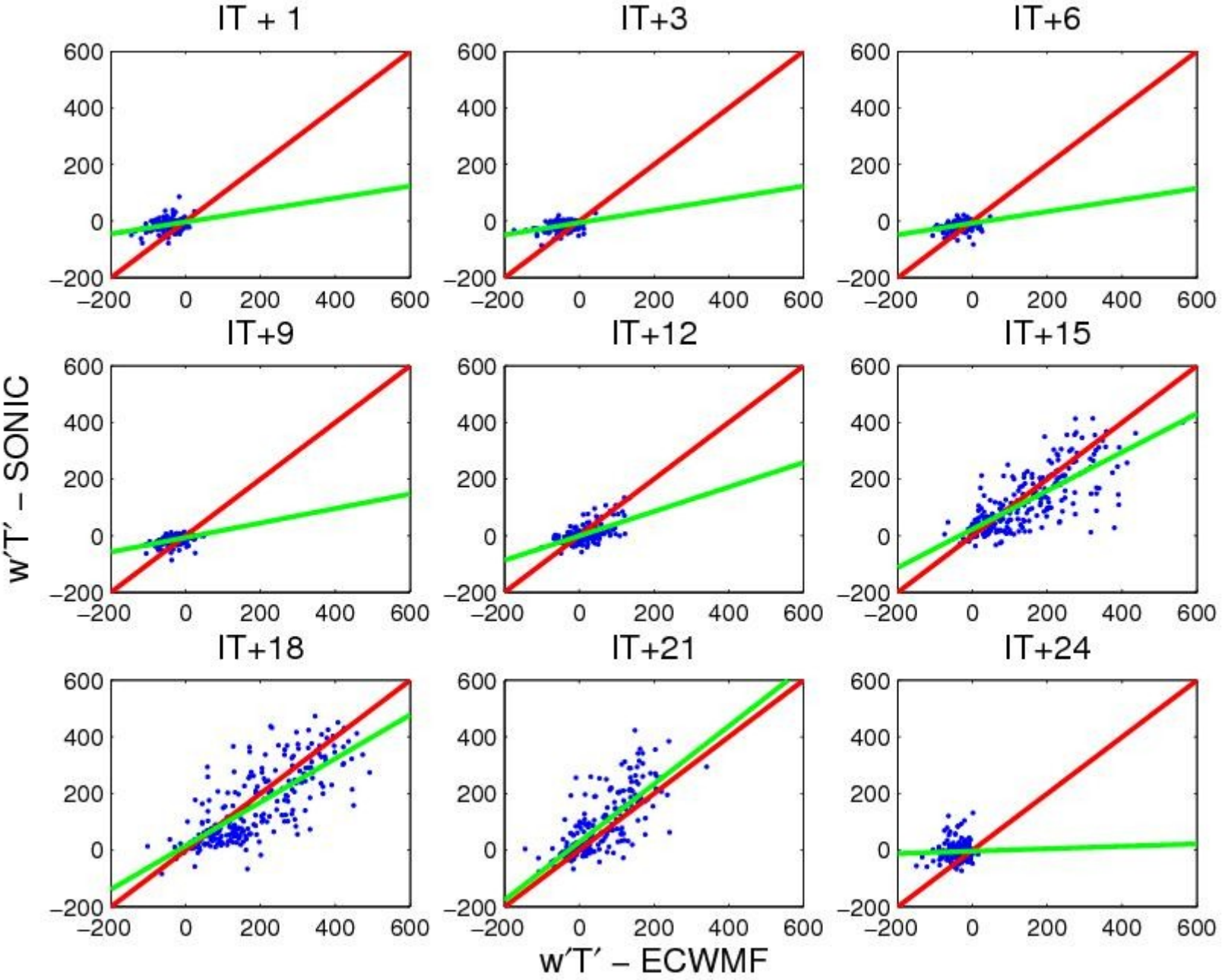
U_* - 24 h prediction



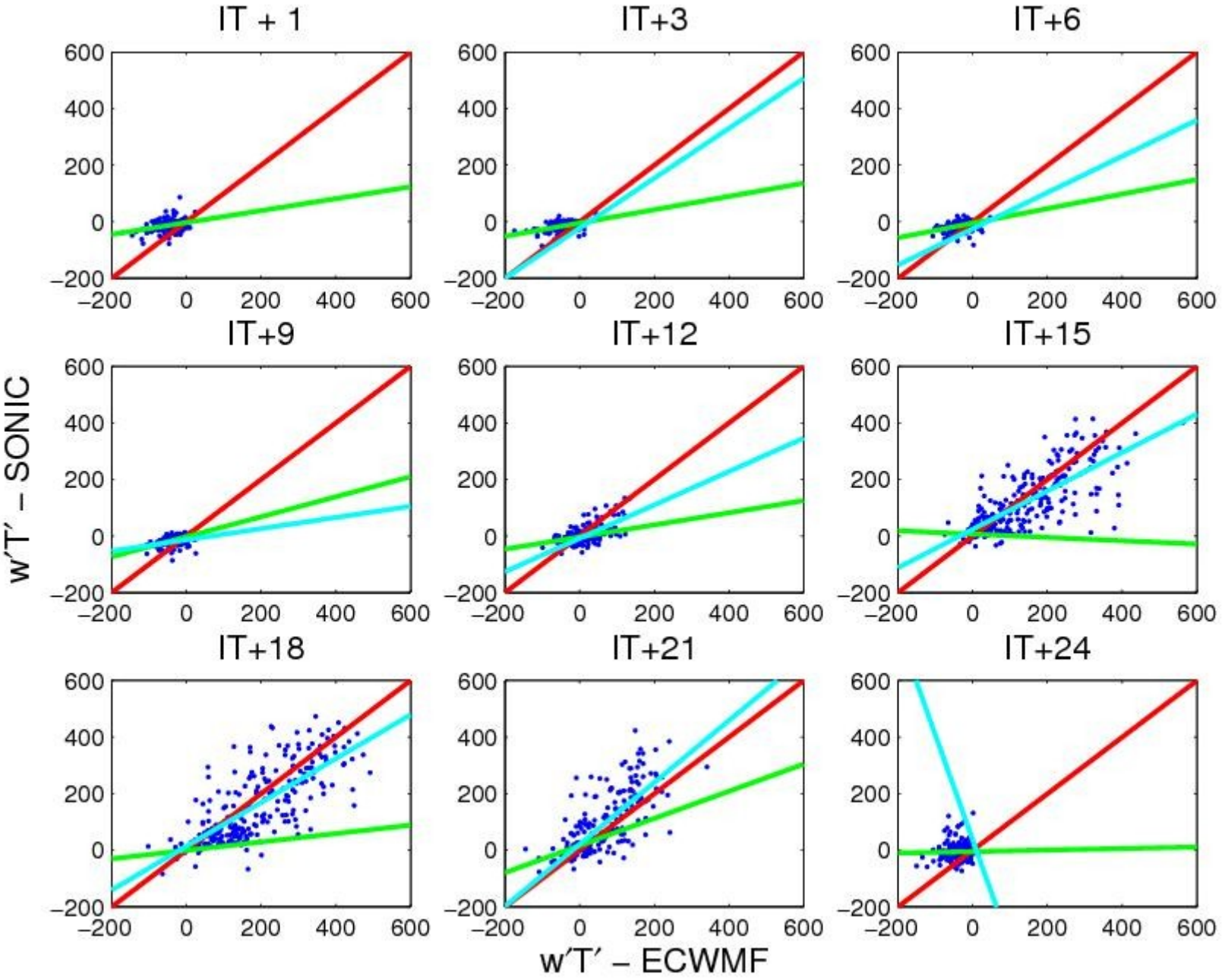
u_* - 24 h prediction – with trend



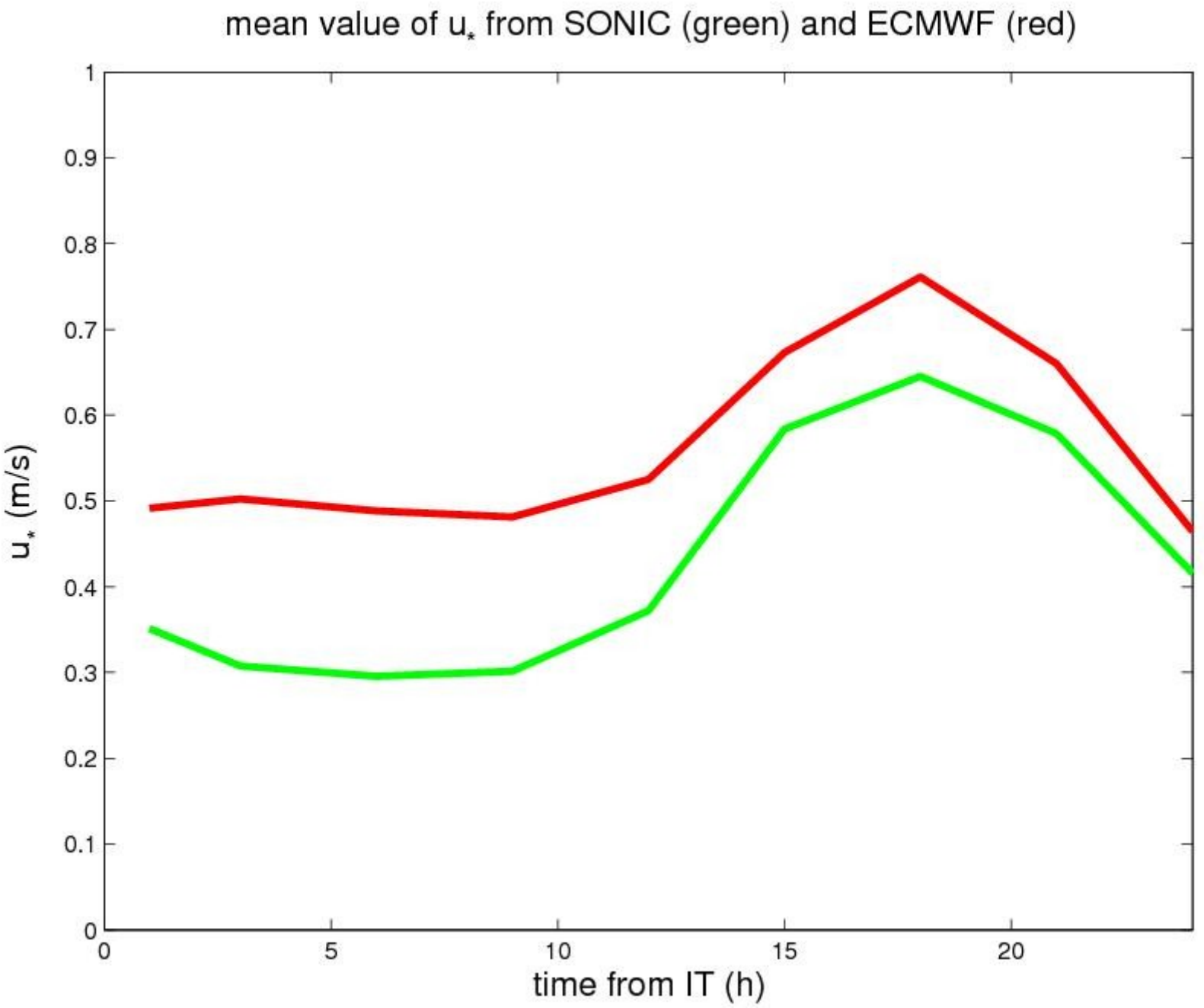
Sensible heat flux



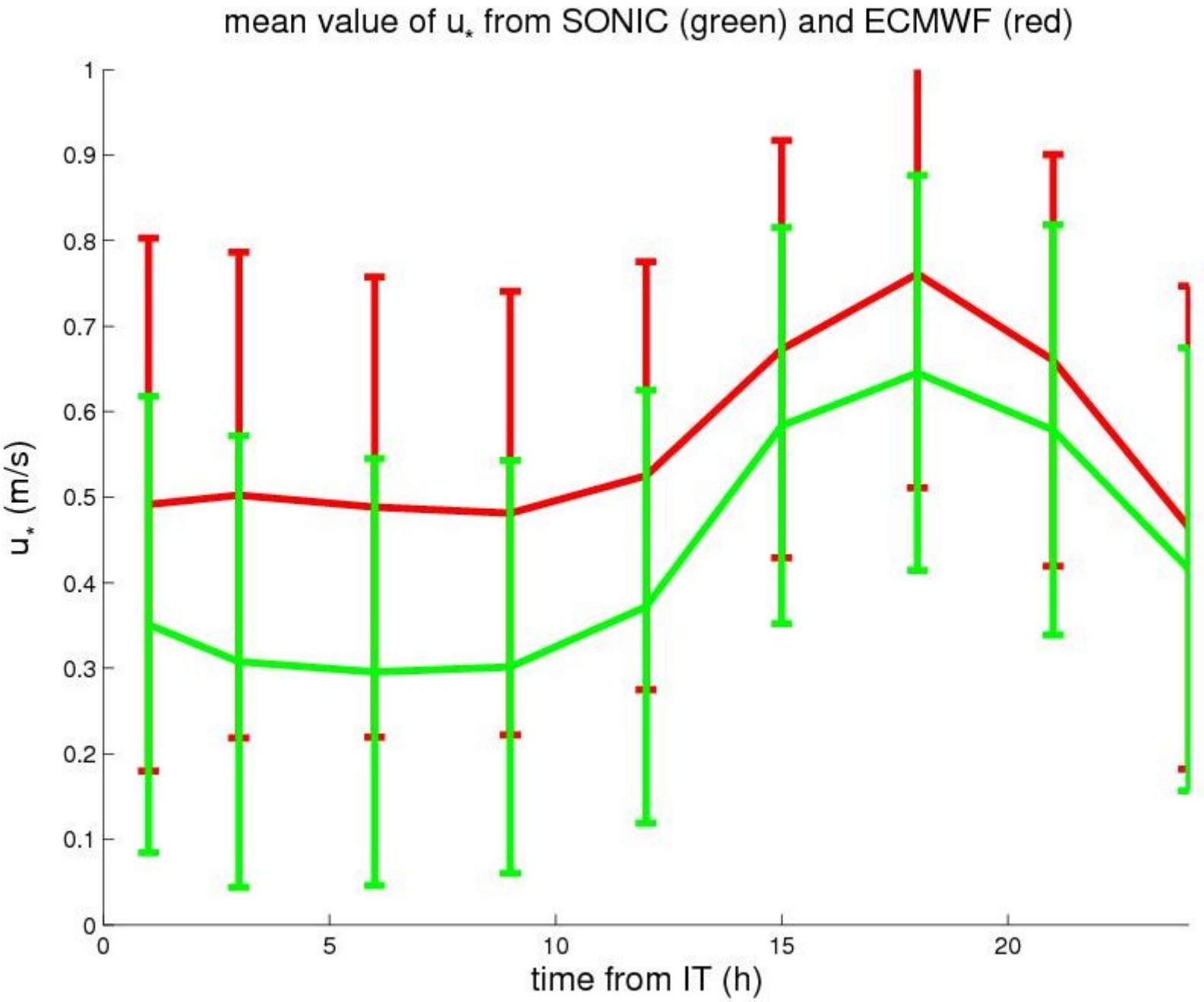
Heat flux – with split trend



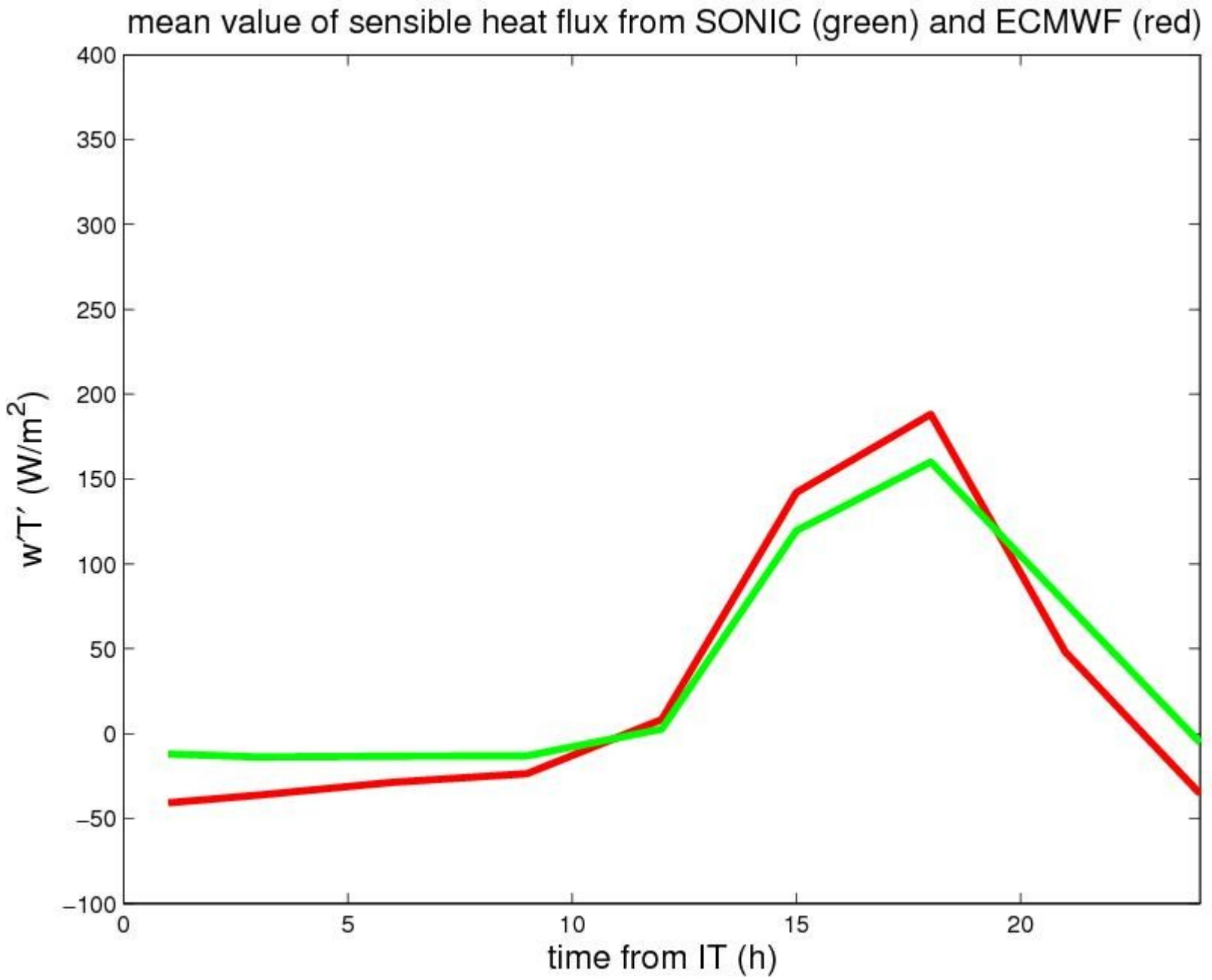
Diurnal cycle of u_*



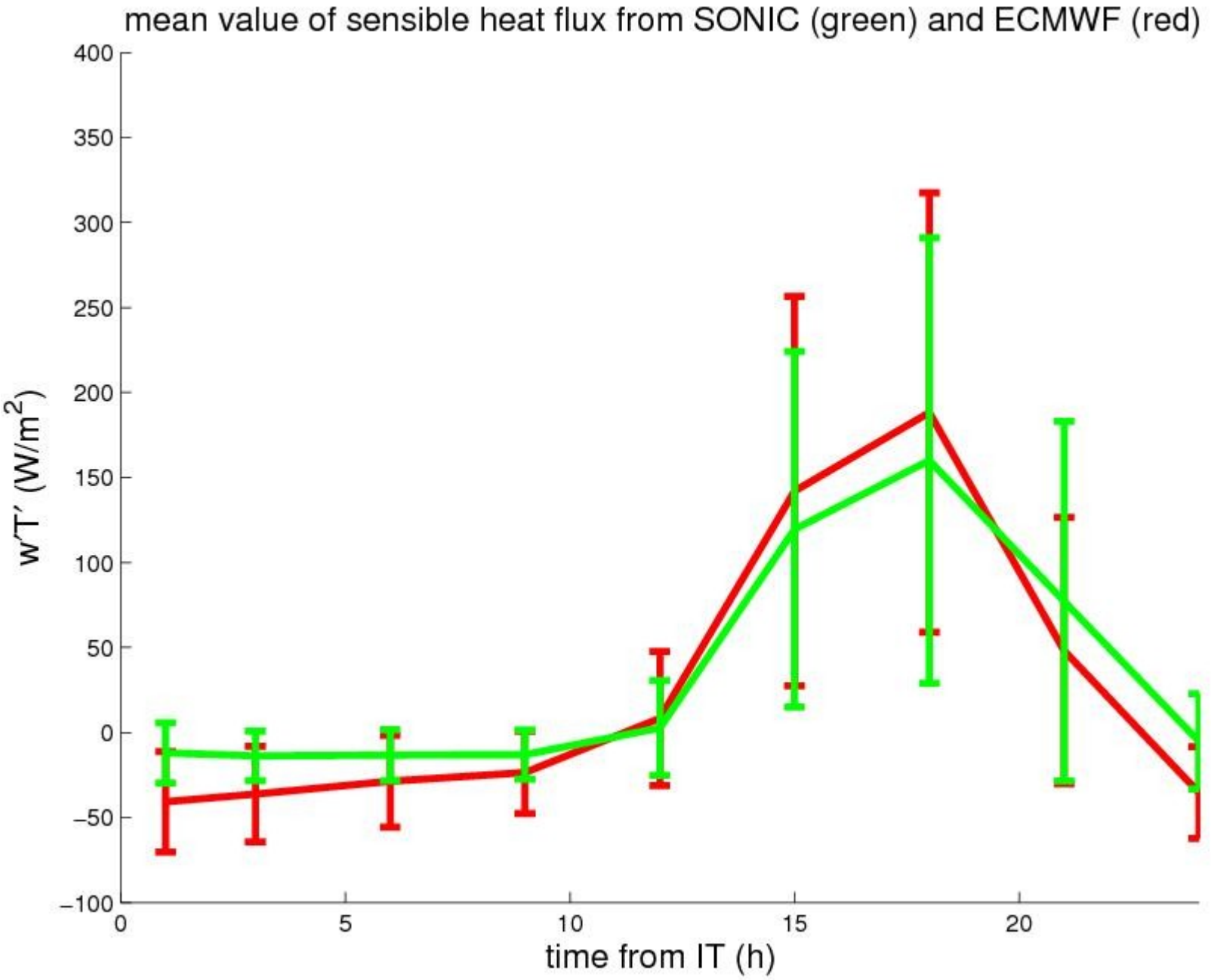
Diurnal cycle of u_*



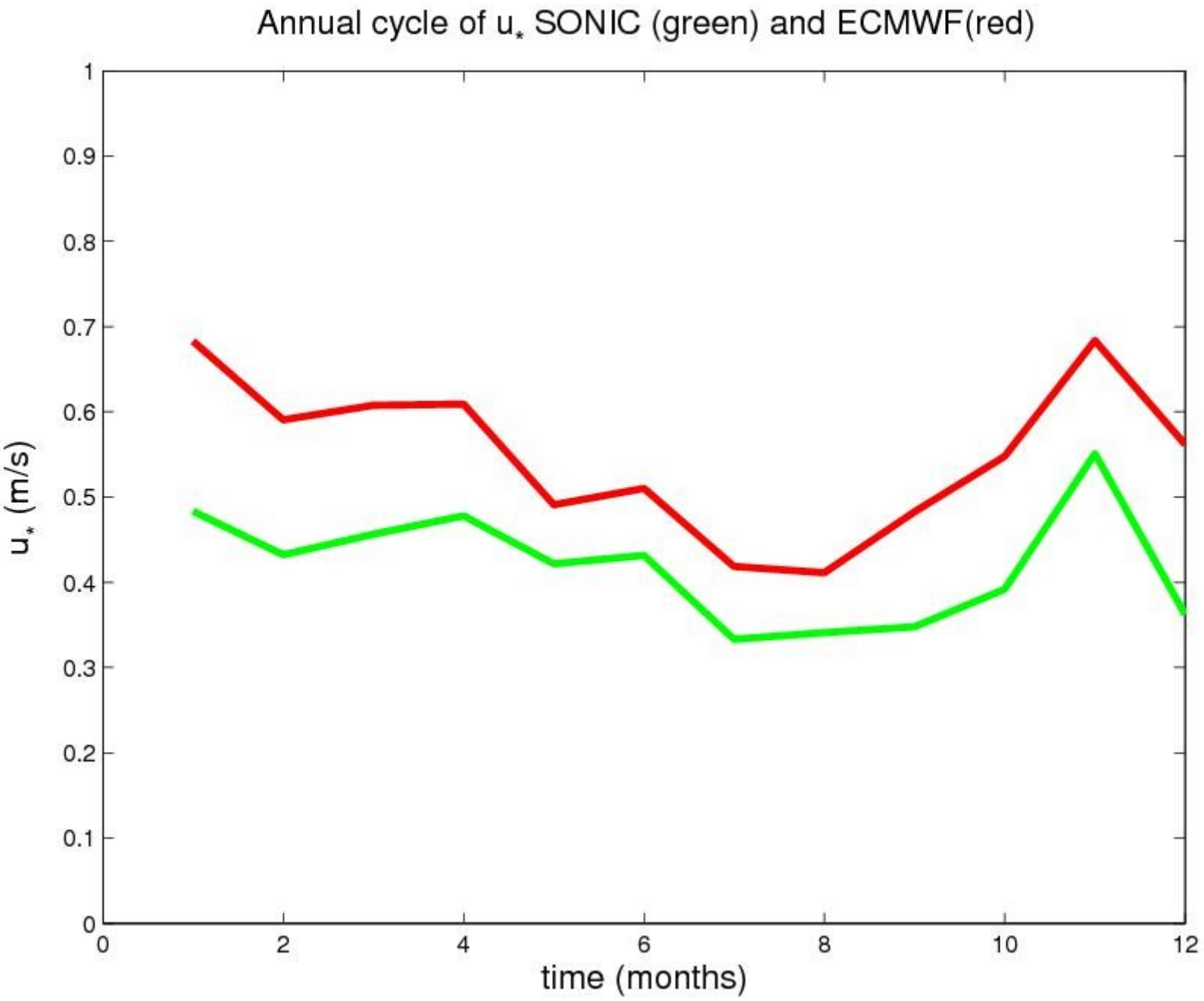
Diurnal cycle of sensible heat flux



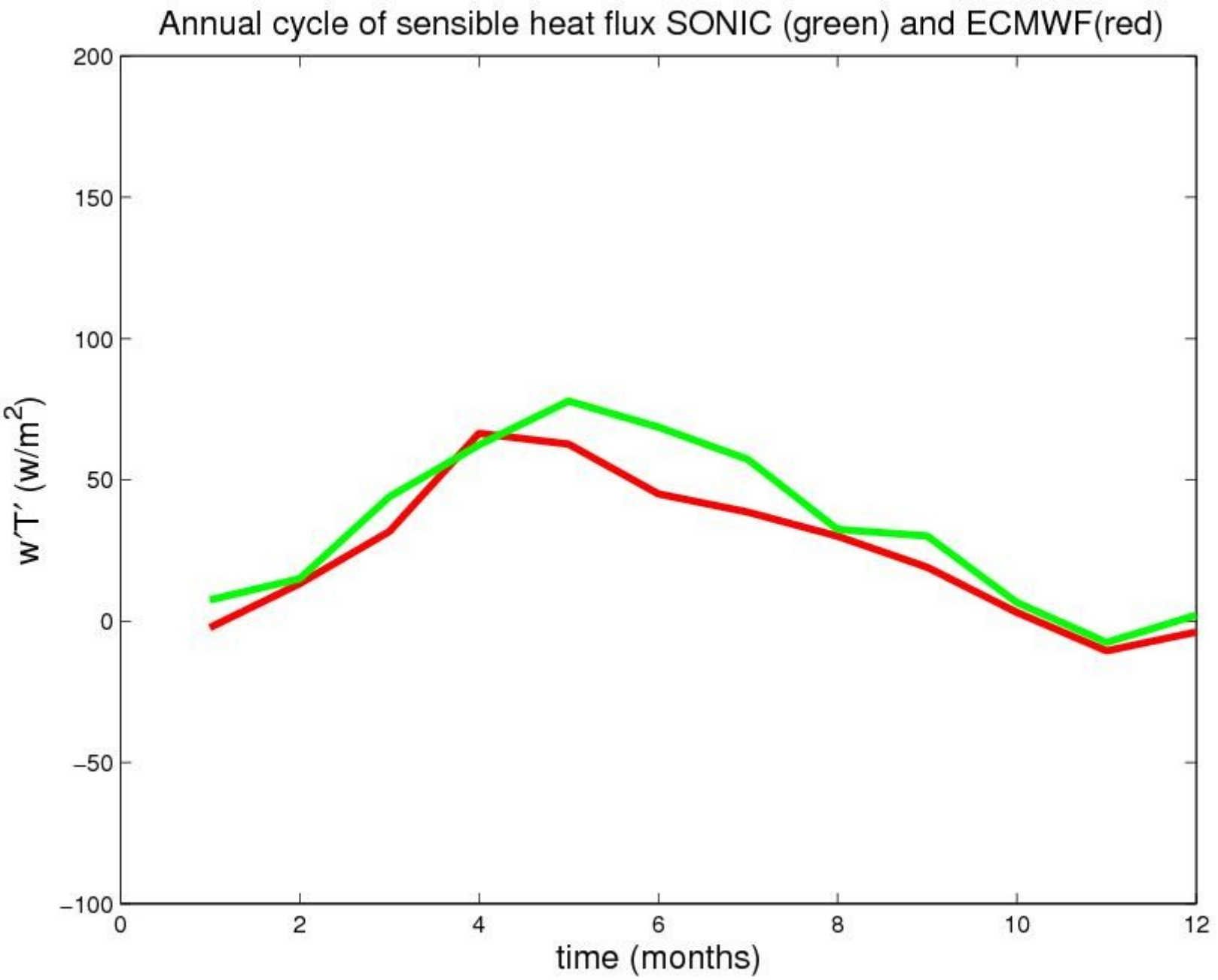
Diurnal cycle of sensible heat flux



Annual cycle of u_*



Annual cycle of sensible heat flux



Conclusions

- There is a systematic over estimation of the momentum flux
- There is a bias in the sensible heat flux diurnal cycle
- In the annual cycle of sensible heat flux, the snow cowered tiles seem to do a better job than the bare soil tiles

Thank you for listening!