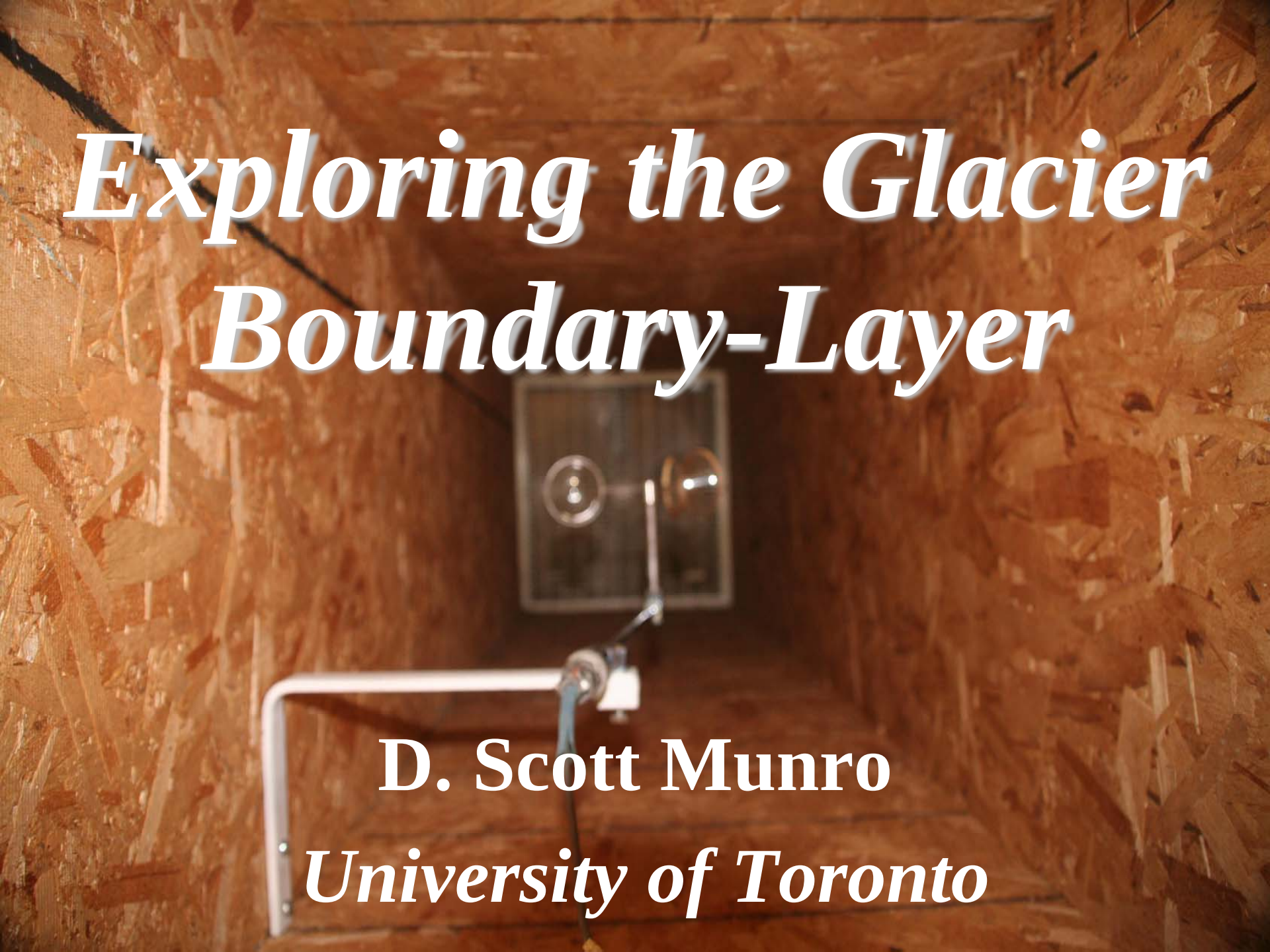
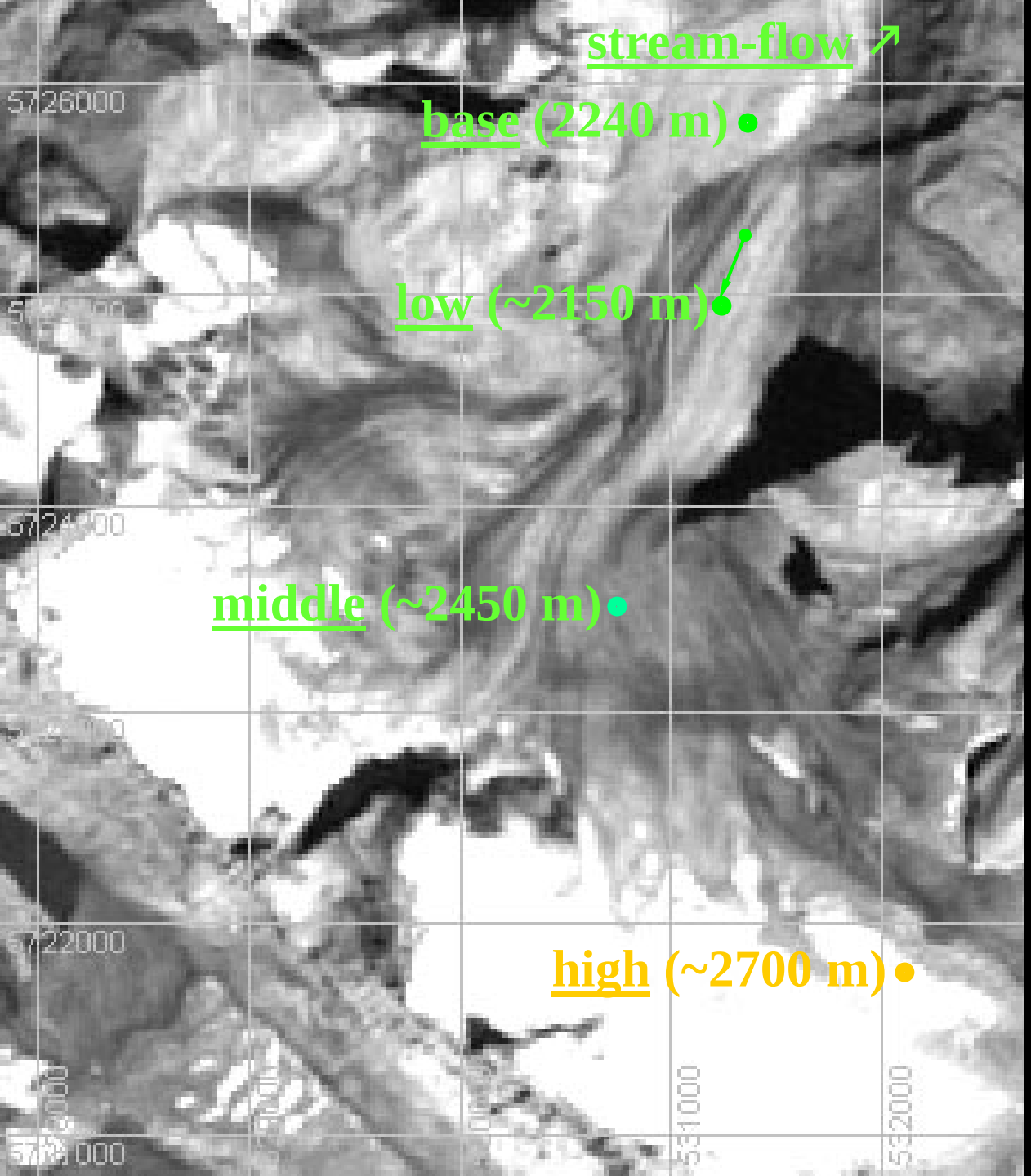


Exploring the Glacier Boundary-Layer

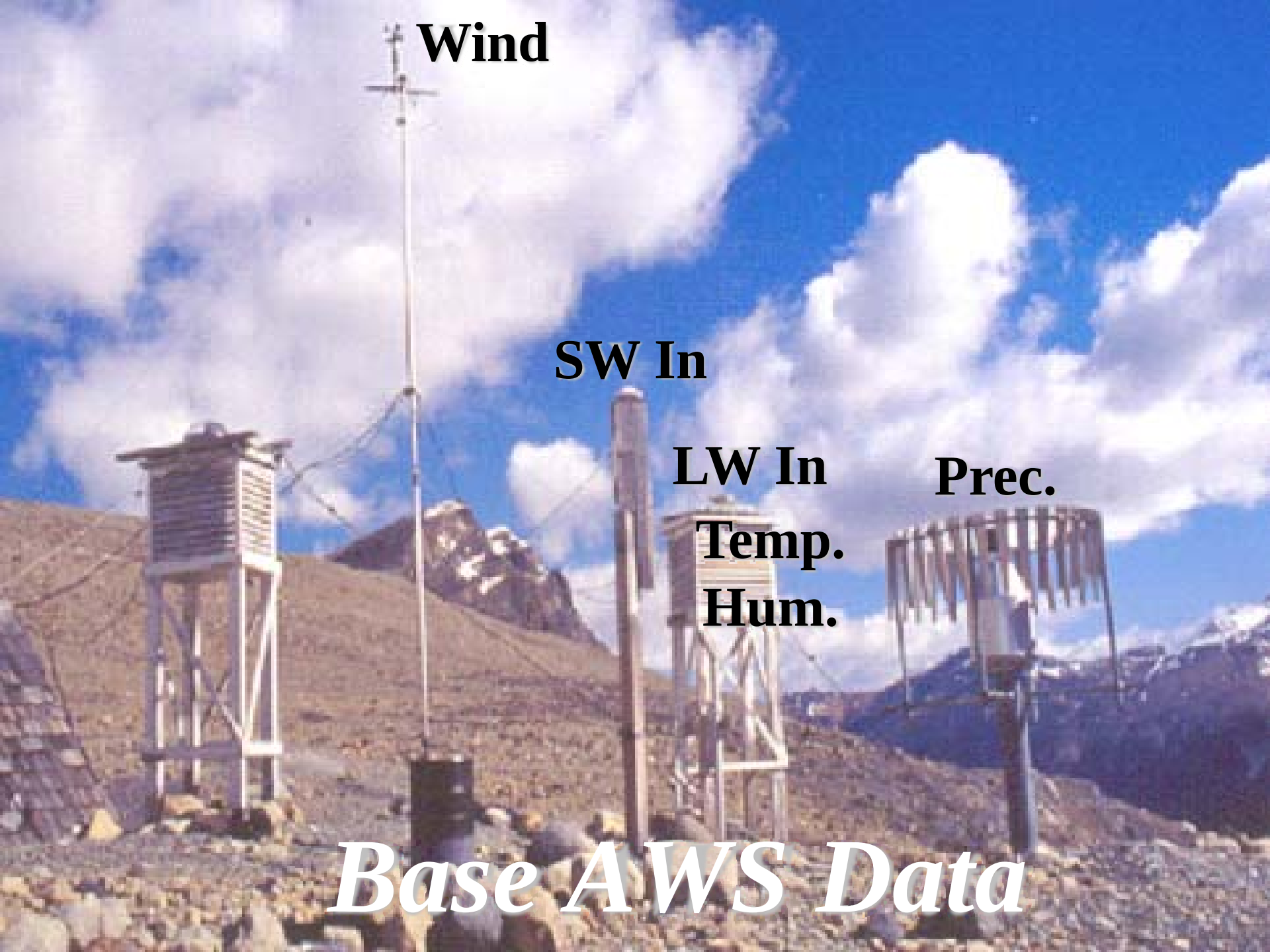
D. Scott Munro

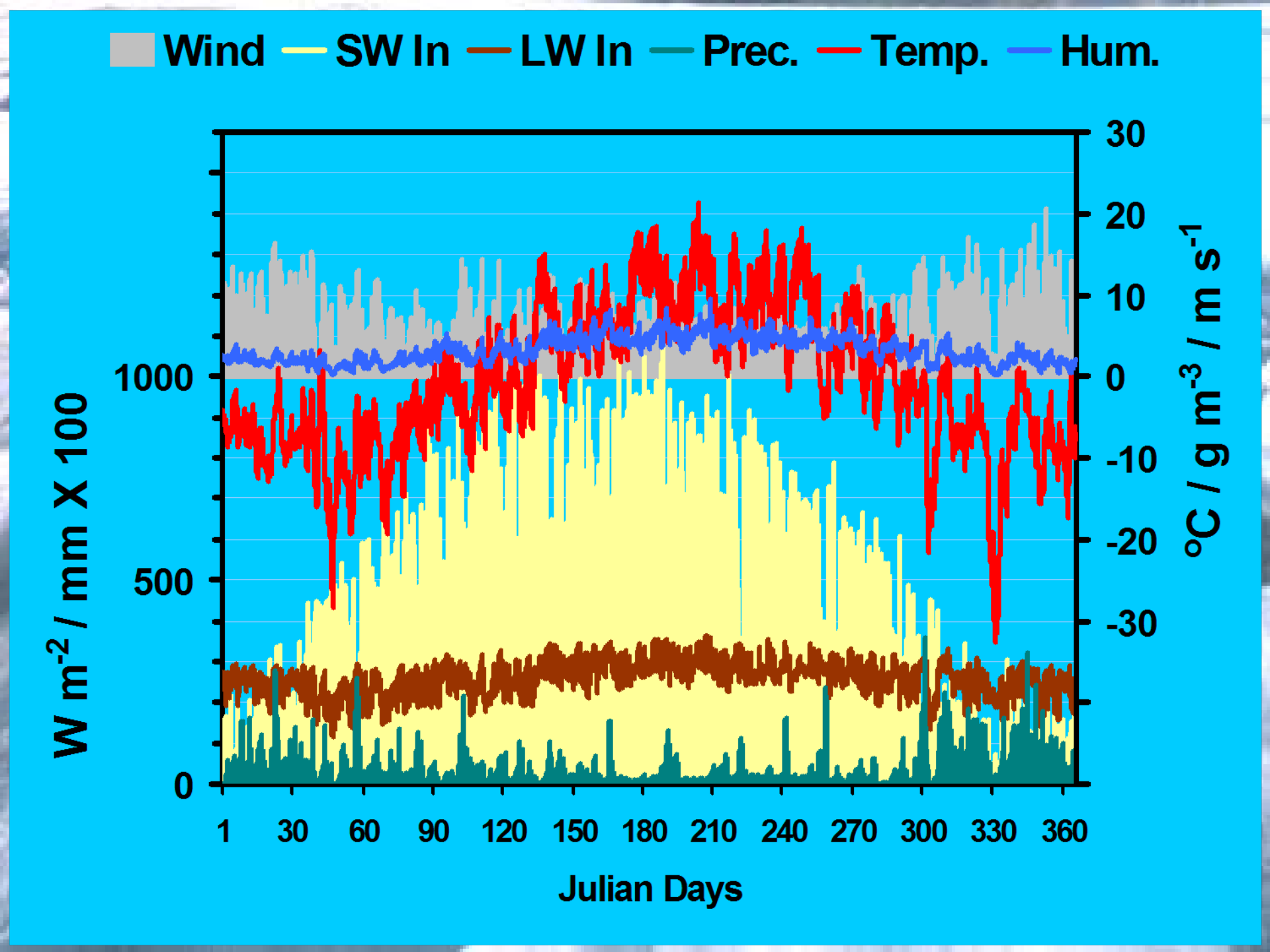
University of Toronto



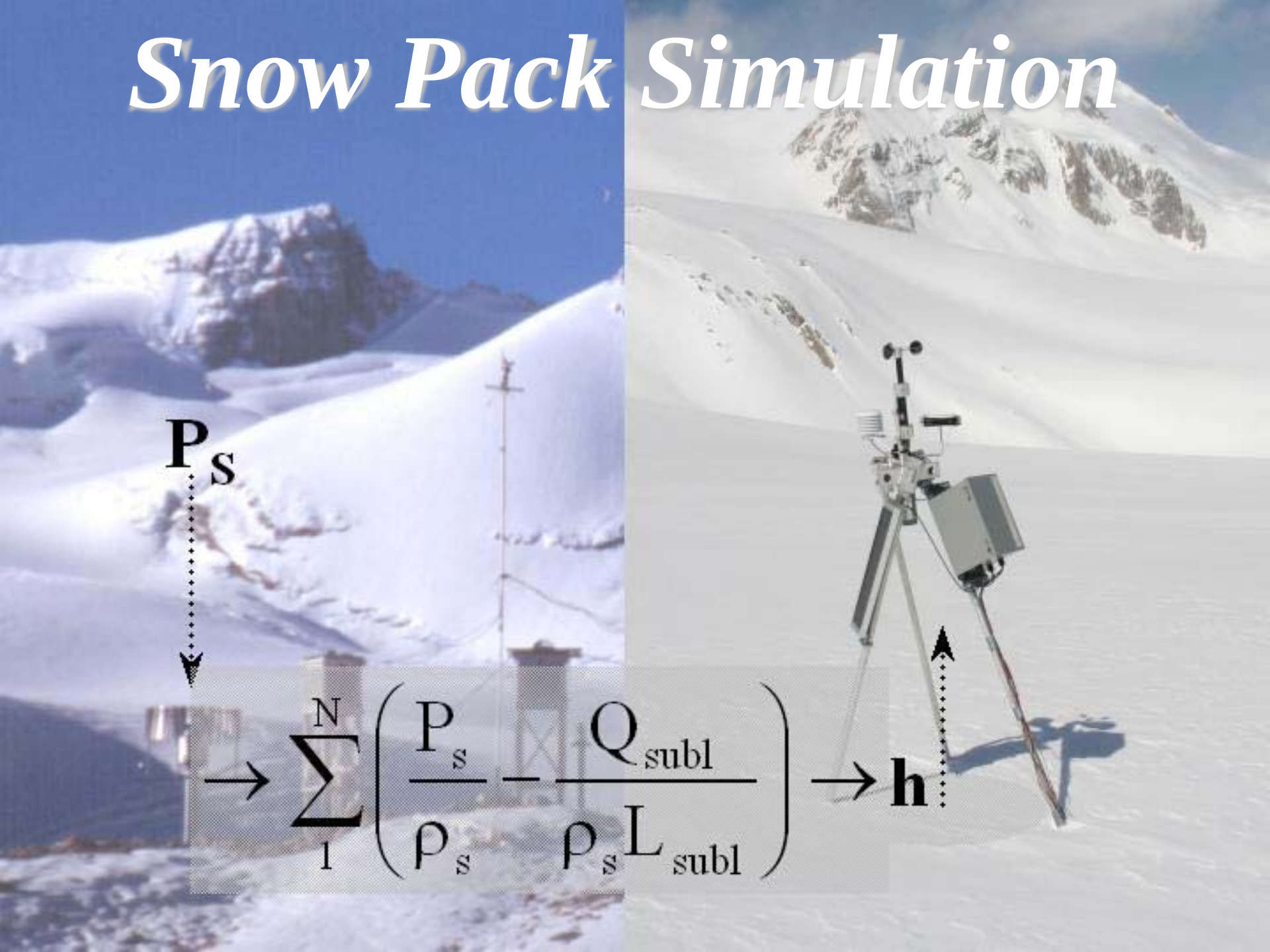
AWS Status

- Point ***process*** investigation
- Spatial distribution tools (DEM, trigonometry, ***parameterization***)
- Distributed modelling and ***prediction***
- Base AWS/RCM forcing

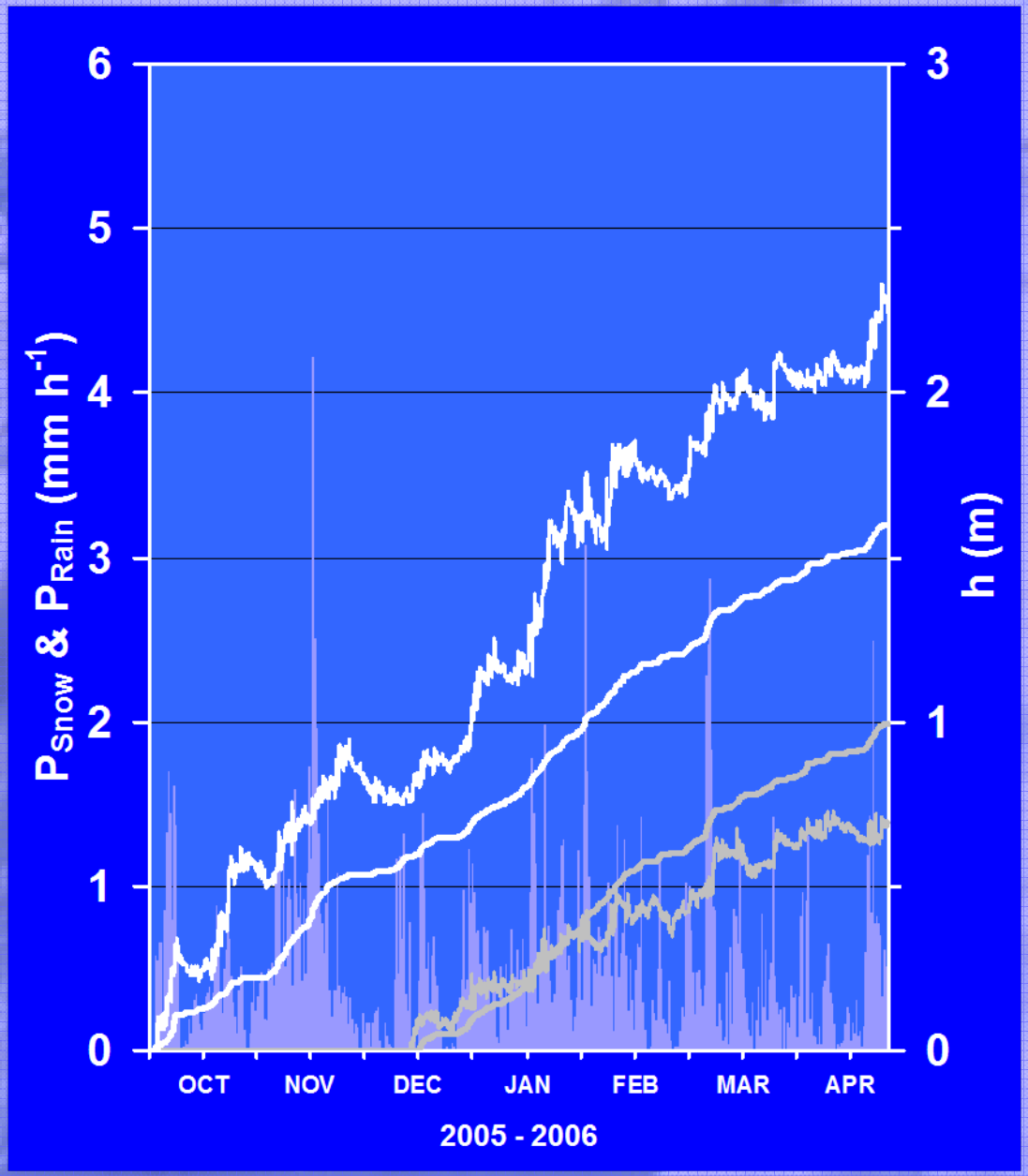

Wind
SW In
LW In
Temp.
Hum.
Prec.
Base AWS Data


Wind
SW In
LW In
Prec.
Temp.
Hum.
W m-2 / mm X 100
°C / g m-3 / m s-1
0
500
1000
30
20
10
0
-10
-20
-30
1
30
60
90
120
150
180
210
240
270
300
330
360
Julian Days

Snow Pack Simulation

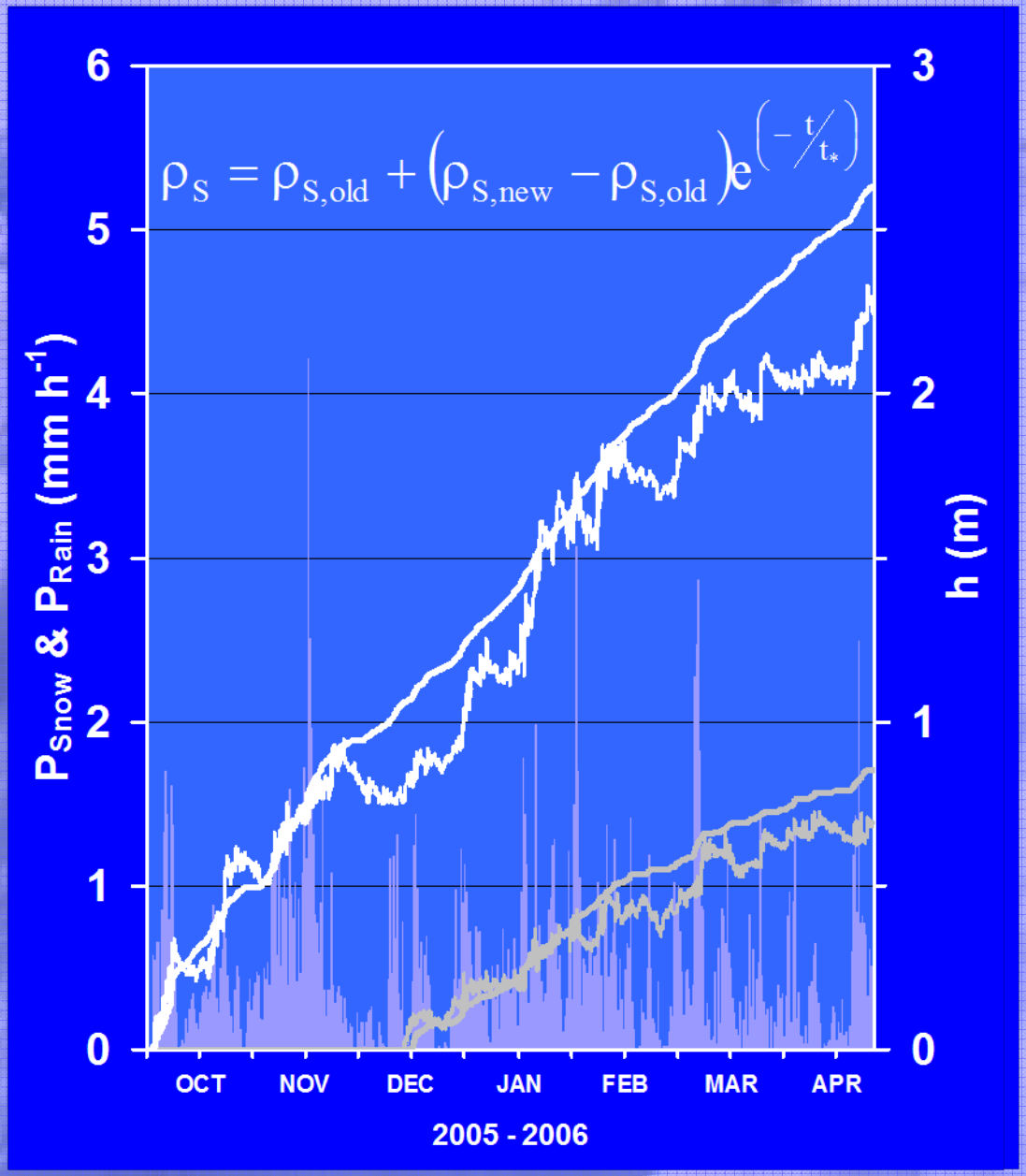


Snow Pack Simulation



- 1.5 °C threshold for P_S, using NLR adjusted base T_a; initial ρ_S = 350 kg m^{-3}
- $P_S = P_{S,base} + \beta\Delta Z$; by equalizing relative MBE for sites, β is optimized to 0.434 mm m^{-1}
- snow density aging model: $\rho_{S,new}$ = 180 kg m^{-3}; $\rho_{S,old}$ = 400 kg m^{-3}; t* = 21.9 days

Snow Pack Simulation



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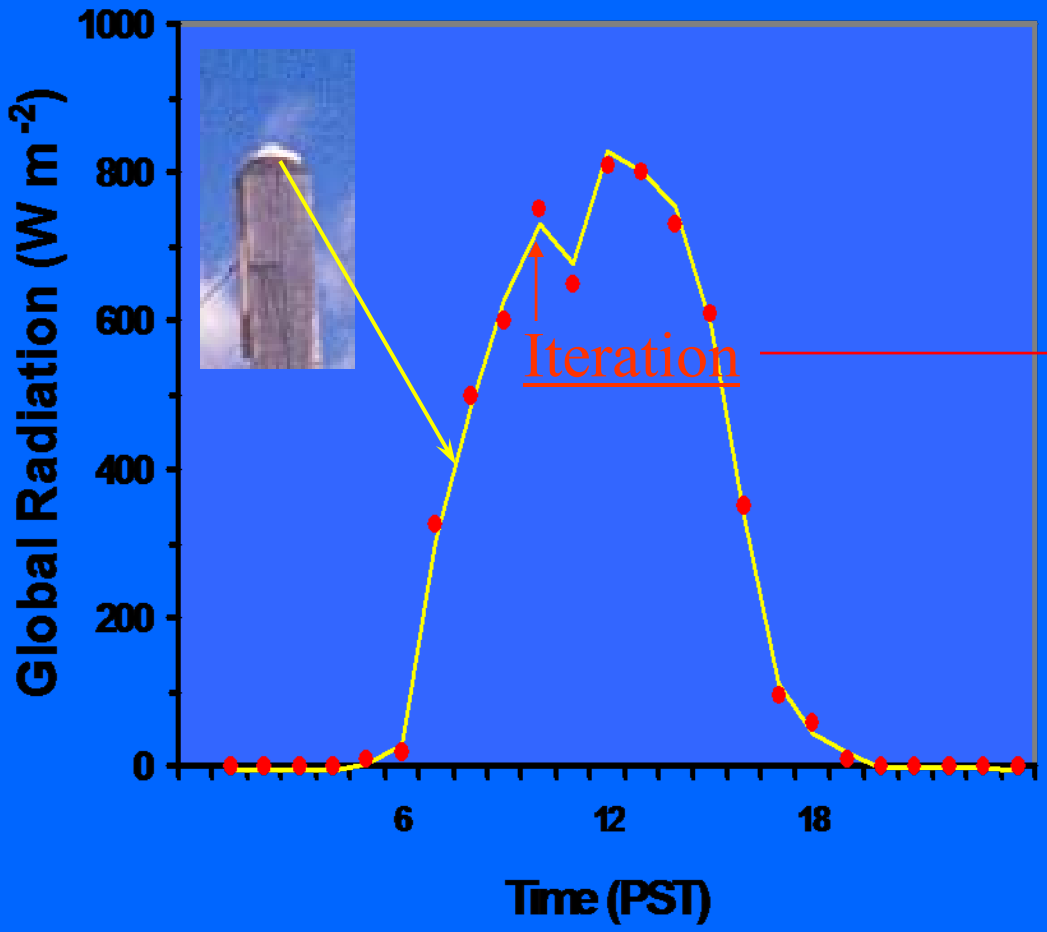
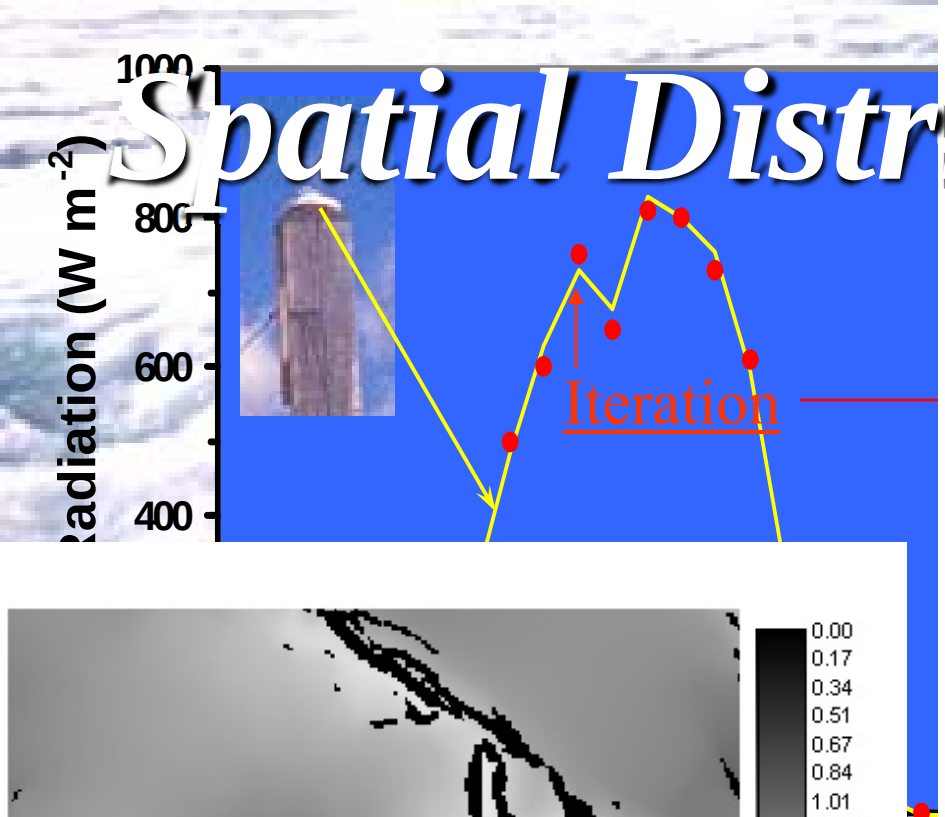
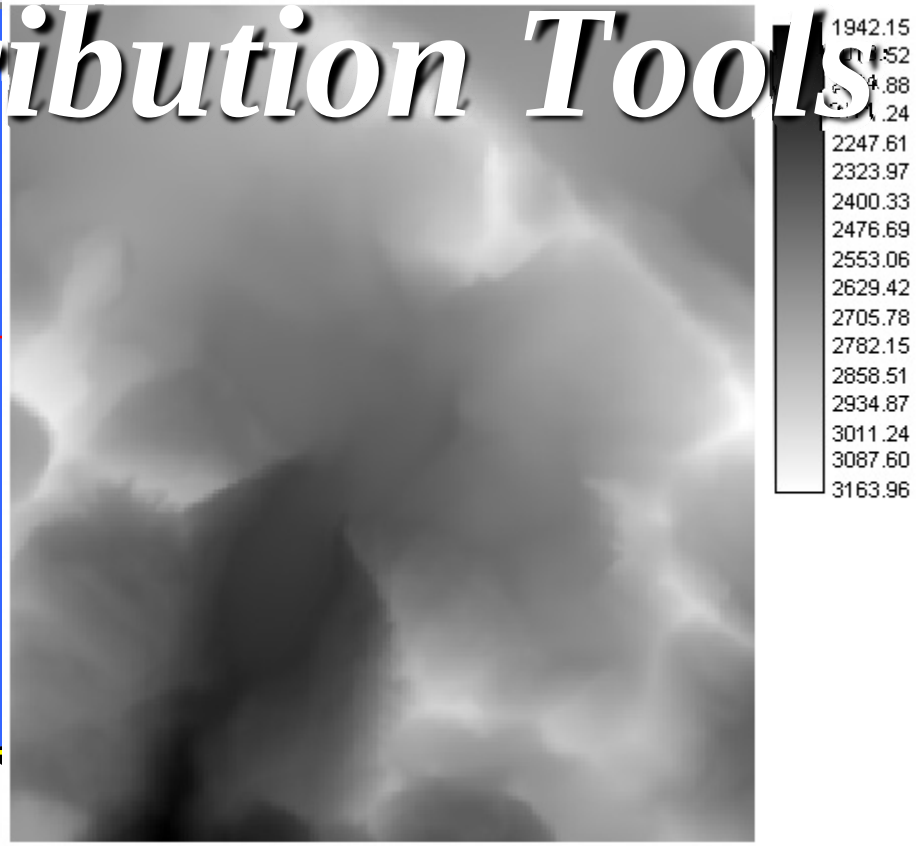
- snow density aging model: $\rho_{S,new}$ = 180 kg m^{-3}; $\rho_{S,old}$ = 400 kg m^{-3}; t* = 21.9 days
- end closure possible by increasing $\rho_{S,old}$: but, what is Q_{subl} from snow and blowing snow?

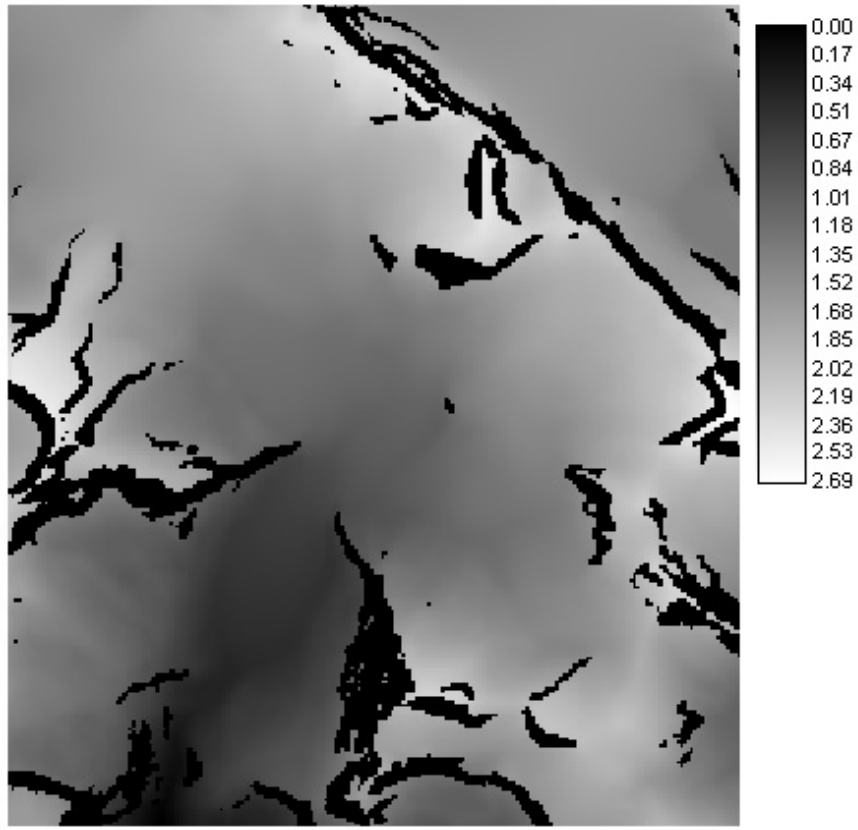


$$\delta M = P_S + \frac{K\downarrow(1-\alpha_S) + L_* + Q_H + Q_E}{L_f}$$

Spatial Distribution Tools

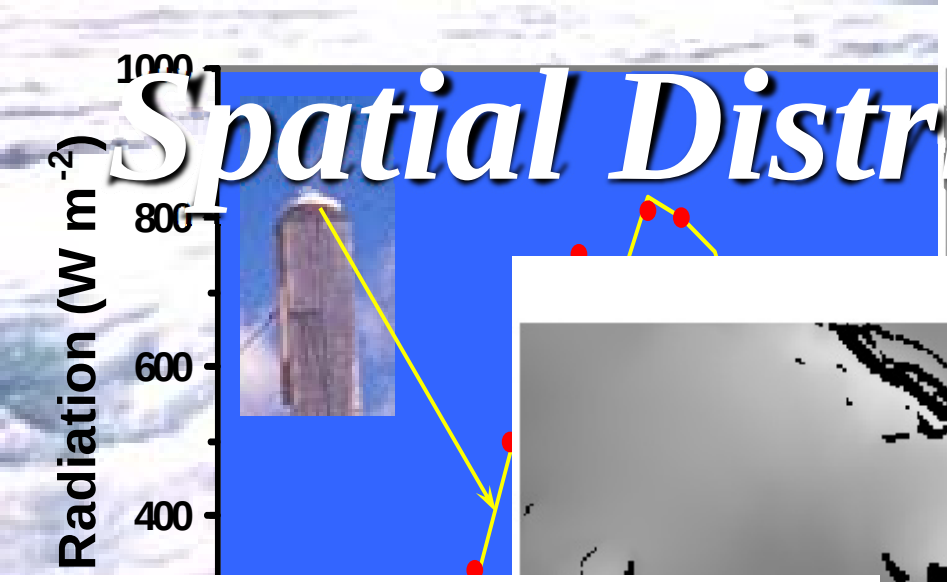


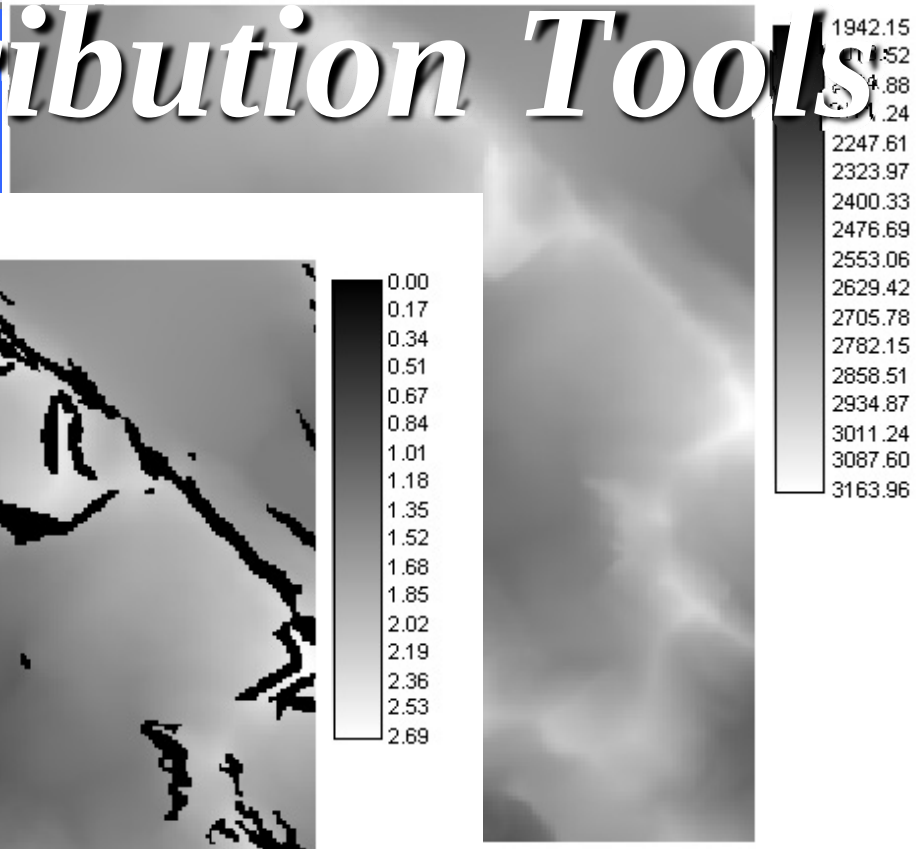


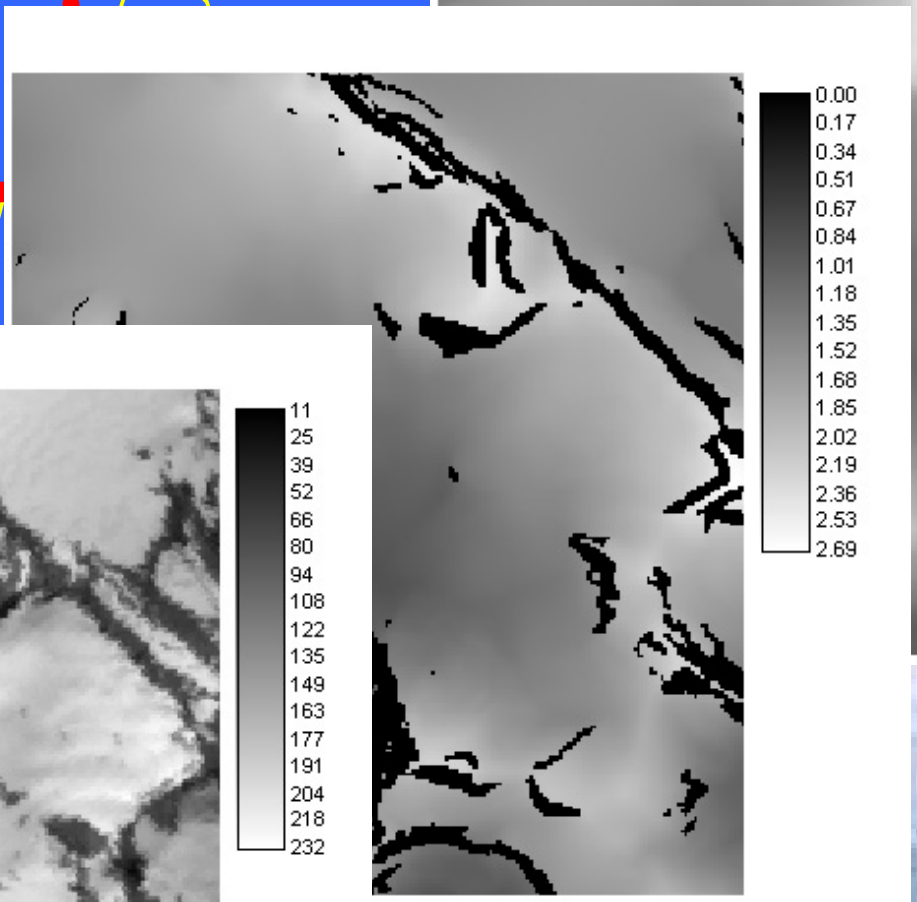


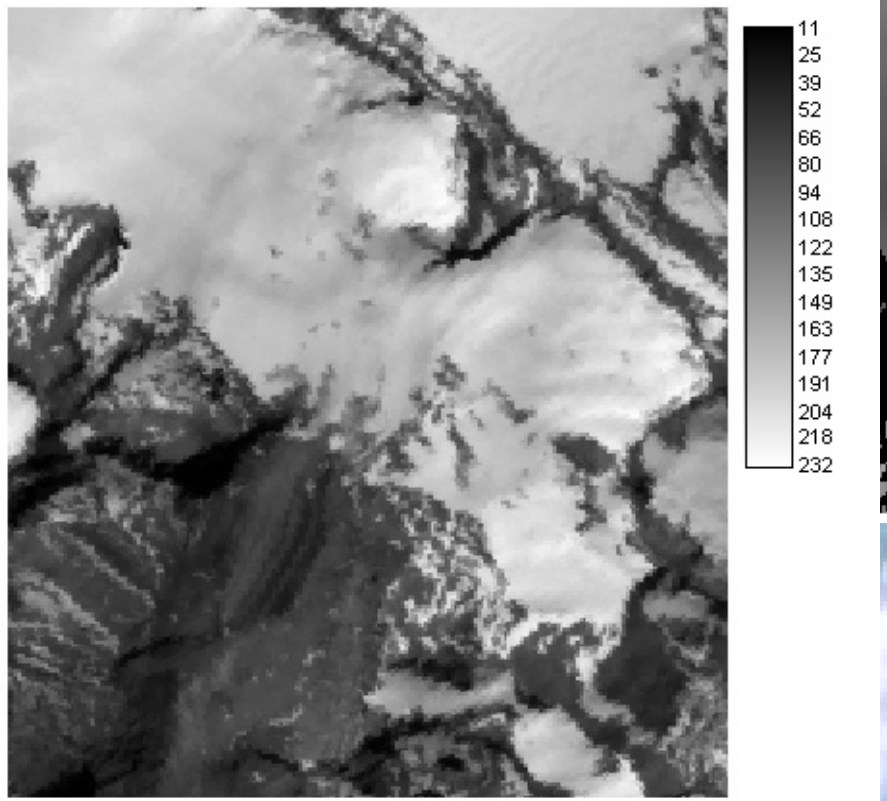
$$\delta M = P_S + \frac{K\downarrow(1-\alpha_S) + L_* + Q_H + Q_E}{L_f}$$

Spatial Distribution Tools



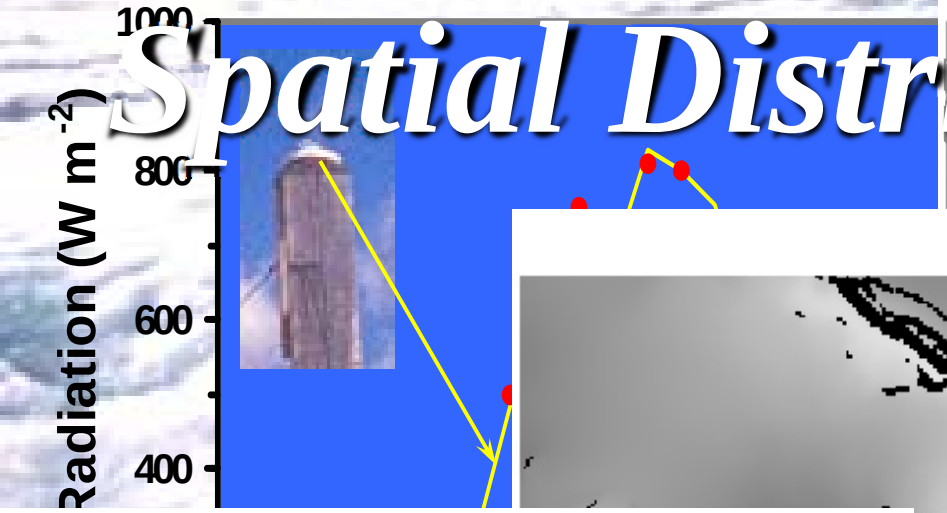


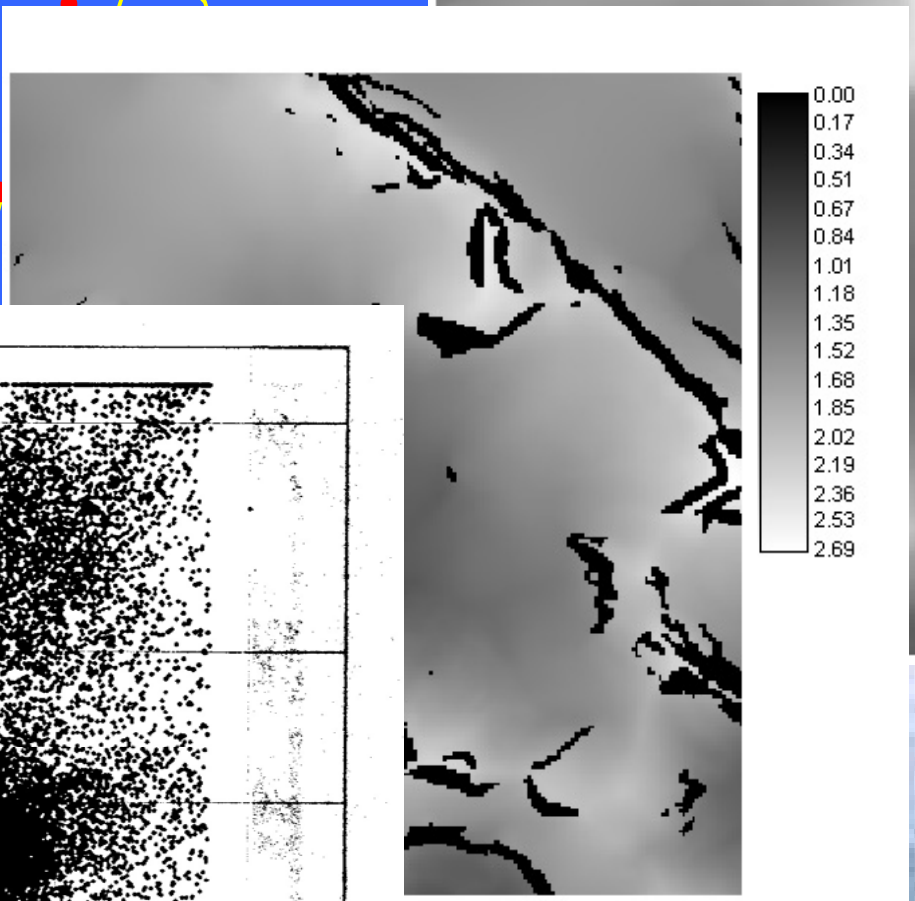


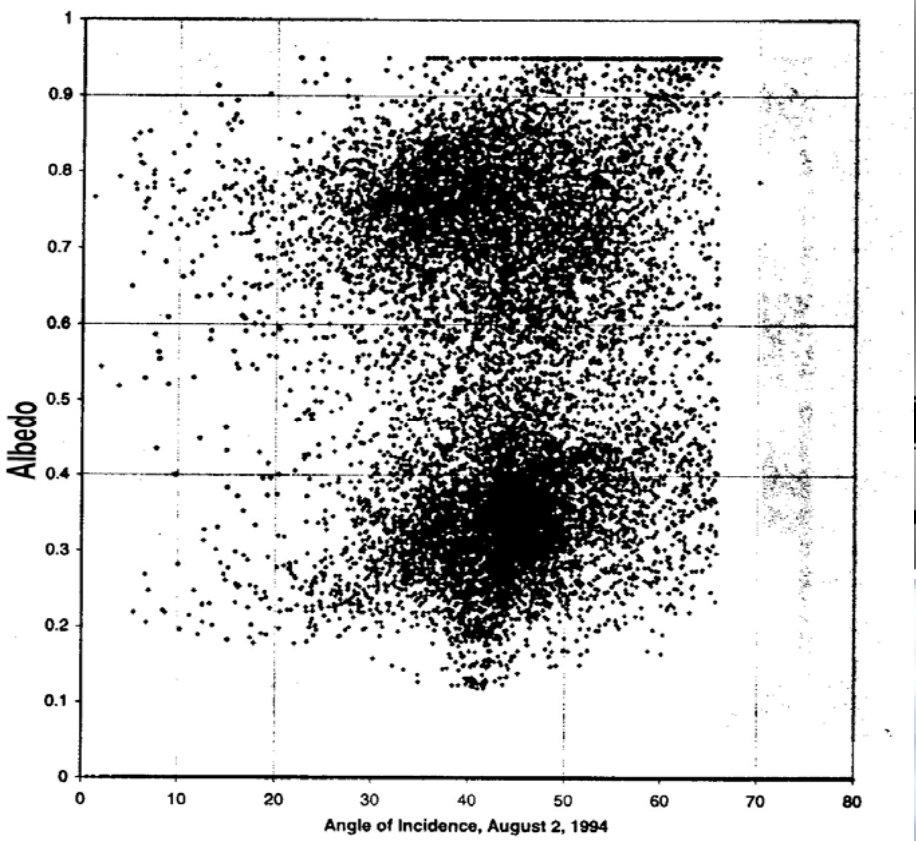


$$\delta M = P_S + \frac{K\downarrow(1-\alpha_S) + L_* + Q_H + Q_E}{L_f}$$

Spatial Distribution Tools







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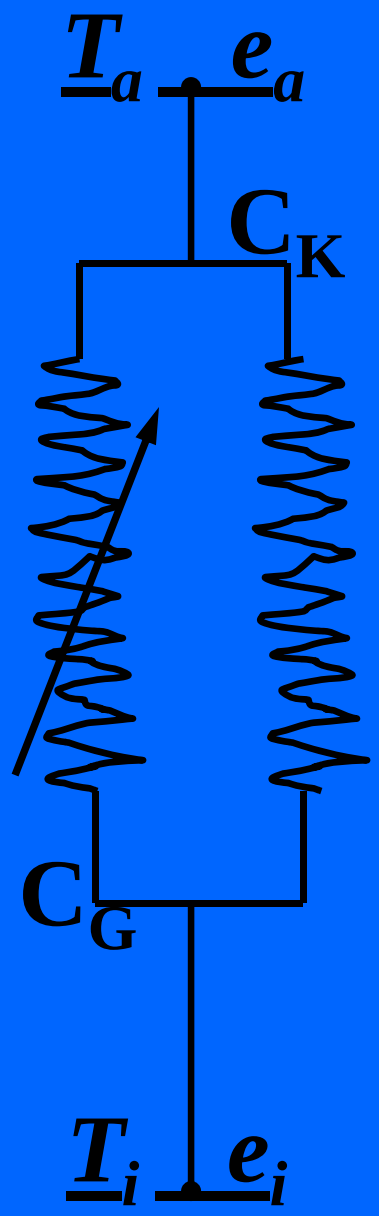
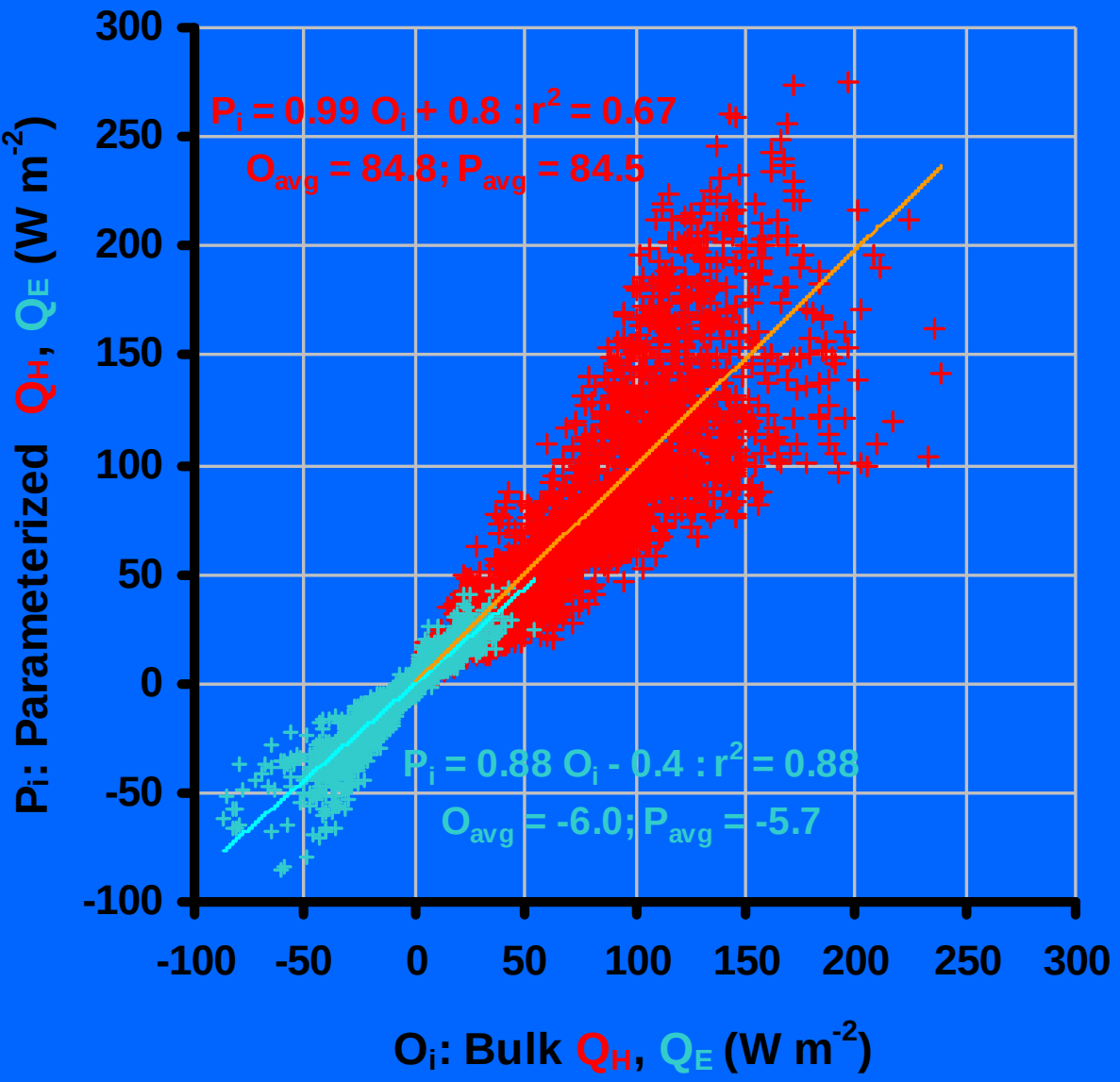
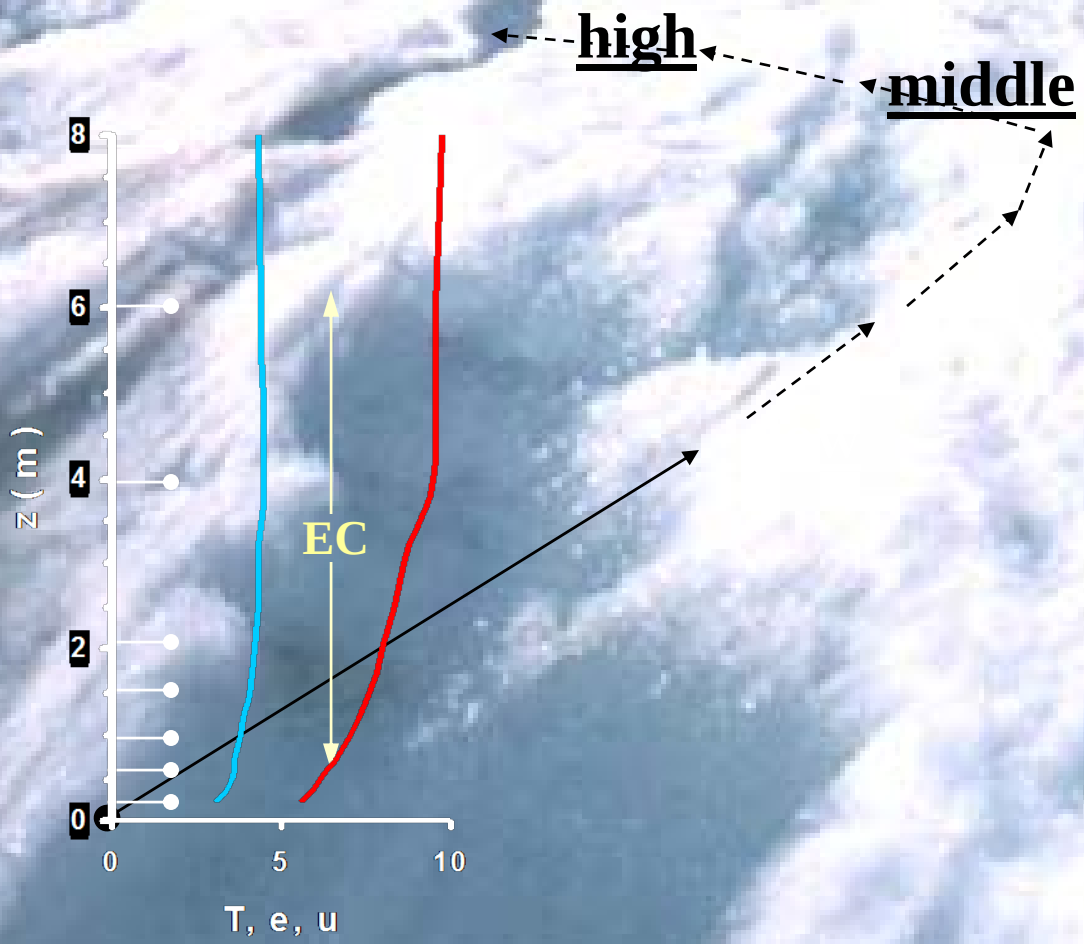
B-L Parameterization



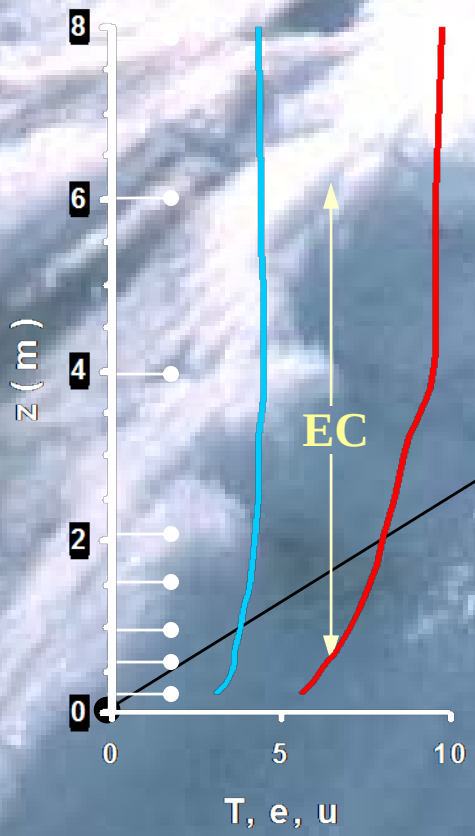
(Oerlemans & Grisogono, 2002)

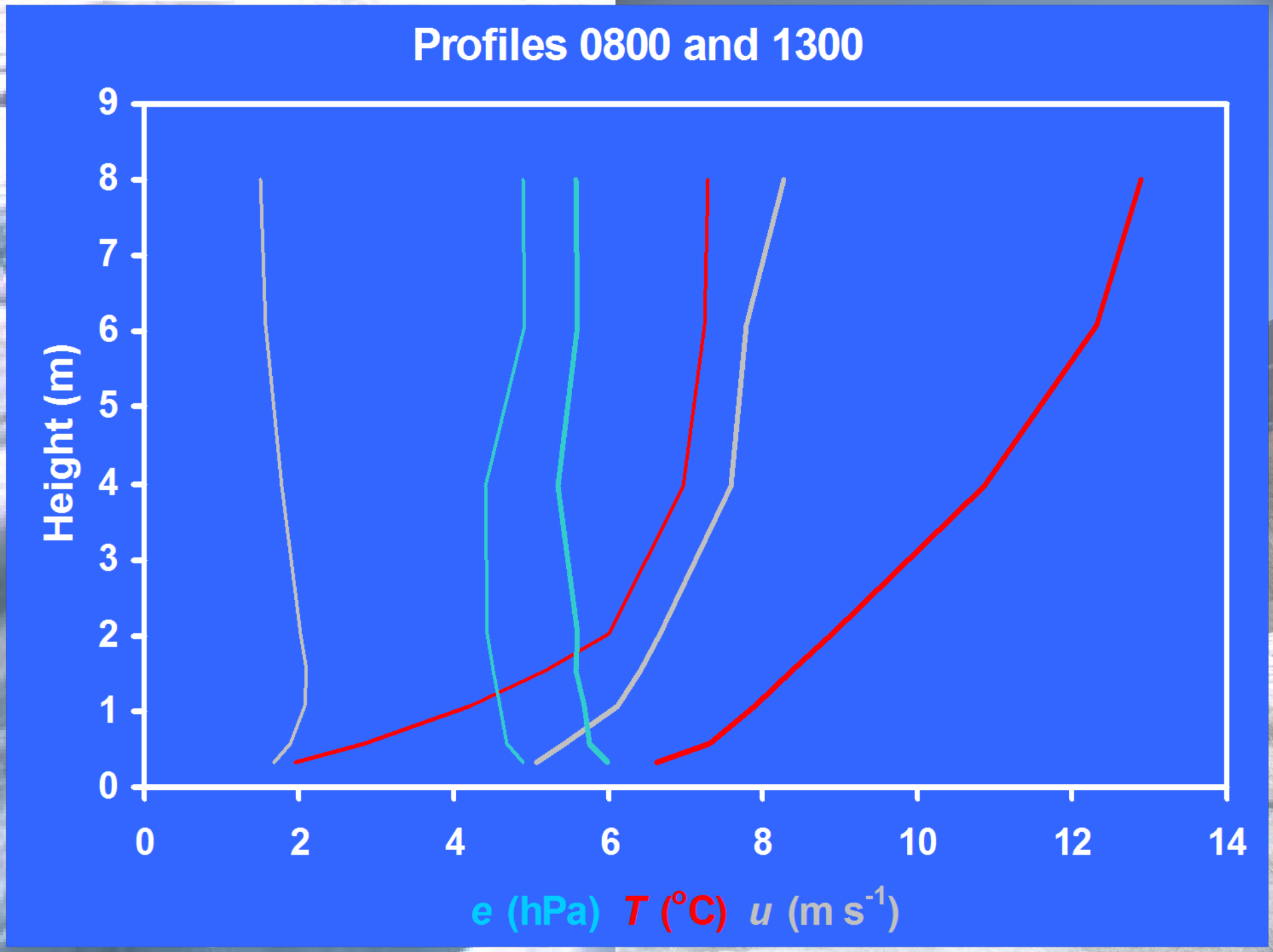


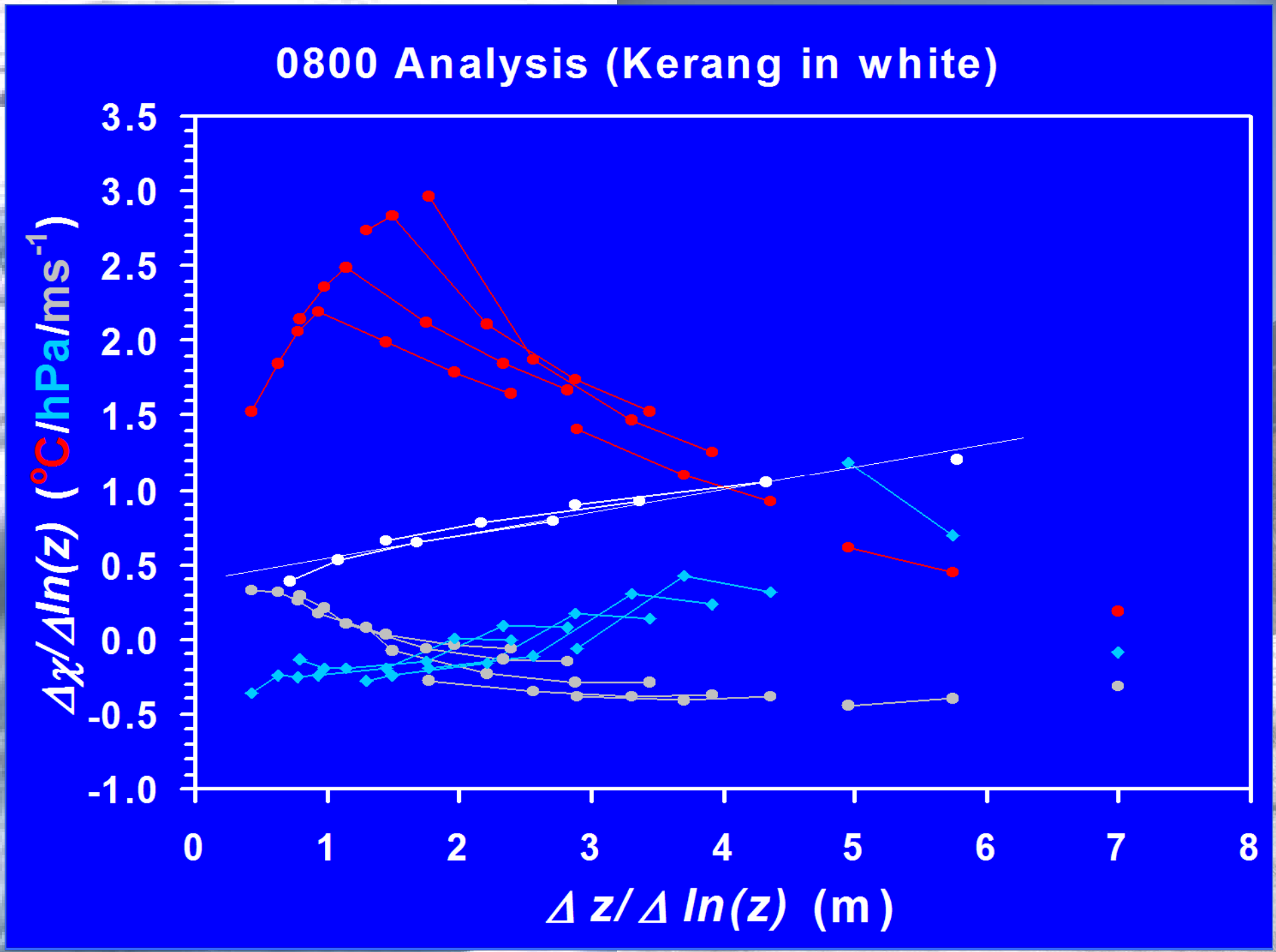
August 2007 Profiles

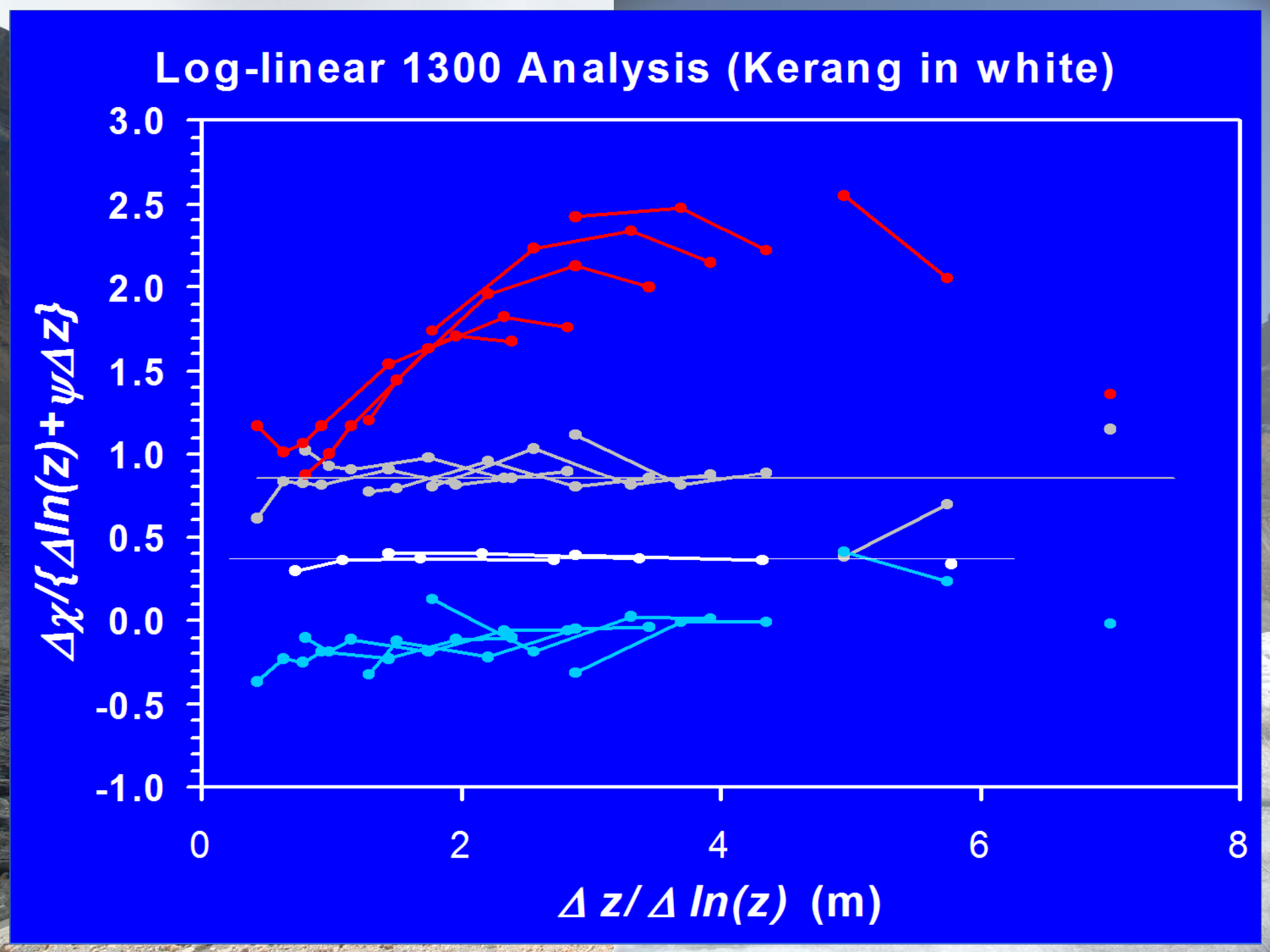


August 2007 Profiles

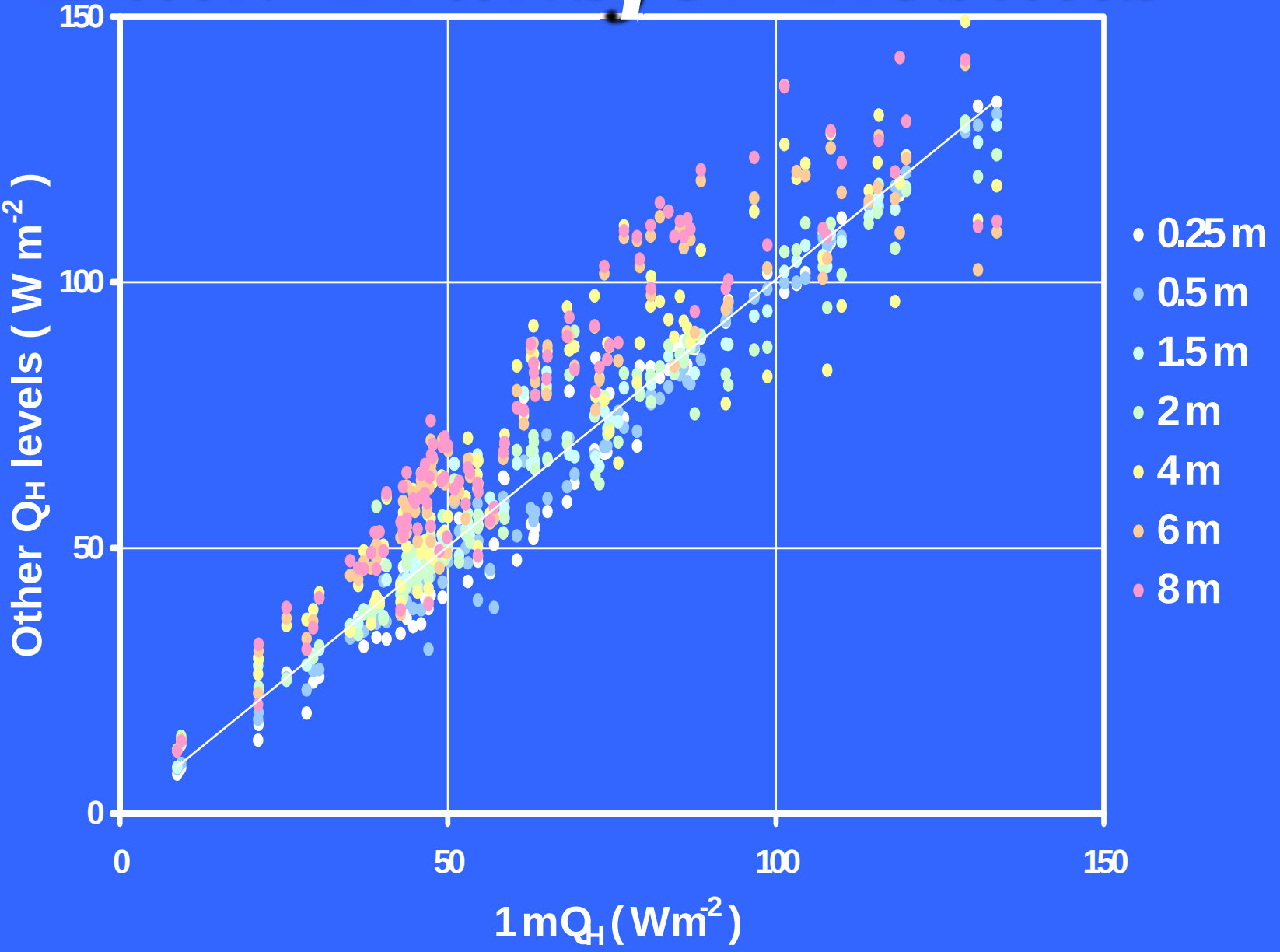



Profiles 0800 and 1300
Height (m)
0
1
2
3
4
5
6
7
8
9
0
2
4
6
8
10
12
14
e (hPa)
T (°C)
u (m s-1)

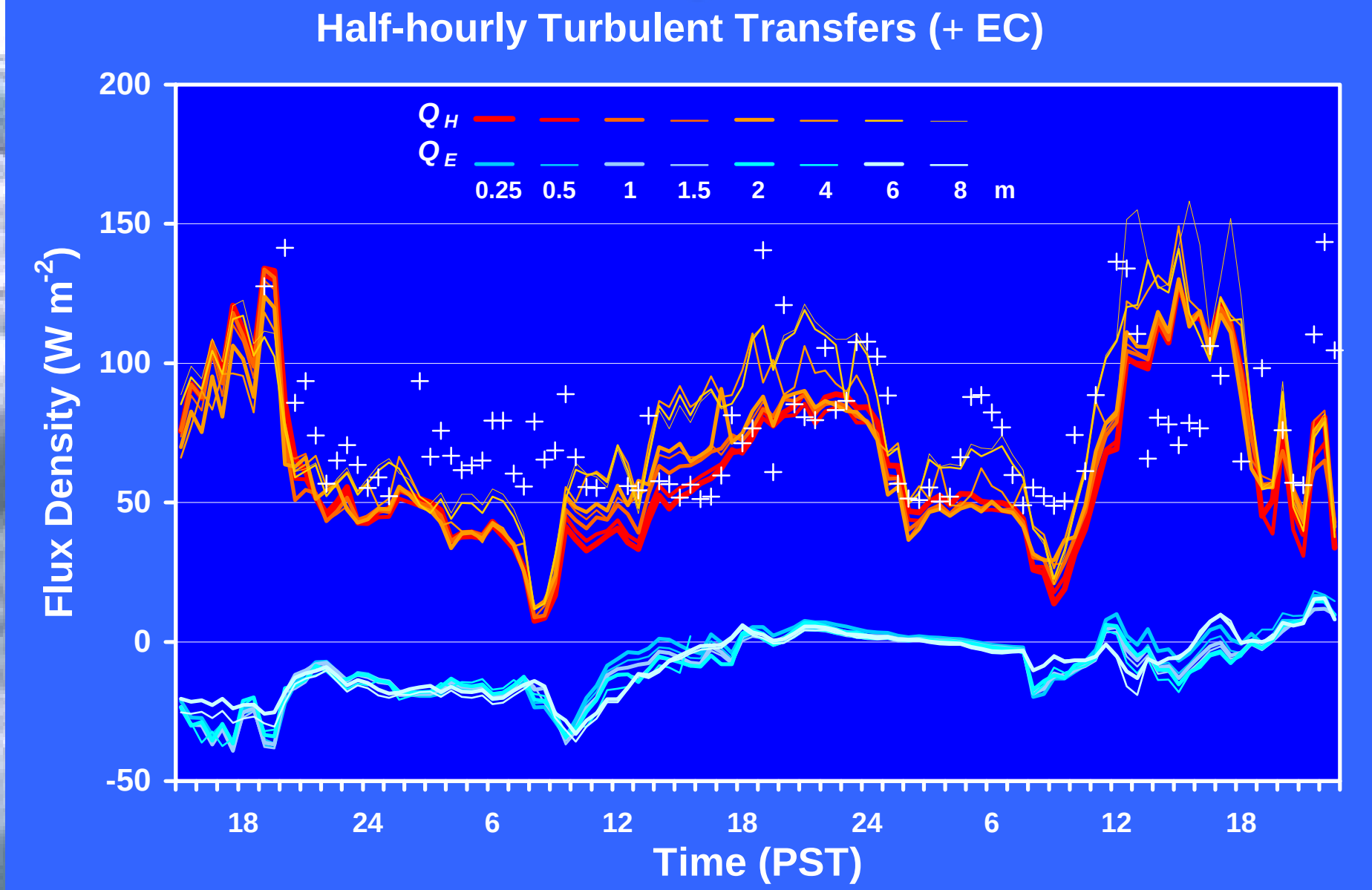

0800 Analysis (Kerang in white)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Δχ/Δln(z) (°C/hPa/ms-1)
0
1
2
3
4
5
6
7
8
Δ z/ Δ ln(z) (m)


Log-linear 1300 Analysis (Kerang in white)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Δχ/{ΔIn(z)+ψΔz}
0
2
4
6
8
Δ z/ Δ In(z) (m)

Bulk Transfer Results

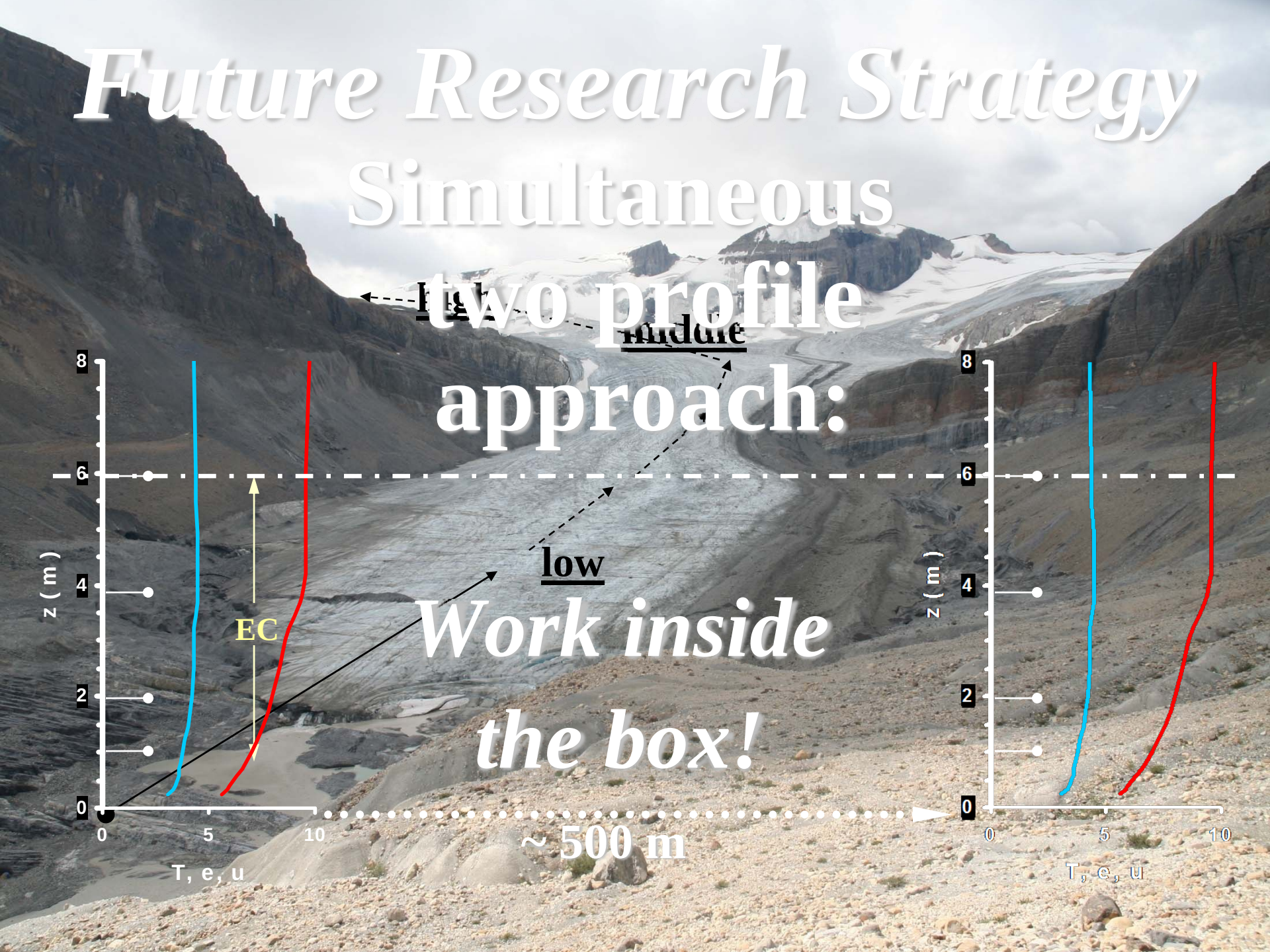


Bulk Transfer Results



Future Research Strategy

Simultaneous two profile approach:



Work inside the box!

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Geological Survey Canada ⇢ Glacier-Climate Obs. Sys.

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