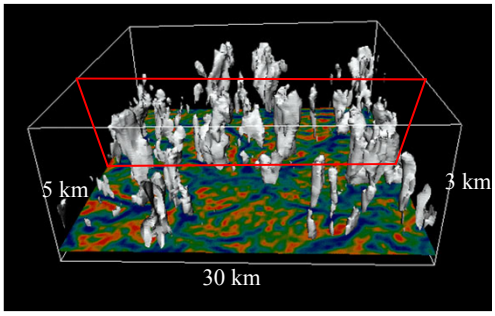
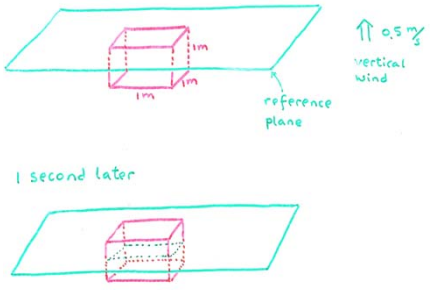
Convection in an unstable atmospheric boundary layer



Source: Moeng, Sullivan and Patton

Eddy covariance: a visual illustration



Principle of eddy covariance

- Reynolds decomposition
  $\varphi = \overline{\varphi} + \varphi'$
- Instantaneous flux = $w\rho$
- Average or Reynolds flux = $\overline{w\rho}$
  $= \overline{w'\rho'} + \overline{w}\,\overline{\rho}$
  $= \overline{w'\rho'}$

Eddy covariance: a numerical example

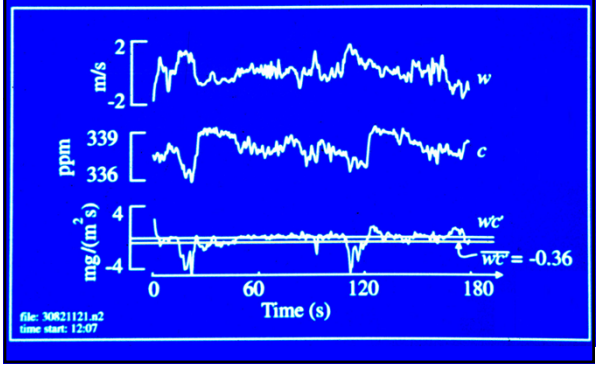
Time	w	ρ_c	ρ_v	w'	ρ_c'	ρ_v'	$w'\rho_c'$	$w'\rho_v'$
s	m/s	mg/m³	g/m³	m/s	mg/m³	g/m³	mg/(m²s)	g/(m²s)
0.0	0.5	670	10.2	0.5	-1	0.2	-0.5	0.10
0.1	-0.5	672	9.8	-0.5	1	-0.2	-0.5	0.10
0.2	0.5	668	10.3	0.5	-3	0.3	-1.5	0.15
0.3	-0.5	674	9.7	-0.5	3	-0.3	-1.5	0.15
Total	0.0	2684	40.0				-4.0	0.50
Average	0.0	671	10.0				-1.0	0.125

CO_2 flux $F_c = \overline{w'\rho_c'}$ = -1.0 mg $m^{-2}s^{-1}$

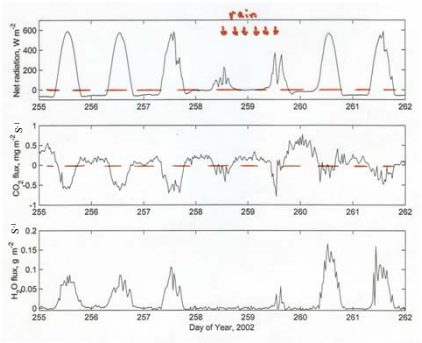
Water vapor flux $E = \overline{w'\rho_v'}$ = 0.125 g $m^{-2}s^{-1}$

Water use efficiency WUE = 0.8%

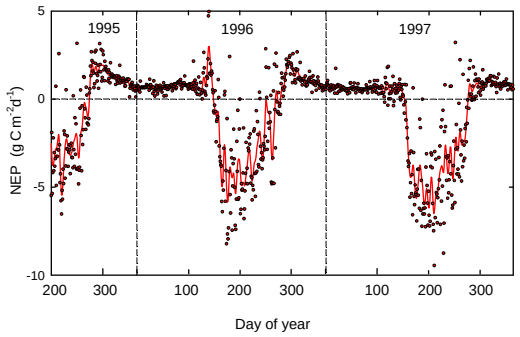
Eddy covariance



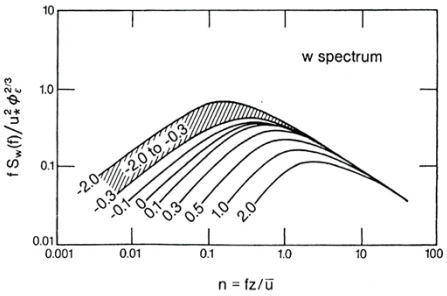
Great Mountain Sept 12-18, 2002



Net Ecosystem Production
Maple-Aspen Forest, Camp Borden, Ontario



Normalized surface layer *w* spectrum



Source: Kaimal and Finnigan

Eddy flux footprint