Field and data
Theory
Results
Conclusion

Aerodynamical adjustment of the snow surface in coastal Adélie Land, East Antarctica

C. Amory, H. Gallée, F. Naaim-Bouvet and A. Trouvilliez

10th AMOMFW (Scott Polar Research Institute, Cambridge, UK) | 17th – 19th June 2015

Adélie Land, one of the windiest place of the planet

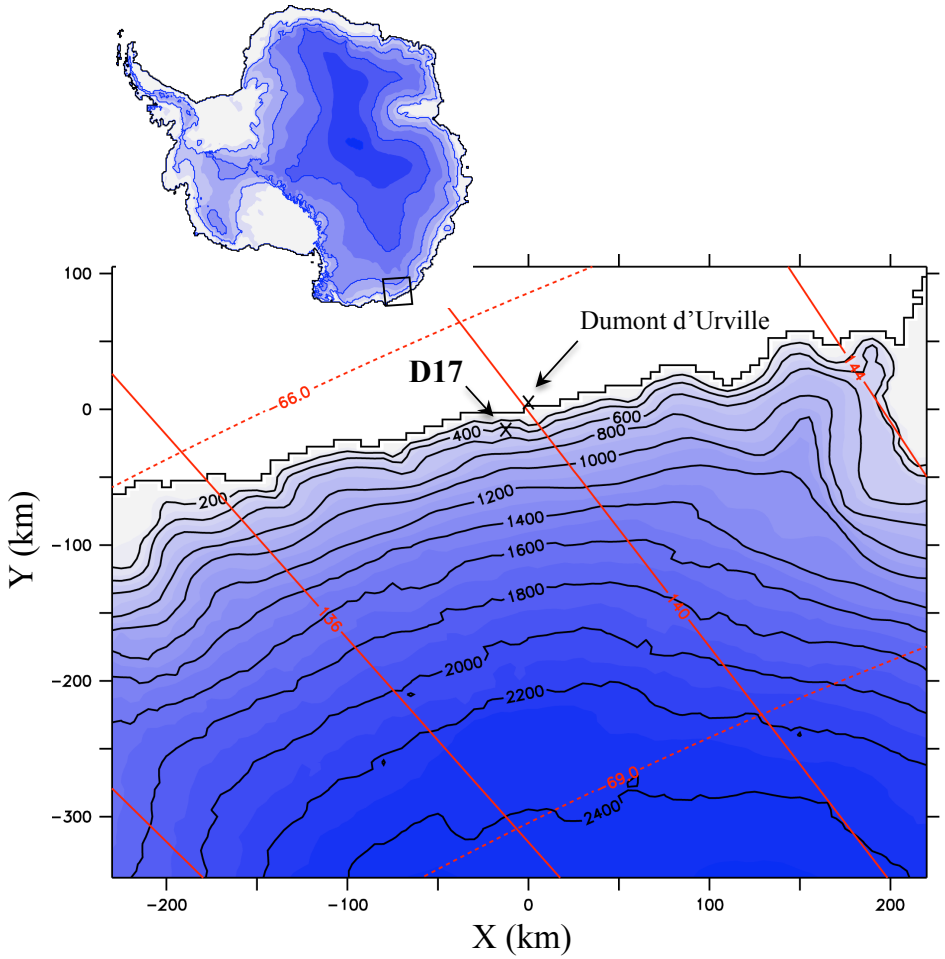


Fig. Topographic map of costal Adélie Land and measurement site.

- D17 : 440 m a.s.l – 10 km inland
- Strong winds ($\bar{U}_{2m}$ = 10.5 m.s^{-1})
- Accumulation zone (400 mm w.e.)

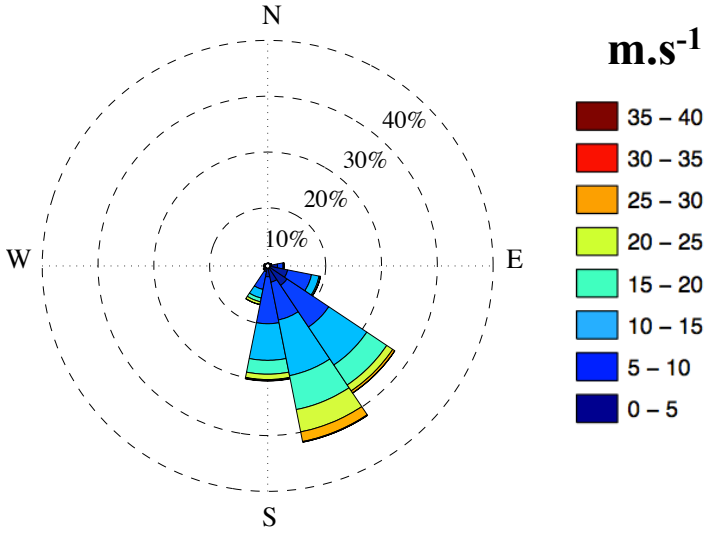
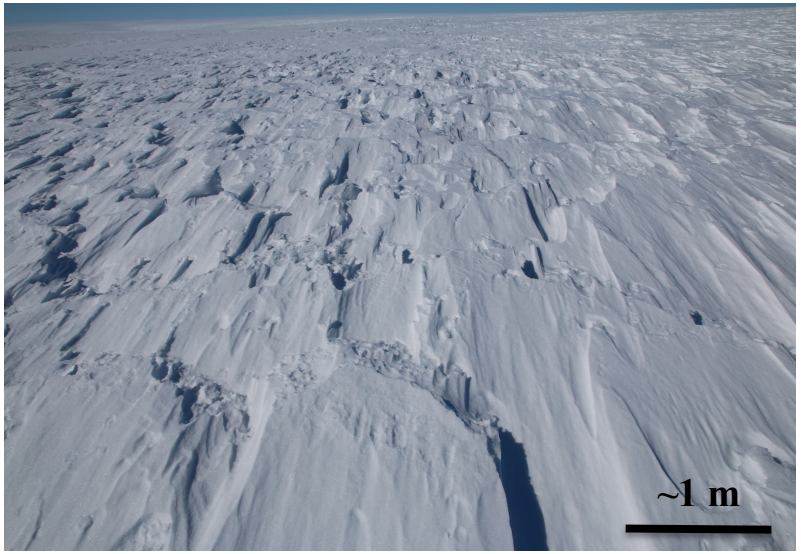
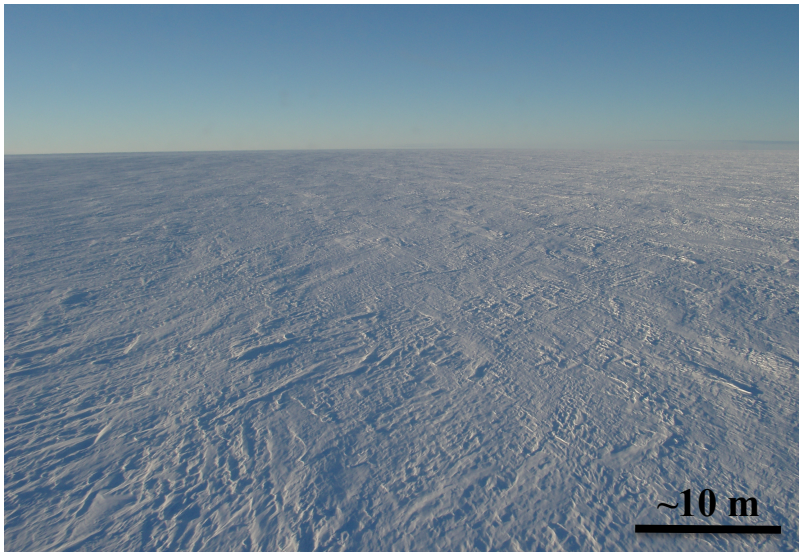
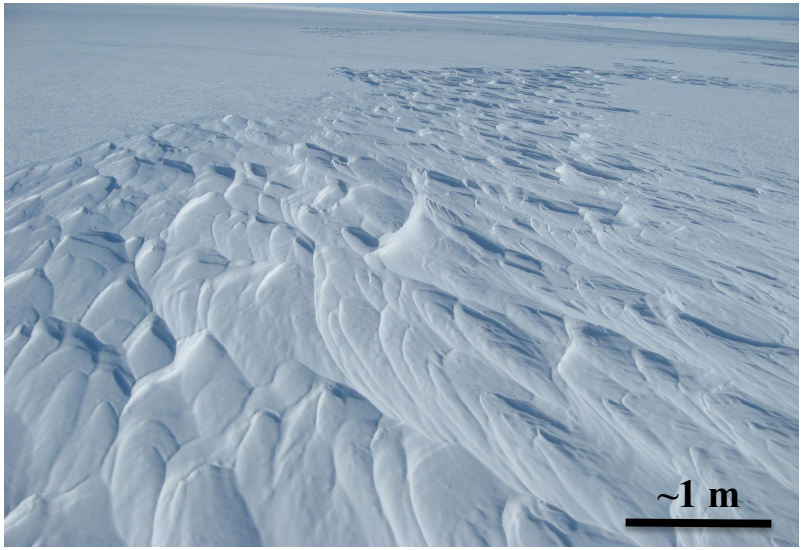


Fig. Wind rose at D17 for the year 2013.

Sastrugi in Adélie Land







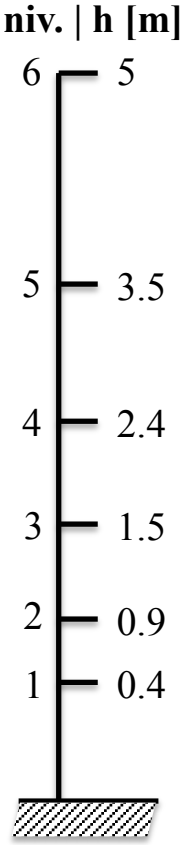
Profiles method

$$\bar{u}(z) = \frac{u_*}{k} \ln(z/z_0)$$ Eq 1.

u_* : friction velocity [m/s]
κ : von Kármán constant (= 0.4)
z : measurement height [m]
z_0 : arodynamic roughness length [m]

$$C_{DN10} = [\kappa / \ln(10/z_0)]^2$$ Eq 2.

- = resistance strength of a surface
- = fct(flow conditions & surface properties)



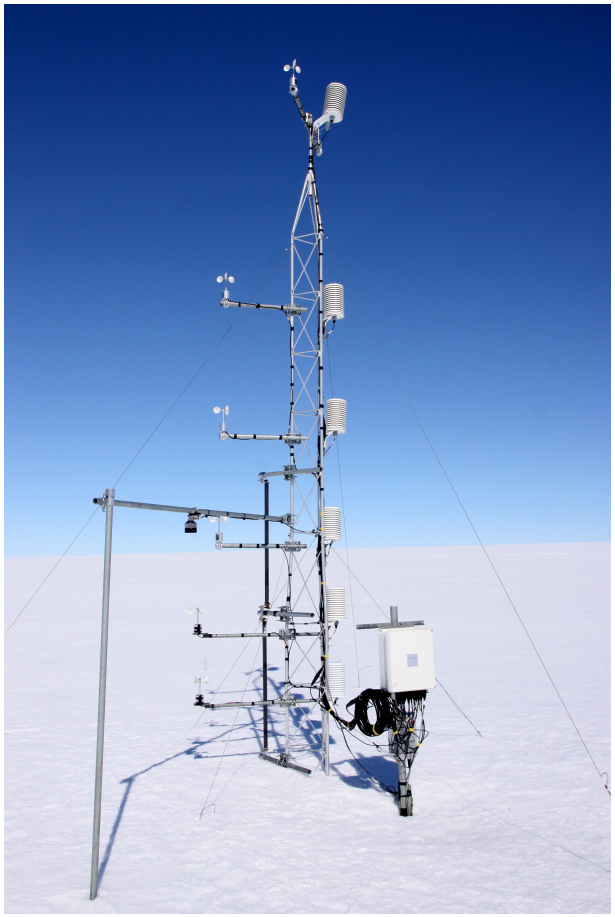
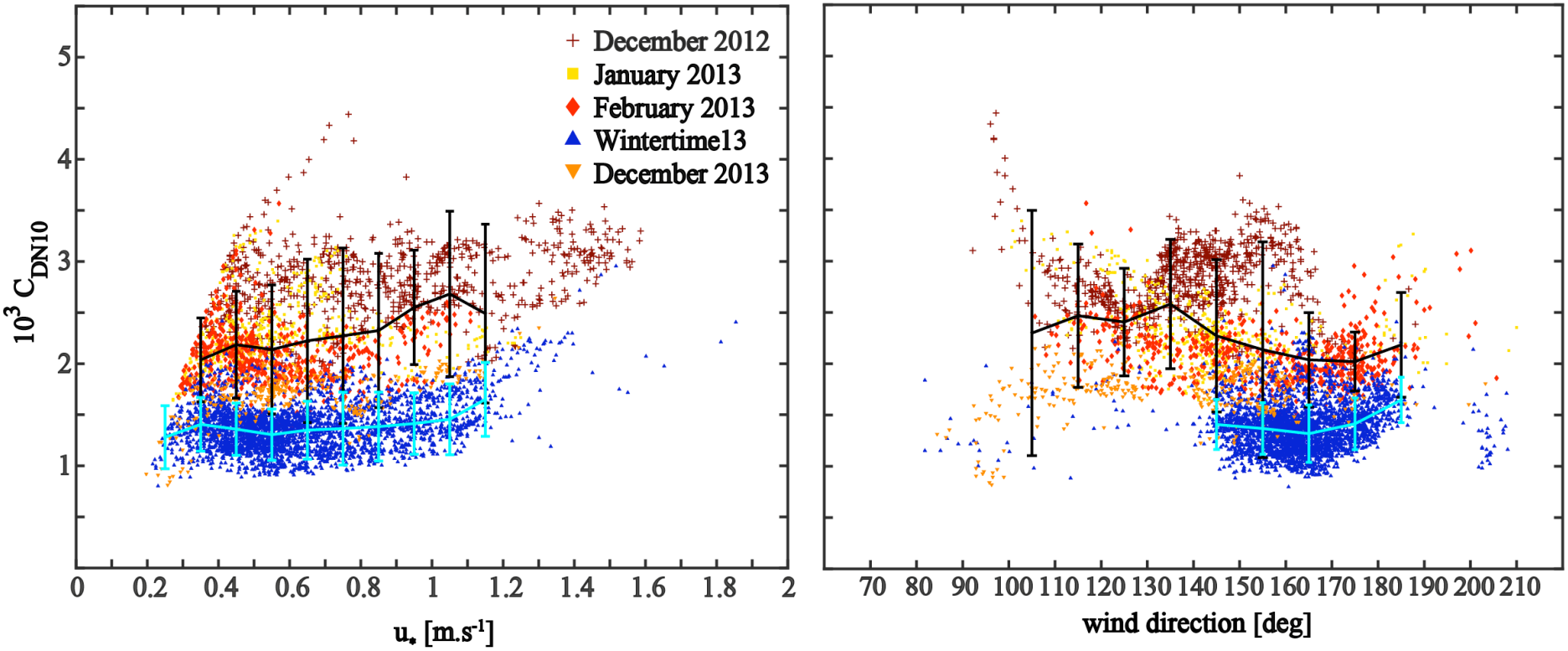
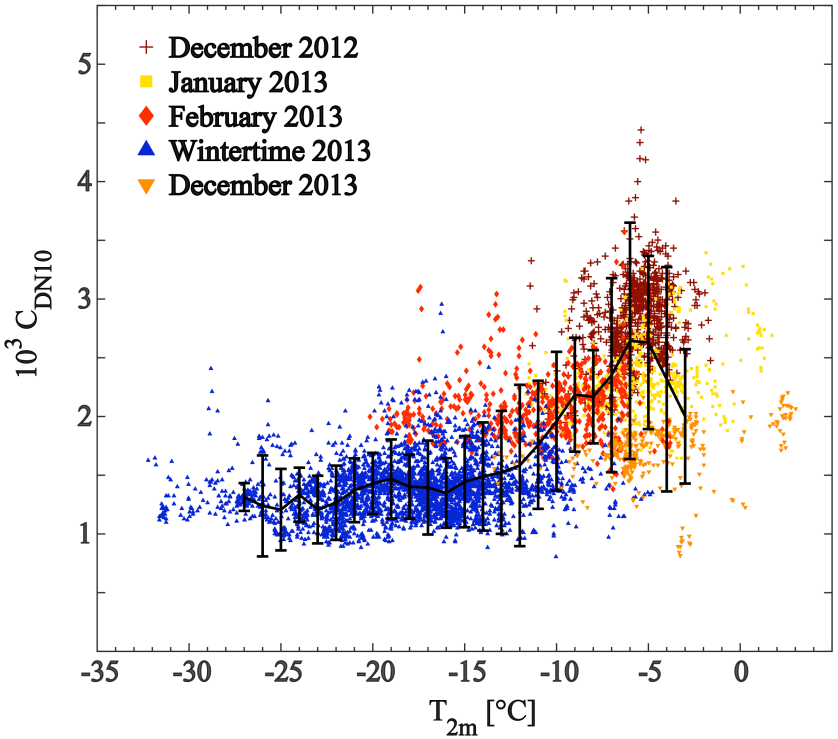


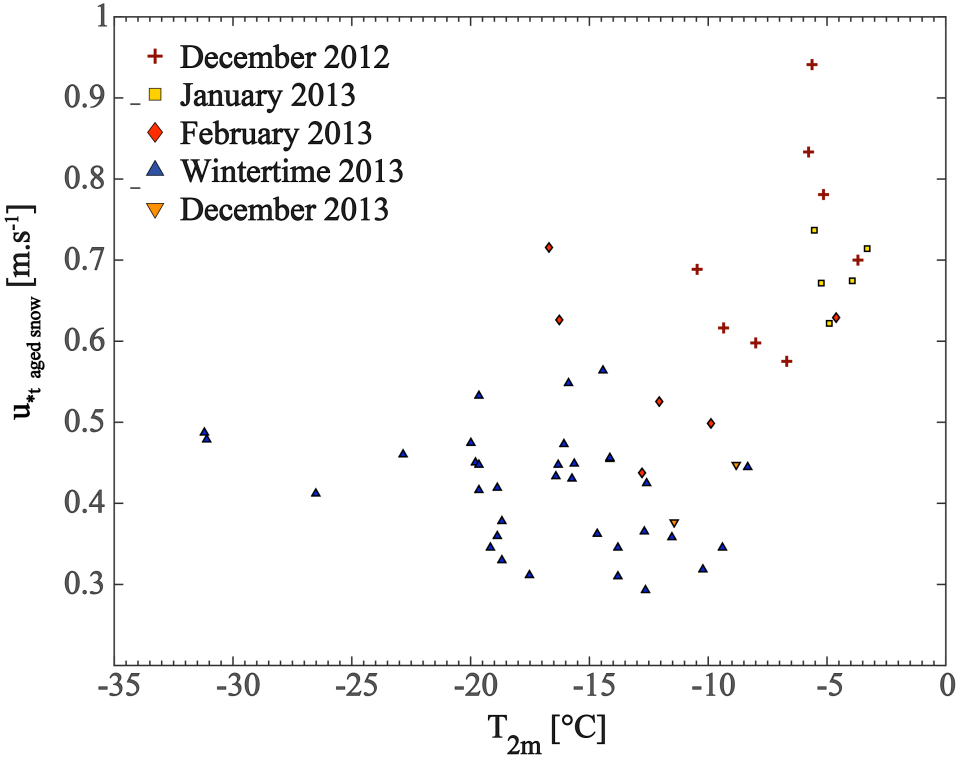
Photo. Measurement mast at D17.

Drag coefficients vs wind statistics

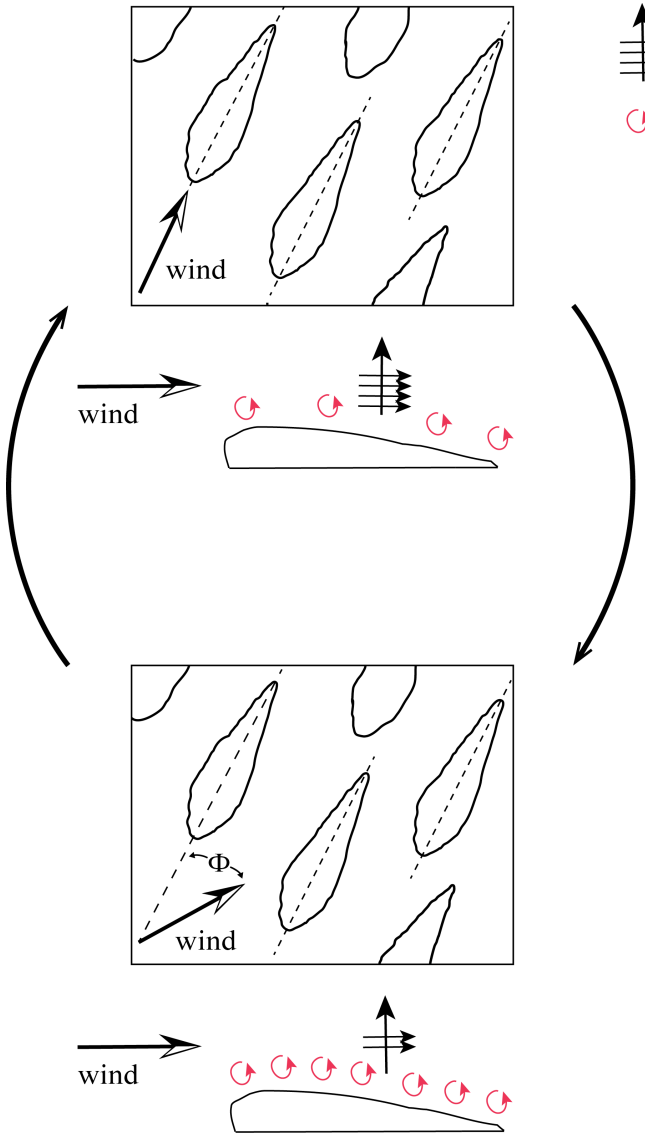


Drag coefficients and snow surface erodibility



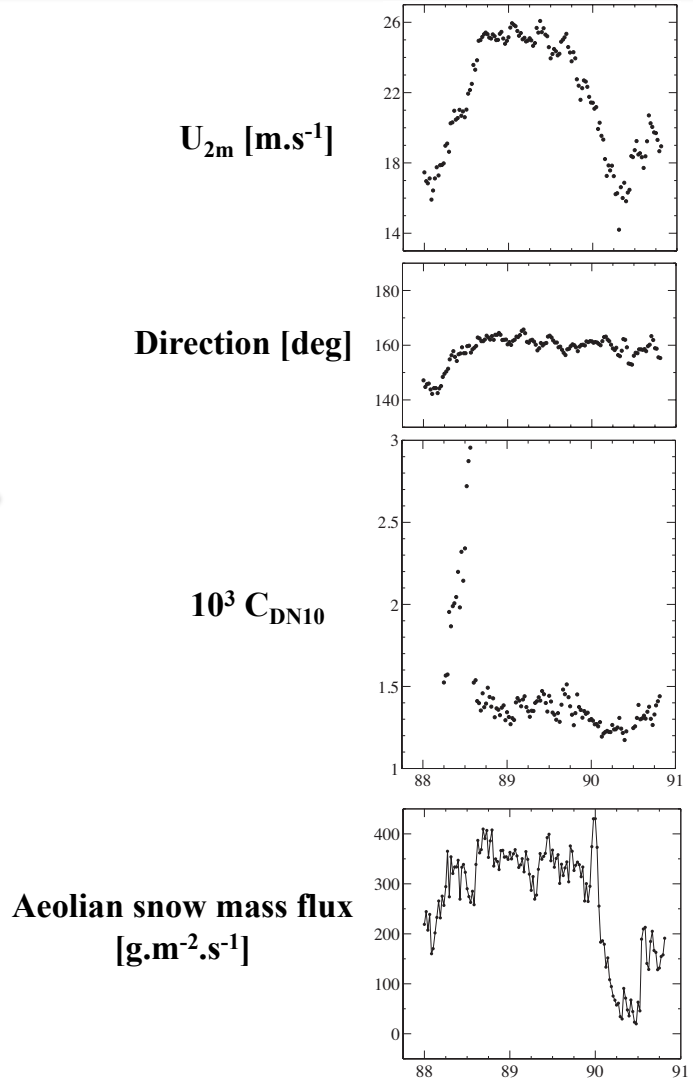


Erosion event in winter (March, 29th 2013)

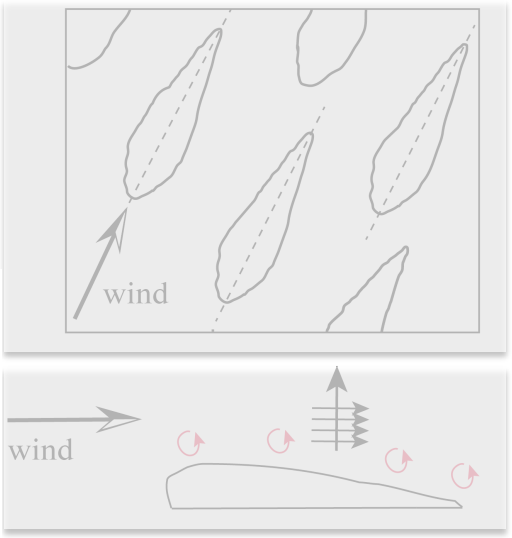


Drifting snow

Frictional drag

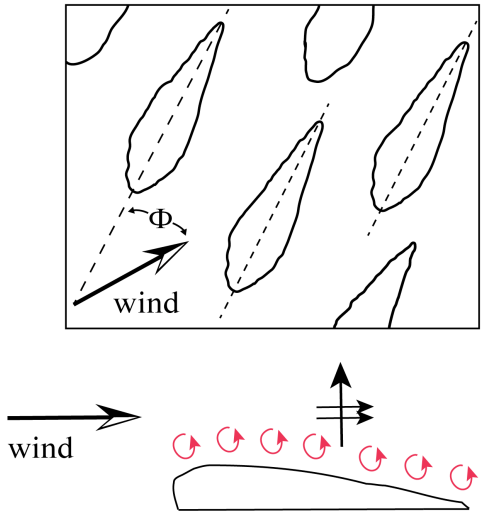


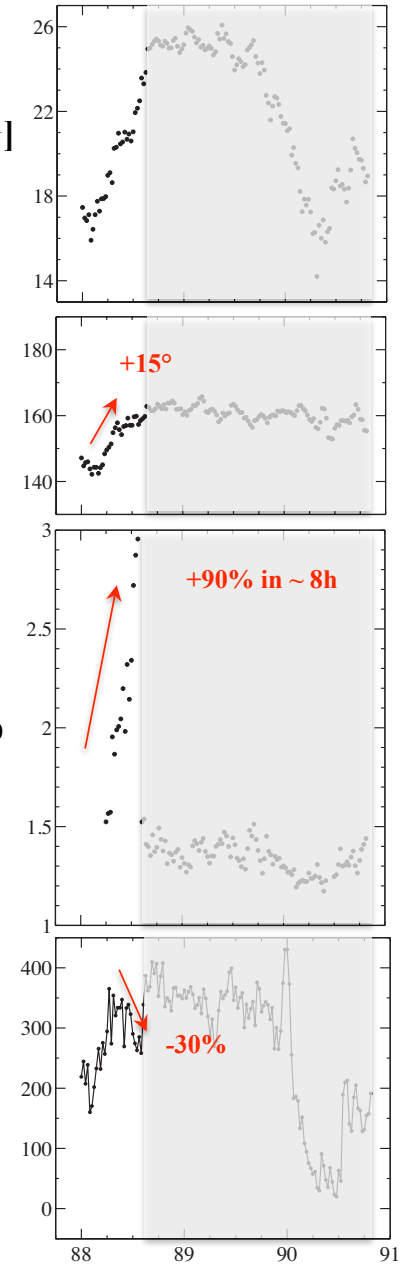
Transitional regime



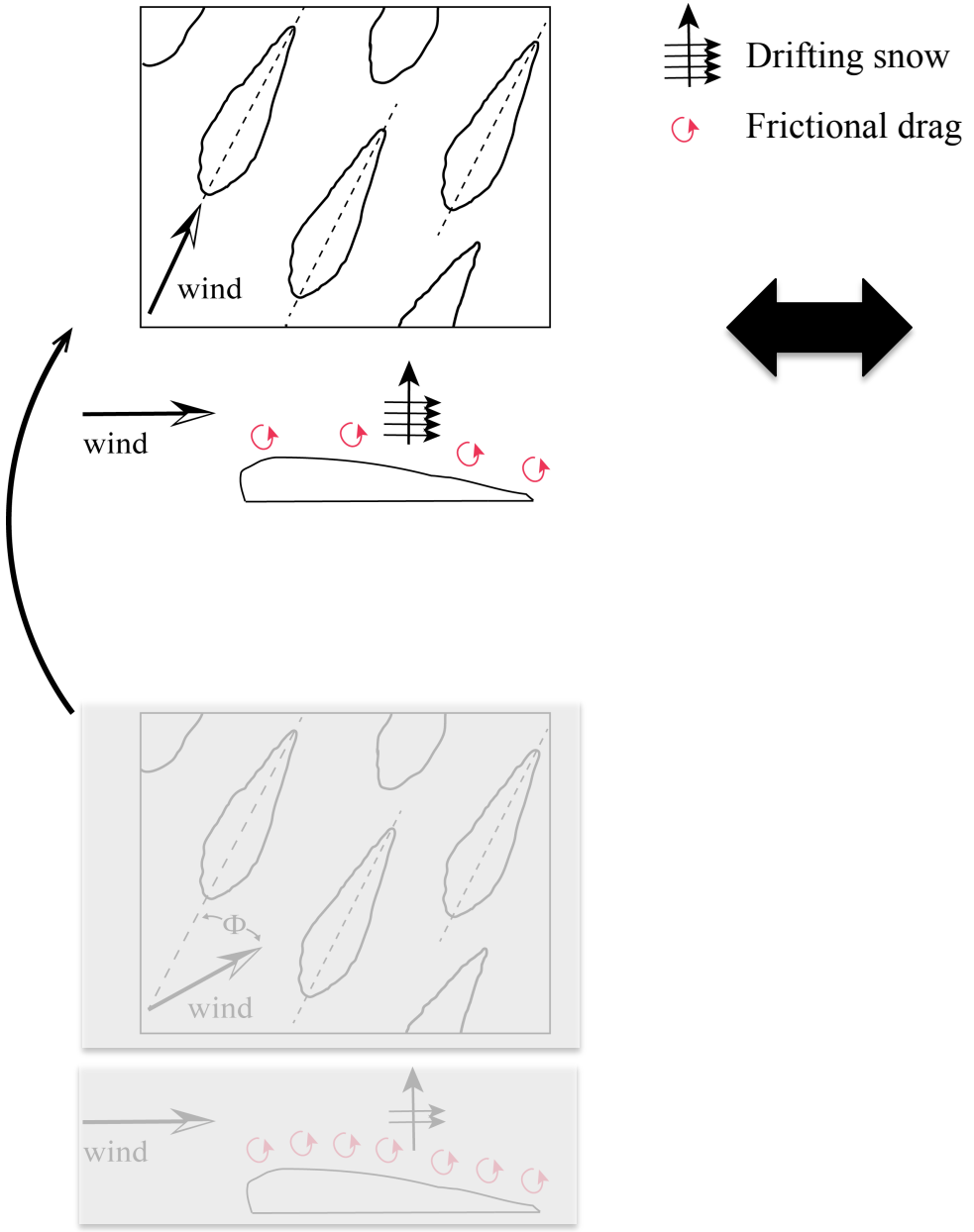
Drifting snow

Frictional drag



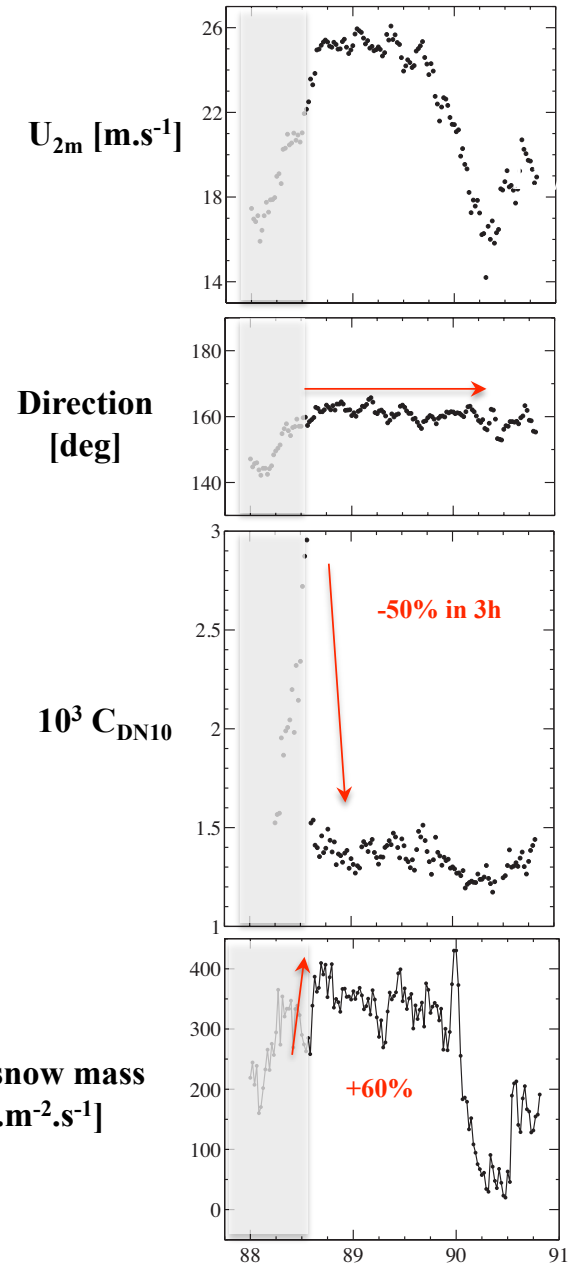


Steady conditions



Drifting snow

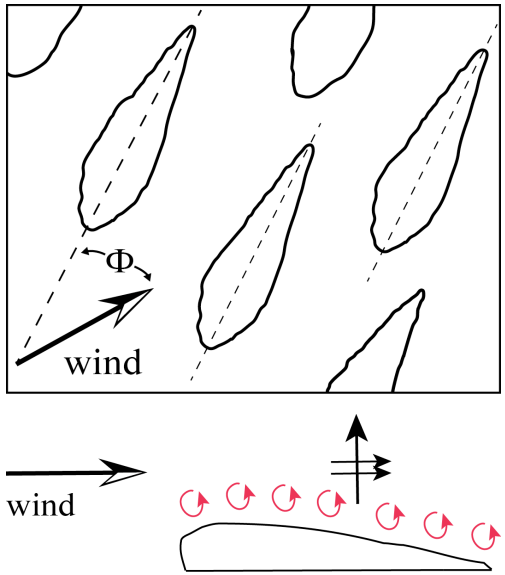
Frictional drag



➢ Seasonal variations related to wind, erosion, and temperature histories

Under **changing** wind conditions

(summertime)



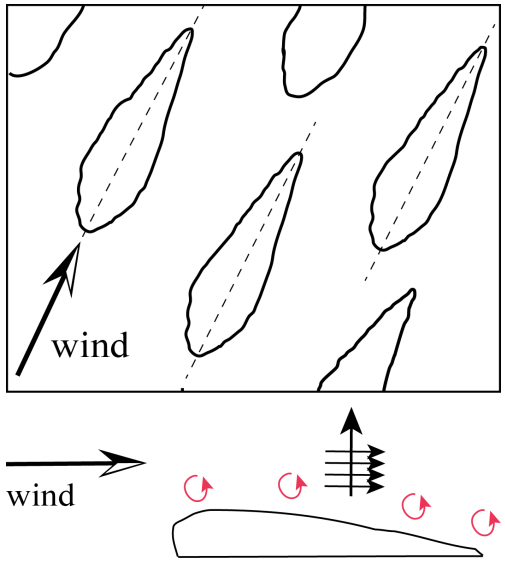
C_{DN10} ↗ (up to 4.5 x 10^3)

+90% with **+15°**

t = fct(erosion flux)

Under **constant** wind conditions

(wintertime)



C_{DN10} ↘ (≈ 1.2 x 10^3)

-50% in **3h** (u=25 m/s)