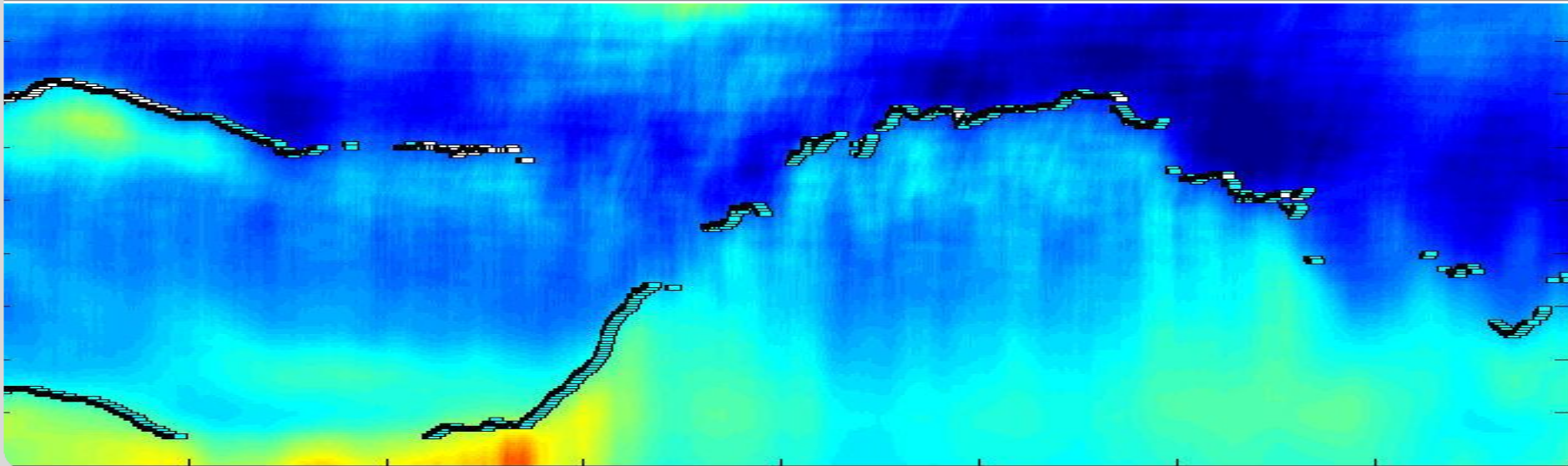


Measured (by SODAR) vertical profiles of Weibull parameters over a hill

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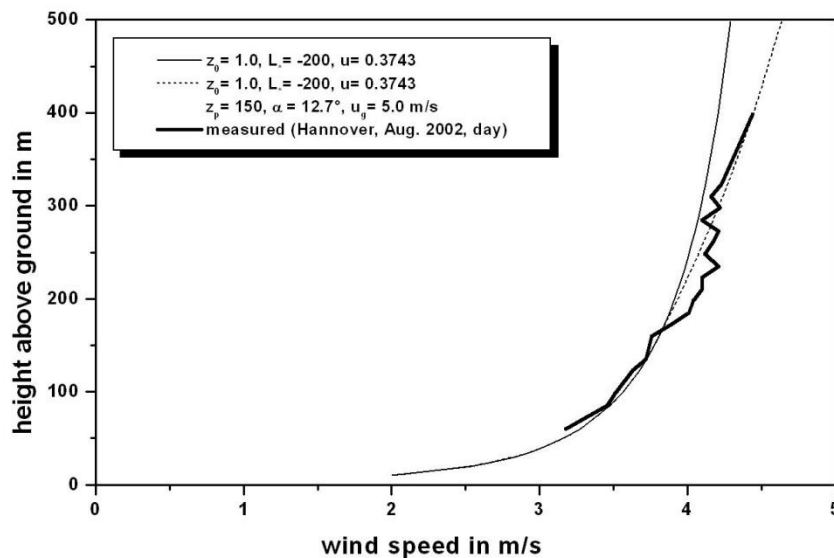


Flat terrain

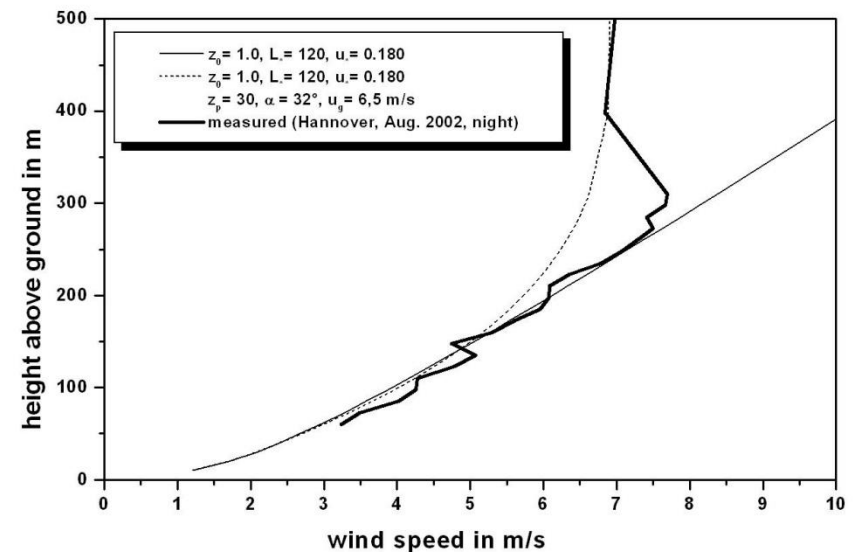
For comparison:

flat homogeneous terrain

wind profiles (SODAR data)



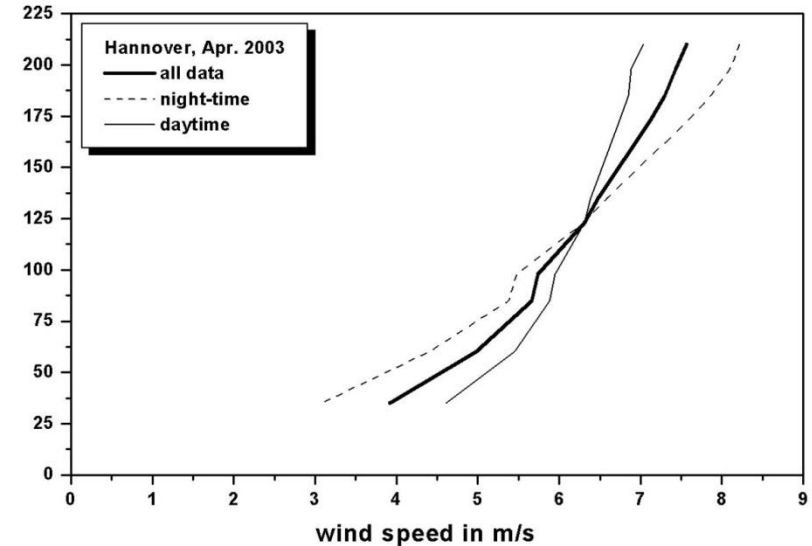
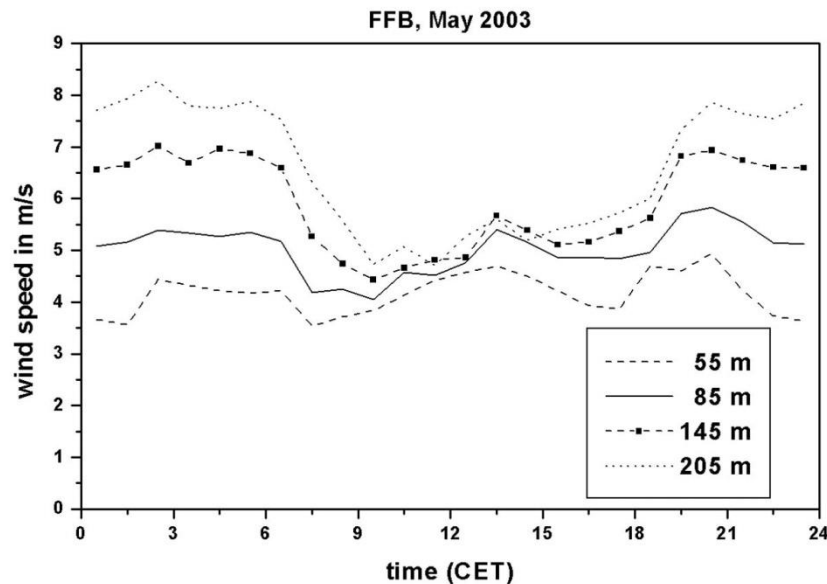
daytime, convective



nocturnal, with low-level jet

For comparison:

flat homogeneous terrain (SODAR data)

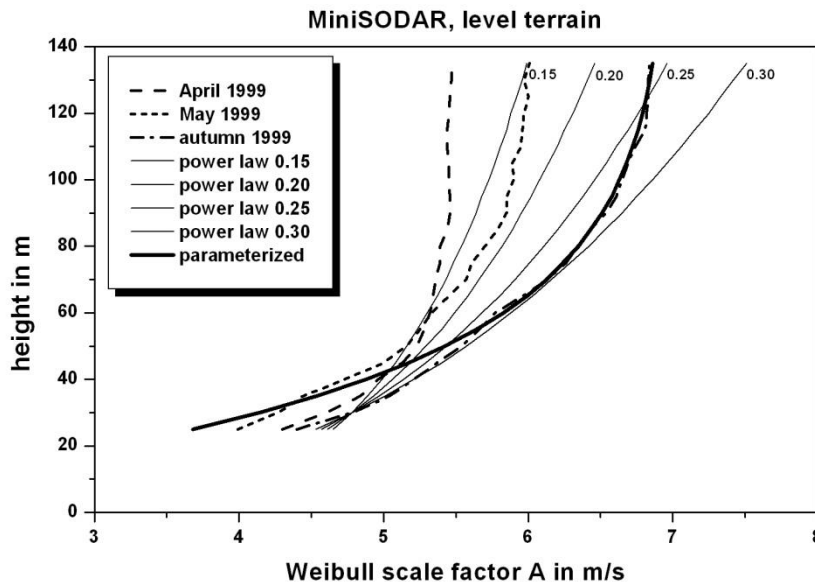


diurnal wind variation in four heights

cross-over of daytime and nocturnal wind profiles

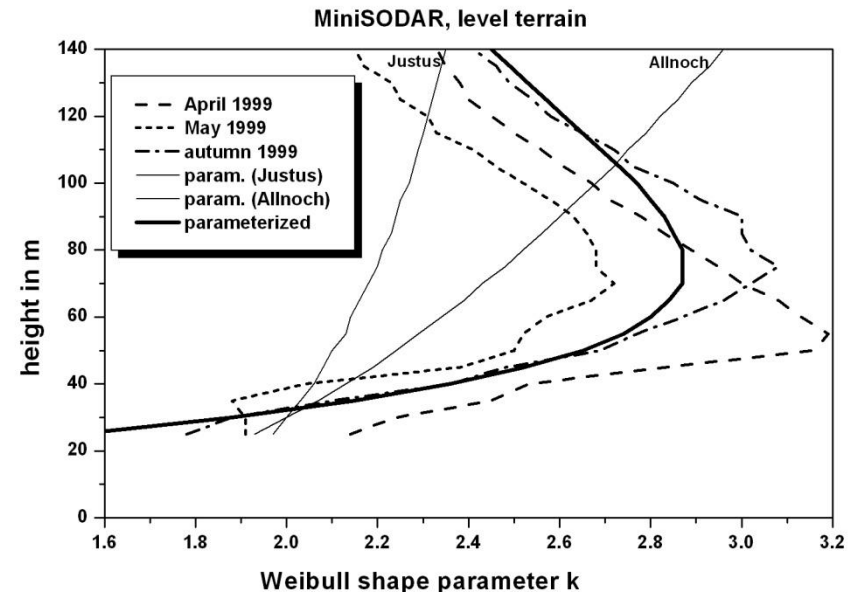
For comparison:

flat homogeneous terrain (SODAR data and empirical relations)



Weibull scale parameter
($A_0 = 6.98 \text{ m/s}$, $\gamma = 0.03$)

$$A(z) = A_0 \left(1 - e^{-\gamma z}\right)$$



Weibull form parameter
($z_A = 10 \text{ m}$, $z_m = 75 \text{ m}$, $c_2 = 0.06$)

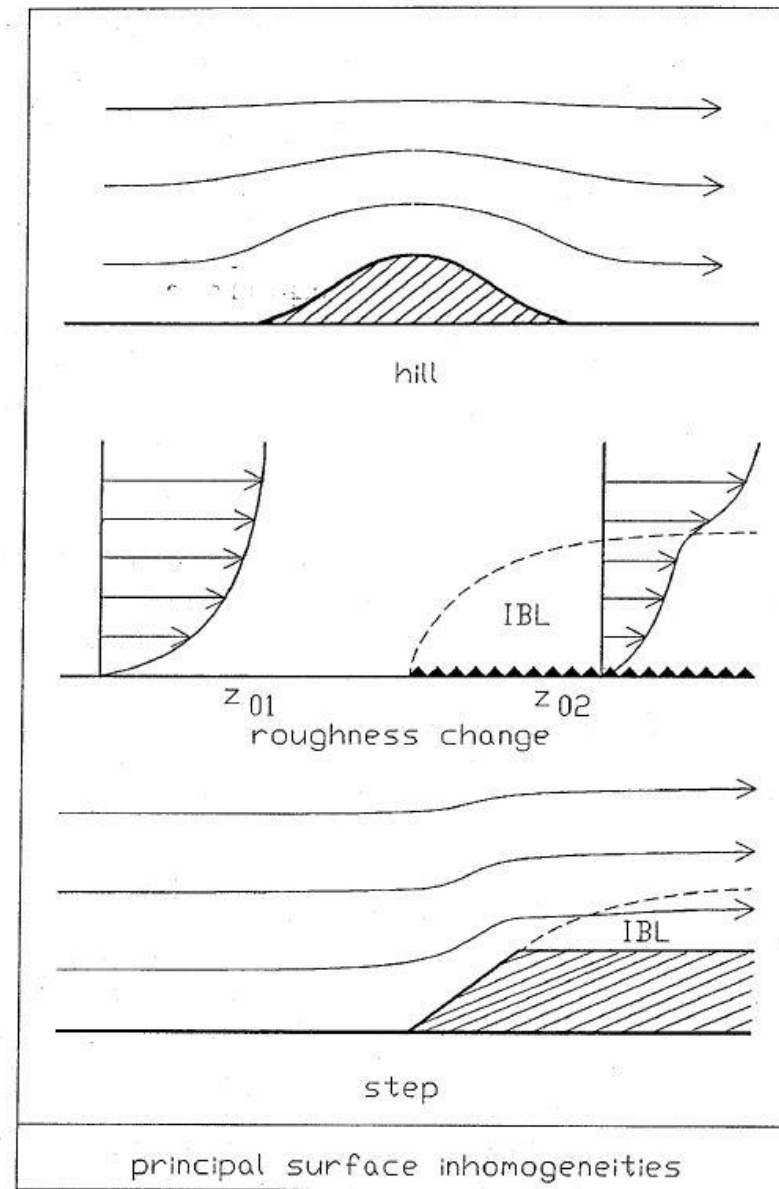
$$k(z) - k_A = c_2 (z - z_A) \exp\left(-\frac{z - z_A}{z_m - z_A}\right)$$

following Wieringa (1988)

Complex terrain

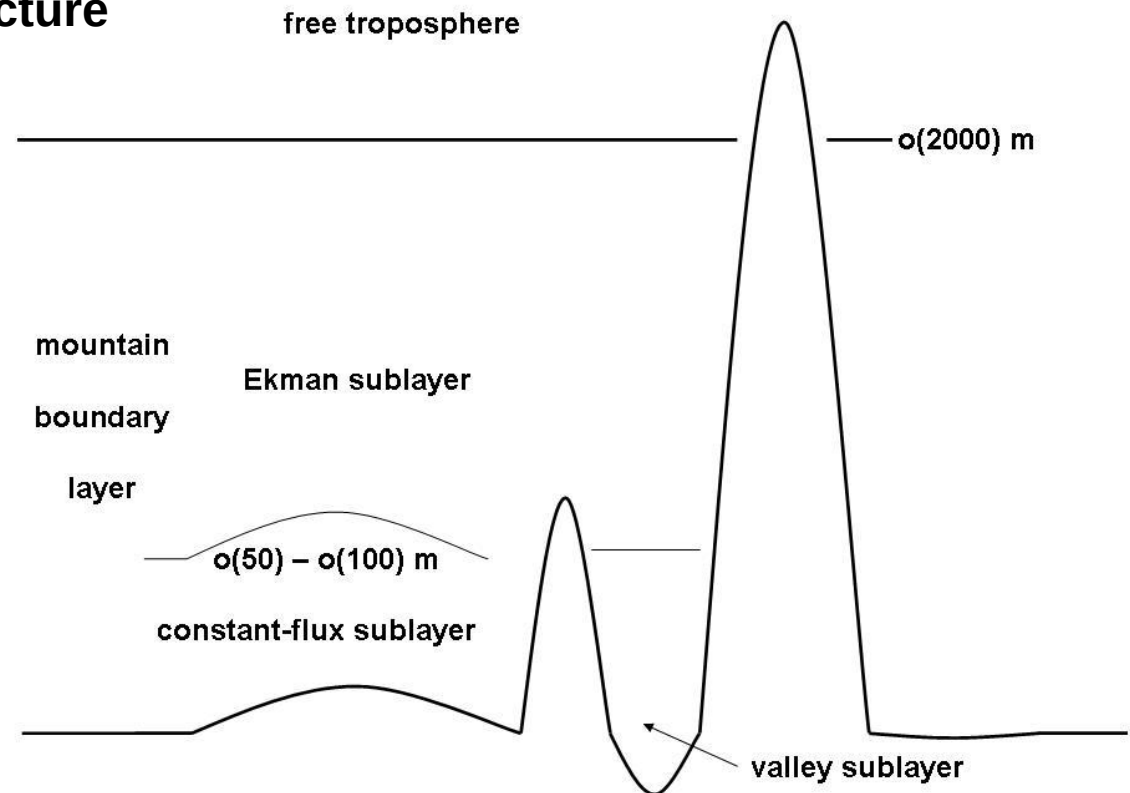
Complex terrain

different forms of complexity



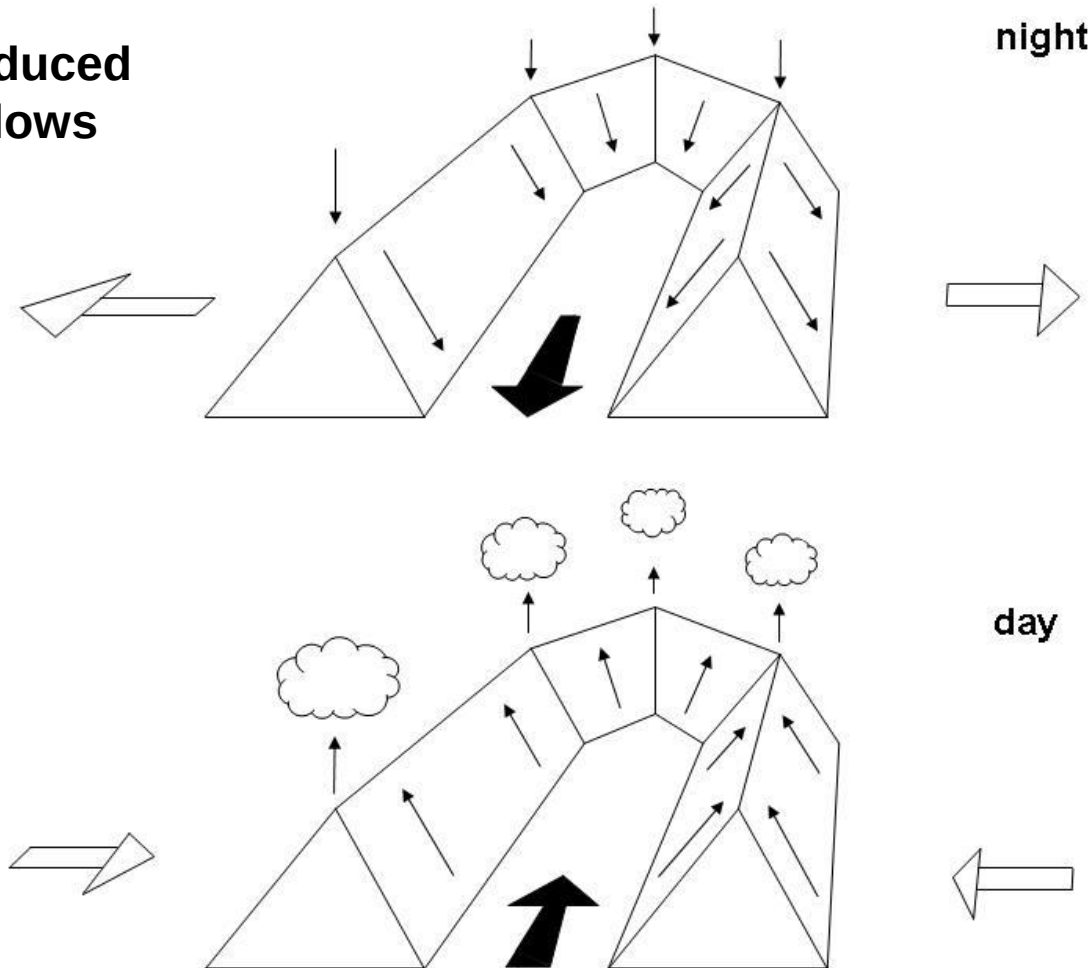
Complex terrain

impact on boundary-layer structure

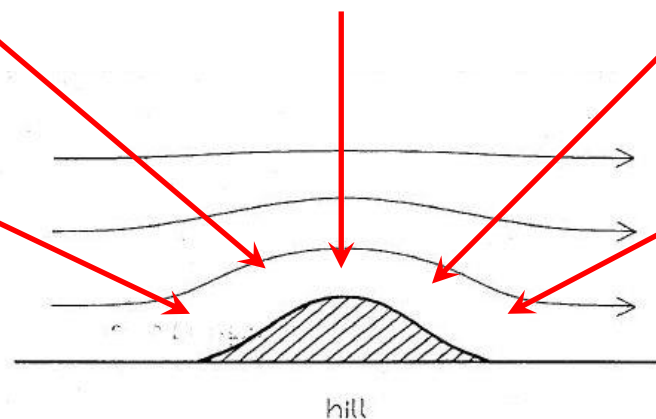
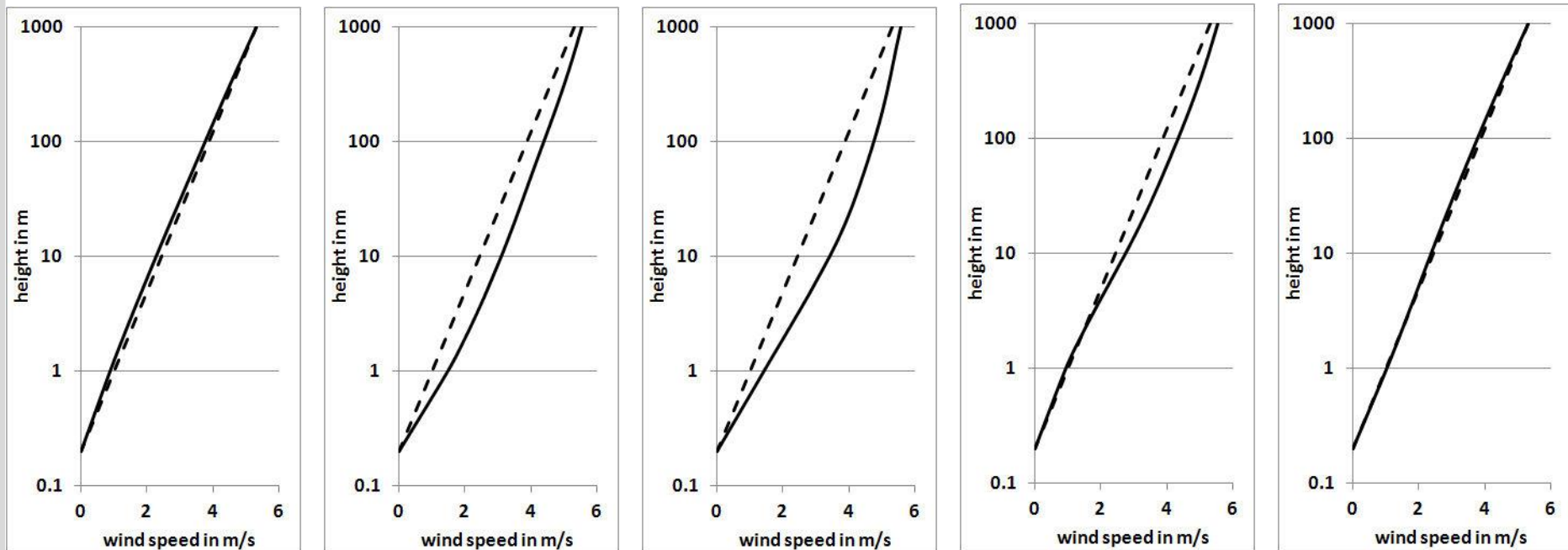


Complex terrain

thermally induced
secondary flows
on different
scales



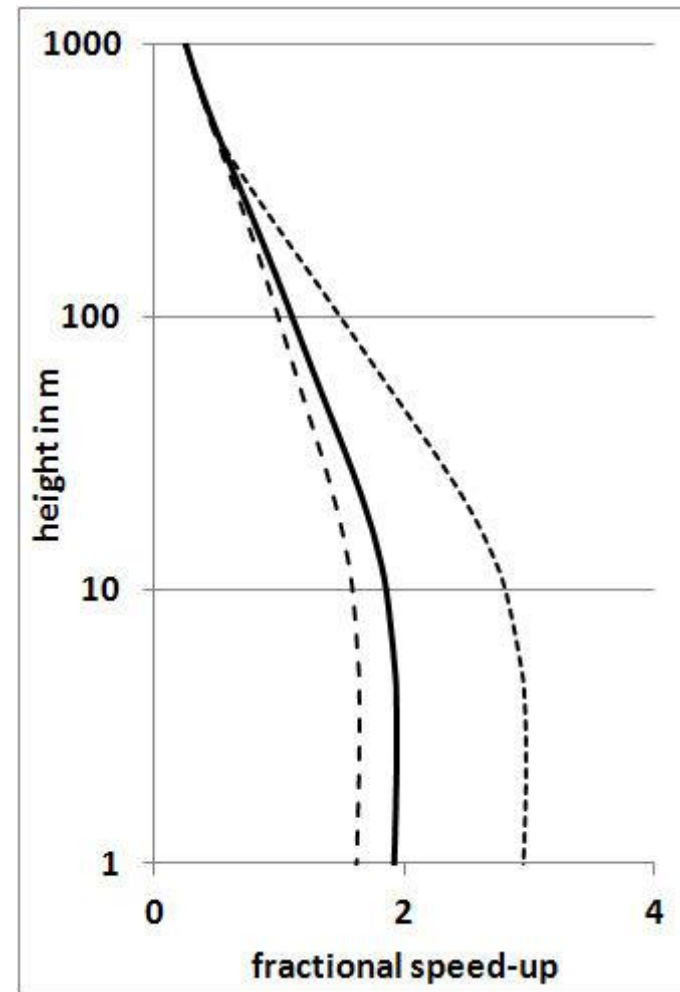
Flow speed-up over a gentle hill (analytical model)



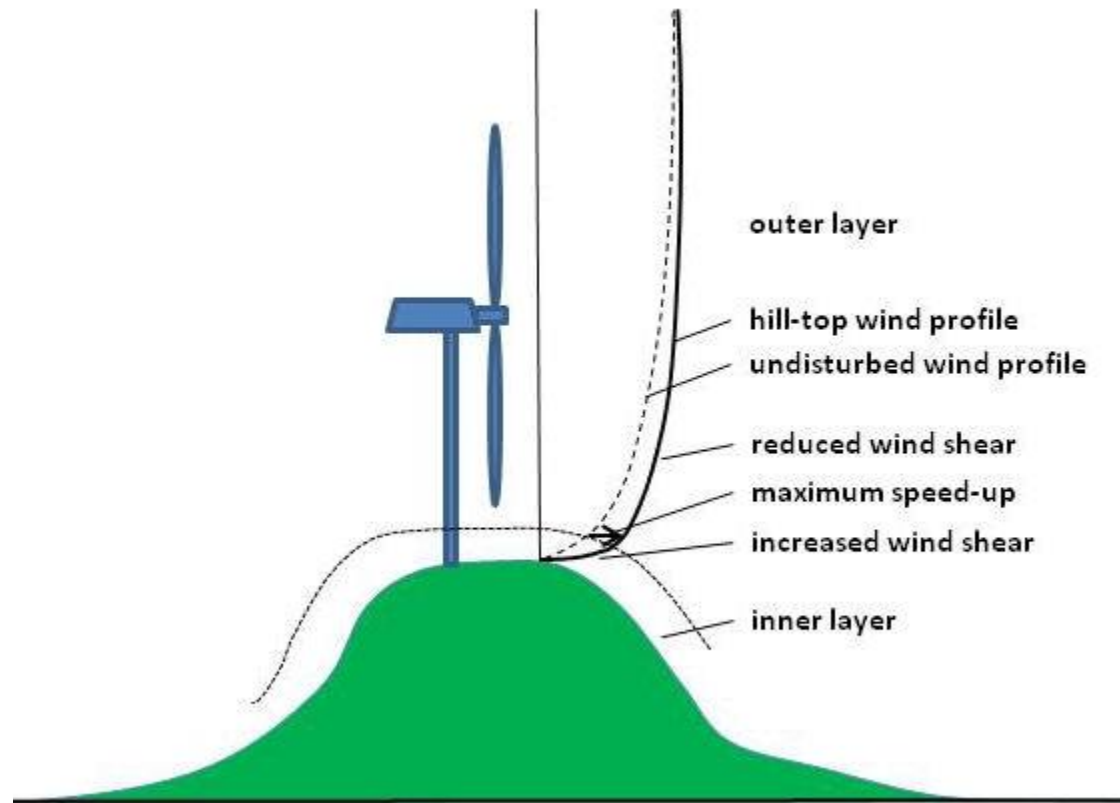
Flow speed-up over a gentle hill (analytical model)

as function of thermal stability

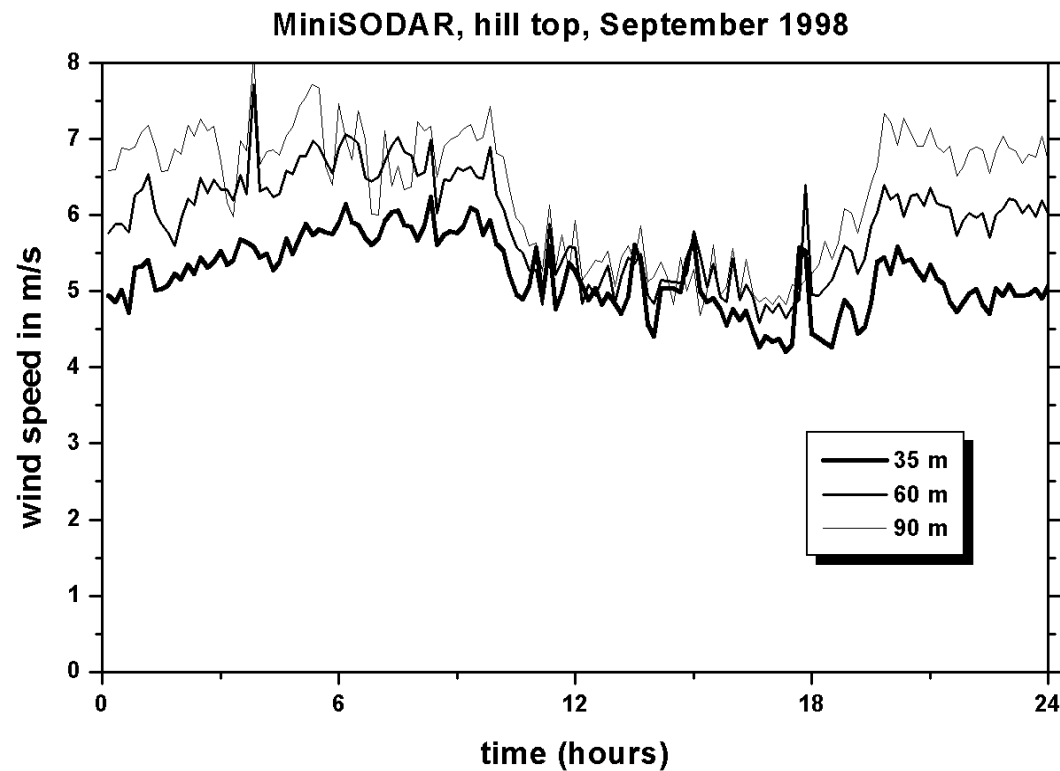
short dash: stable
 full: neutral
 dash: unstable



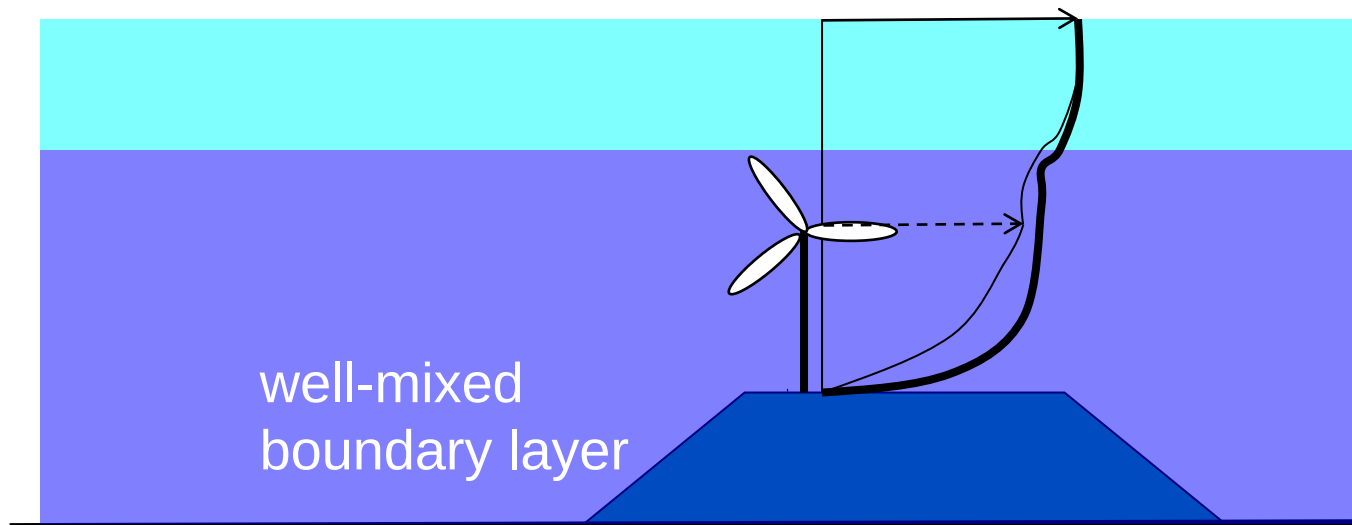
Flow speed-up over a gentle hill



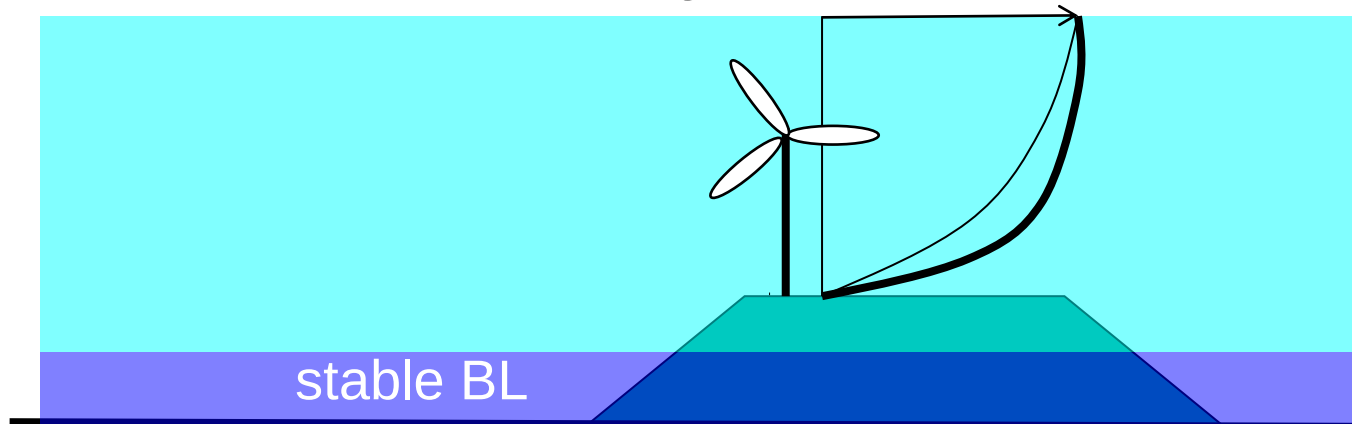
diurnal wind variation in three heights (SODAR data)



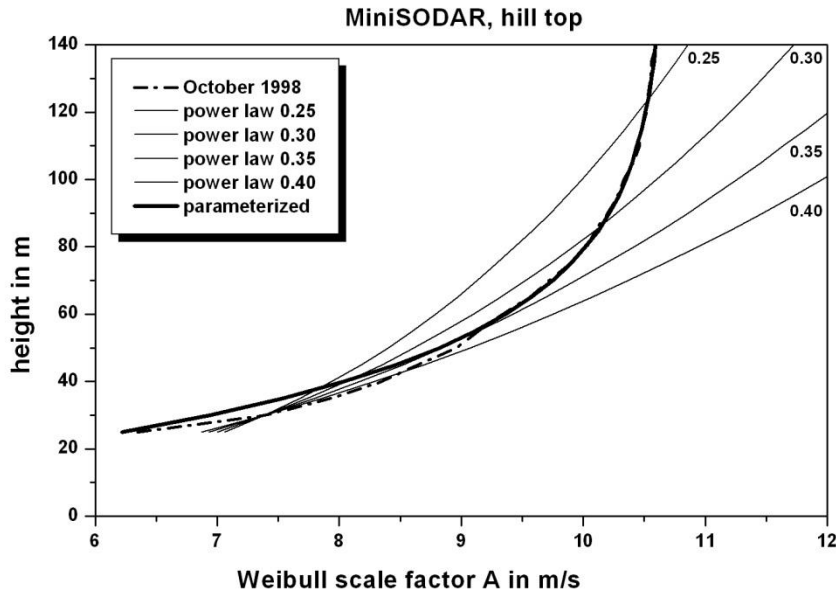
day



night

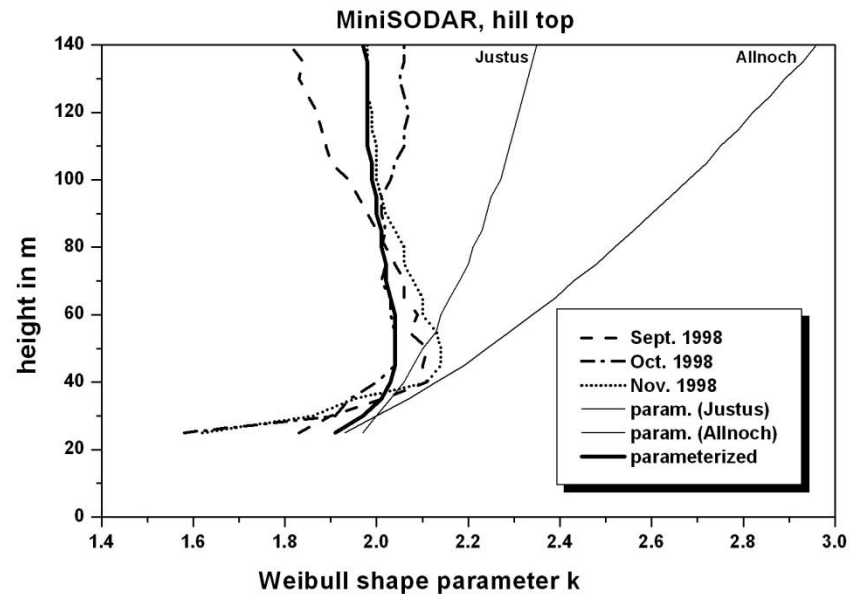


Flow over a gentle hill (SODAR data and empirical relations)



Weibull scale parameter
($A_0 = 10.67 \text{ m/s}$, $\gamma = 0.035$)

$$A(z) = A_0 \left(1 - e^{-\gamma z}\right)$$

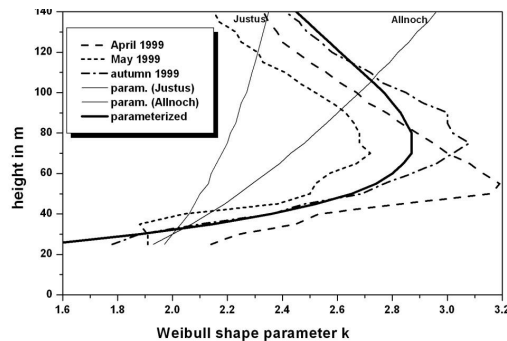
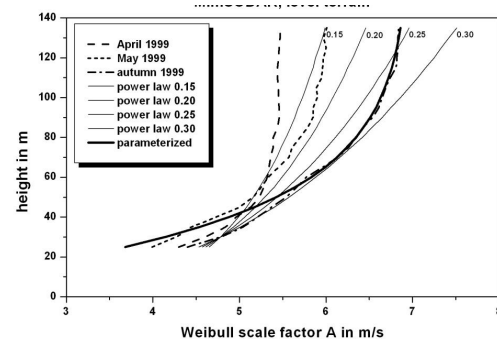
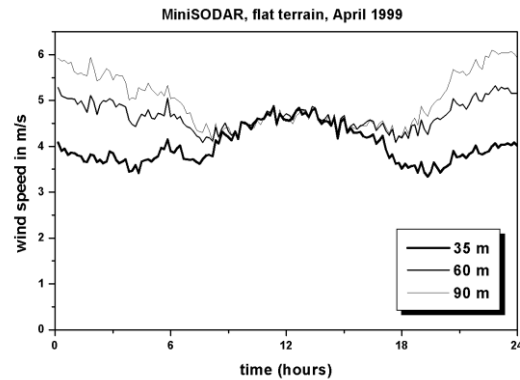


Weibull form parameter
($z_A = 10 \text{ m}$, $z_m = 50 \text{ m}$, $c_2 = 0.01$)

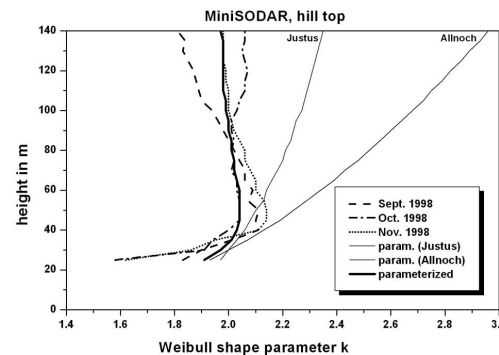
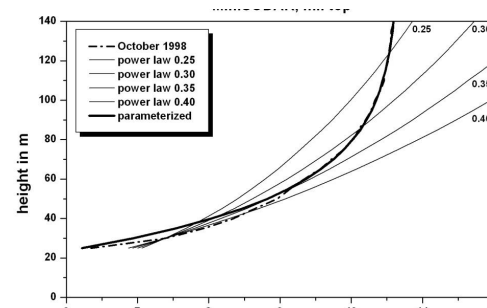
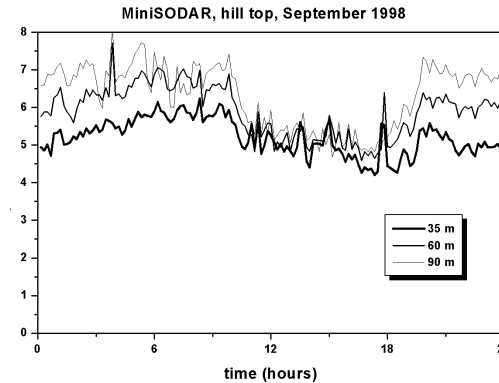
$$k(z) - k_A = c_2 (z - z_A) \exp\left(-\frac{z - z_A}{z_m - z_A}\right)$$

following Wieringa (1988)

flat terrain



hill top



diurnal wind variation

scale parameter

form parameter

Thank you for your attention

