Funded by the European Union
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AWACASURF
Weather observations

AWACA
Atmospheric WAter Cycle over Antarctica
past, present & future

LMD
LATMOS
EPFL
LSCE
INSTITUT POLAIRE FRANÇAIS PAUL-ÉMILE VICTOR

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Felipe Toledo Bittner

Valentin Wiener

Justine Charrel

Other essential people

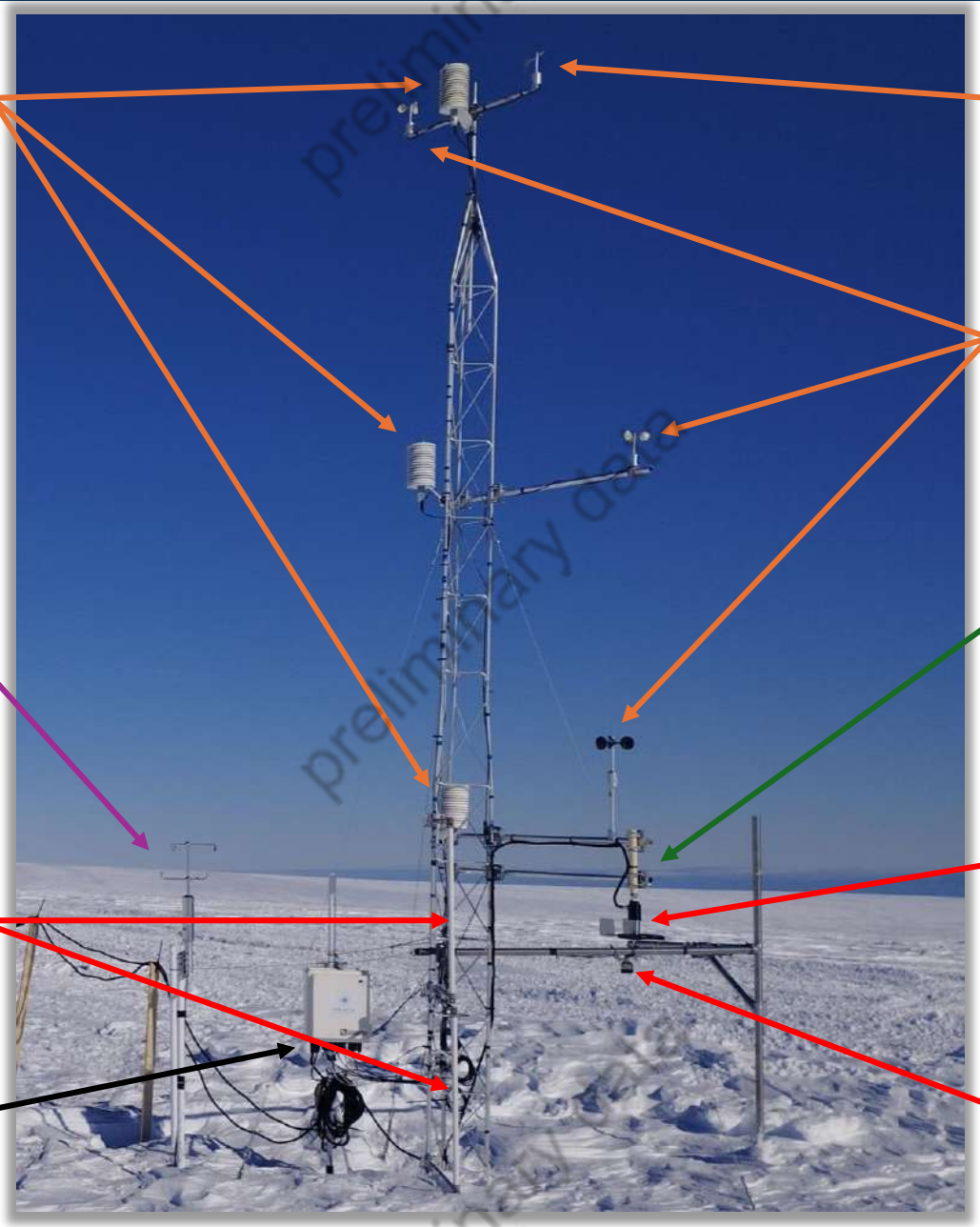
Image: Installation of weather sensors on the tower at D85 by Felipe and Théophile (T. Lauwers)

Weather tower instrumentation

Thermo-hygrometer (*HMP155A*)
Temperature and humidity
2.5, 4.5, 7 m

Windvane (*W200P*)
Wind direction
7 m

Cup Anemometer (*BLET / A100LK*)
Wind speed
2.5, 4.5, 7 m



3D Sonic Anemometer 10 Hz
(METEK *uSonic3-Omni*)
Turbulence
2.5 m

Radiometers (*SN500SS*)
Vis. and IR (↓ et ↑)
2.4m

FlowCapts (*FC4*)
blowing snow flux
between ~ 30 cm and 2.4 m

Snow Particle Counter (*SPC*)
Snow size distribution
2.5 m

Barometer (*BaroVue10*)
Pressure
1.2 m

Snow-height gauge (*SR50A*)
2.4 m

Some specificities on

Measuring blowing snow

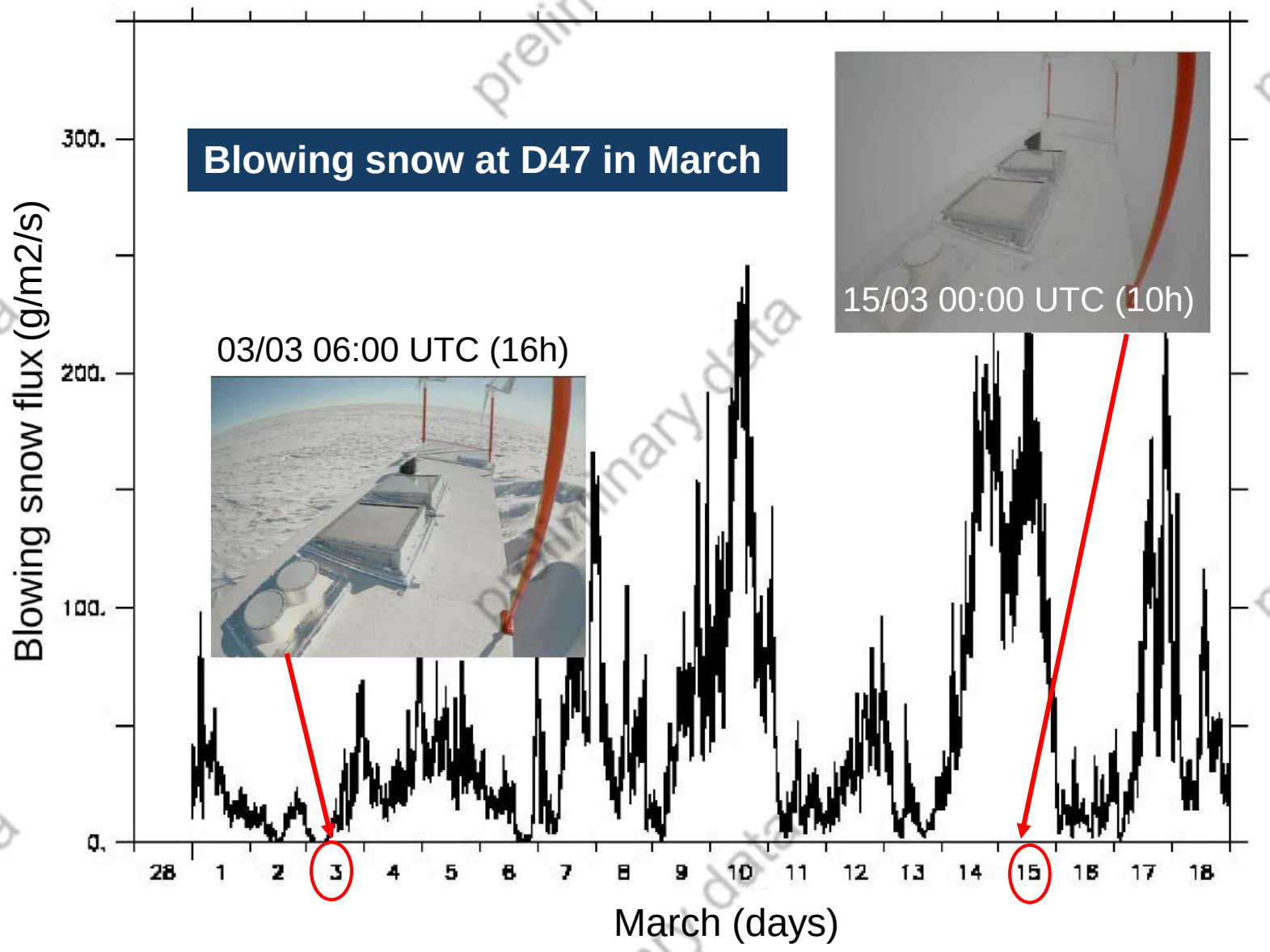
SPC (Snow Particle Counter)
- optic
- precise but local
- energy-consuming

FlowCapts
- acoustic
- robust
- low power consumption

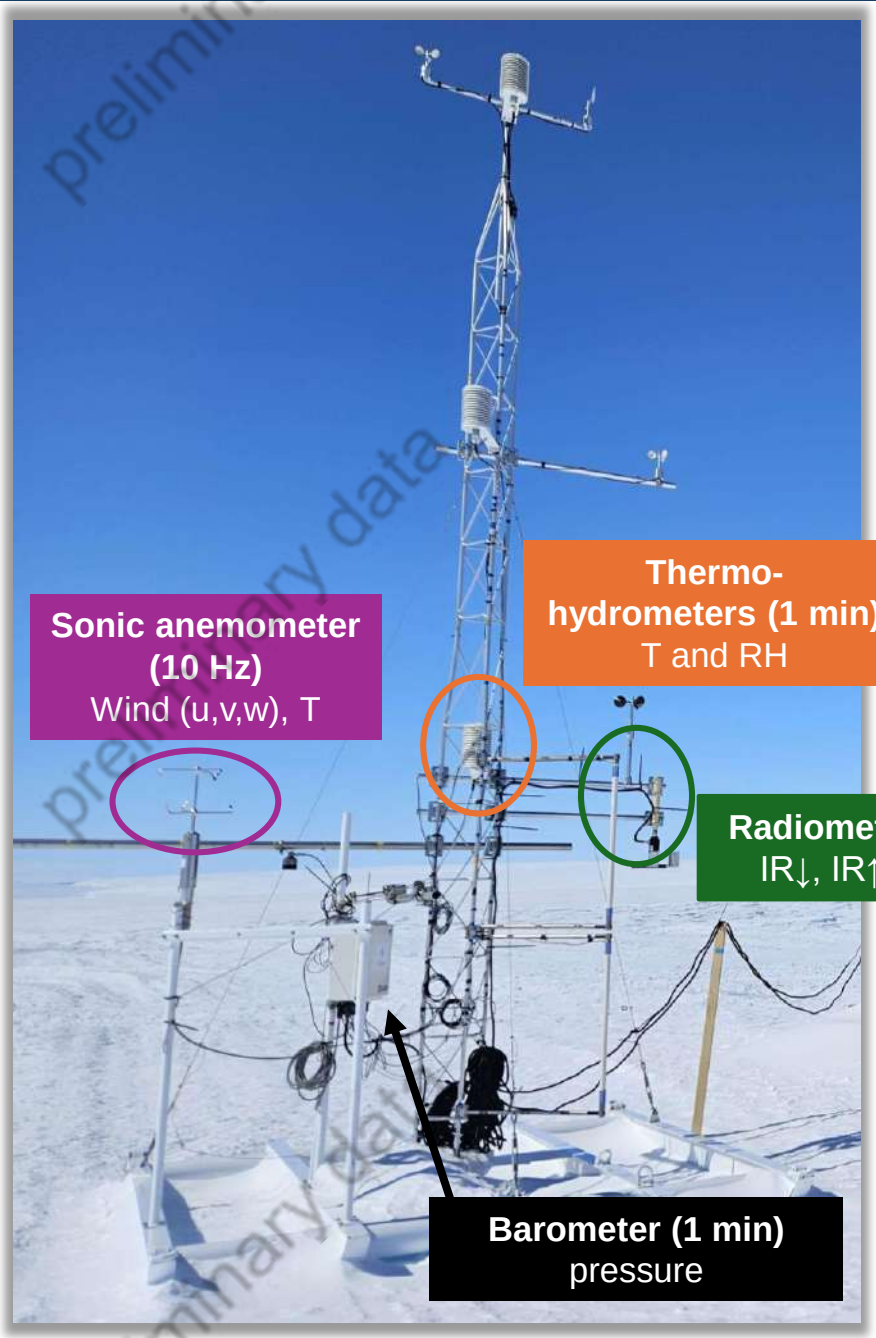
Measuring turbulence

Sonic anemometer difficulties:
- temperature
- wind
- frost
- blowing snow

Flowcapt preliminary results



Sonic anemometer data-processing for turbulence



TURBULENCE

Over 30-minute periods:

- some corrections
- removal of outliers
- double rotation in the mean plane
- filters
- hypotheses (neutrality, stationarity, etc.)

Friction velocity

$$u_* = \left(\left(\overline{u'w'} \right)^2 + \left(\overline{v'w'} \right)^2 \right)^{1/4}$$

Sensible heat flux

$$Q_s = \frac{p\, M_{air} C_p \overline{w'T'}}{R\, T_{2m}}$$

Turbulent kinetic energy

$$TKE = \frac{1}{2}(\overline{u'u'} + \overline{v'v'} + \overline{w'w'})$$

Anisotropy factor

$$X_{cov} = \begin{bmatrix} \overline{u'u'} & \overline{u'v'} & \overline{u'w'} \\ \overline{v'u'} & \overline{v'v'} & \overline{v'w'} \\ \overline{w'u'} & \overline{w'v'} & \overline{w'w'} \end{bmatrix}$$

$$\lambda, V = eig\left(\frac{X_{cov}}{2\, TKE}\right)$$

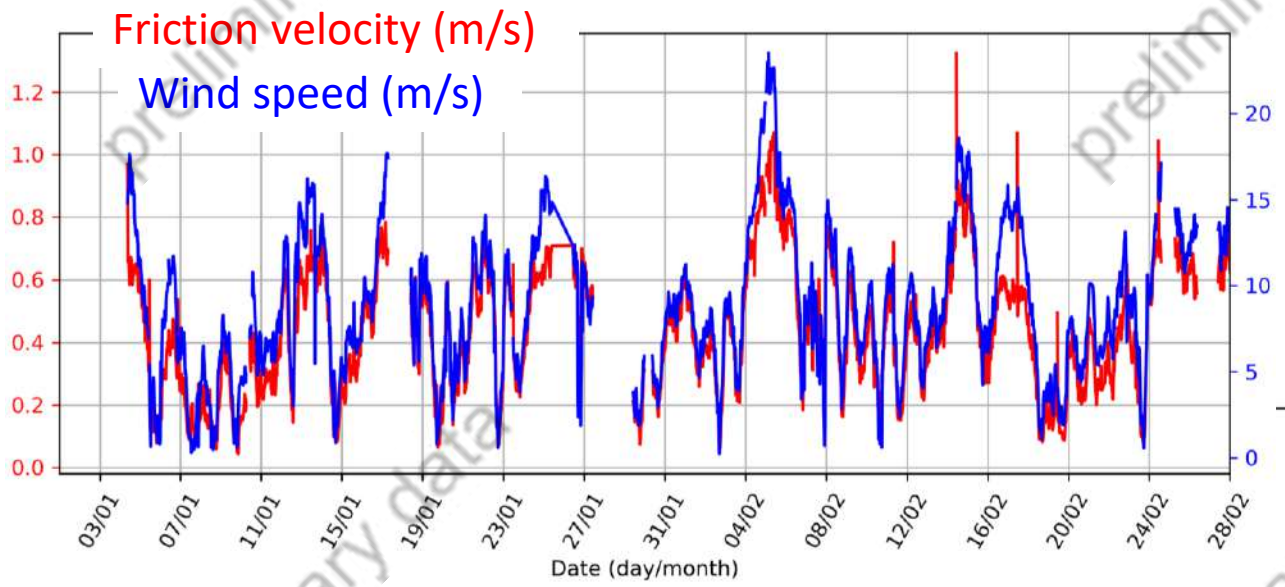
$$d_3 = \min(\lambda)$$

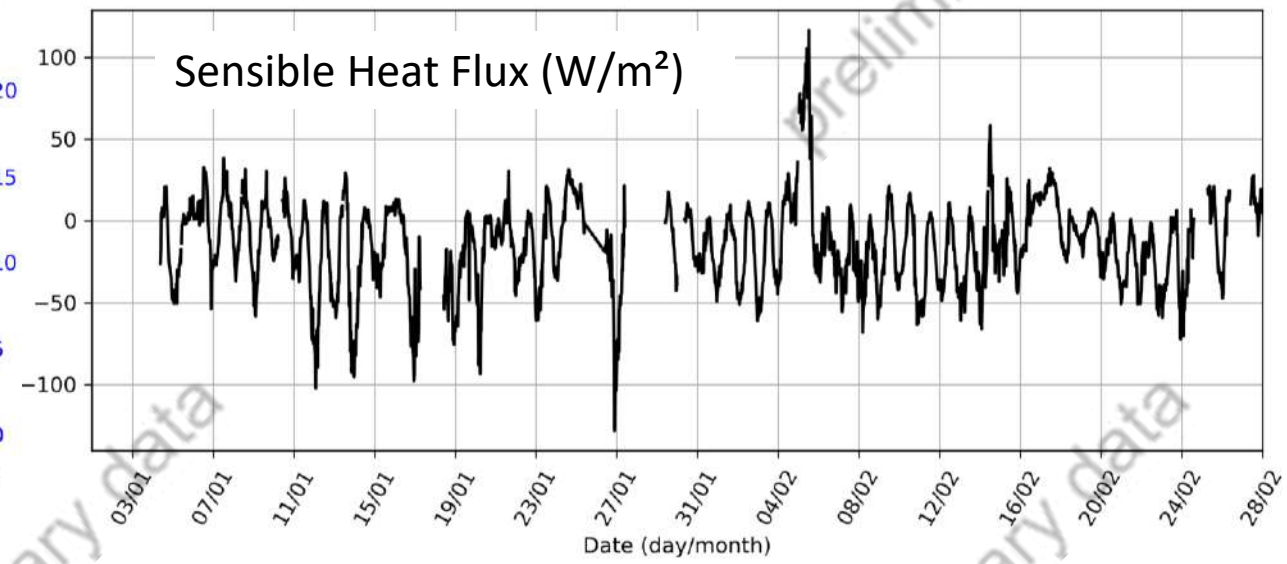
$$C_3 = 3\, d_3$$

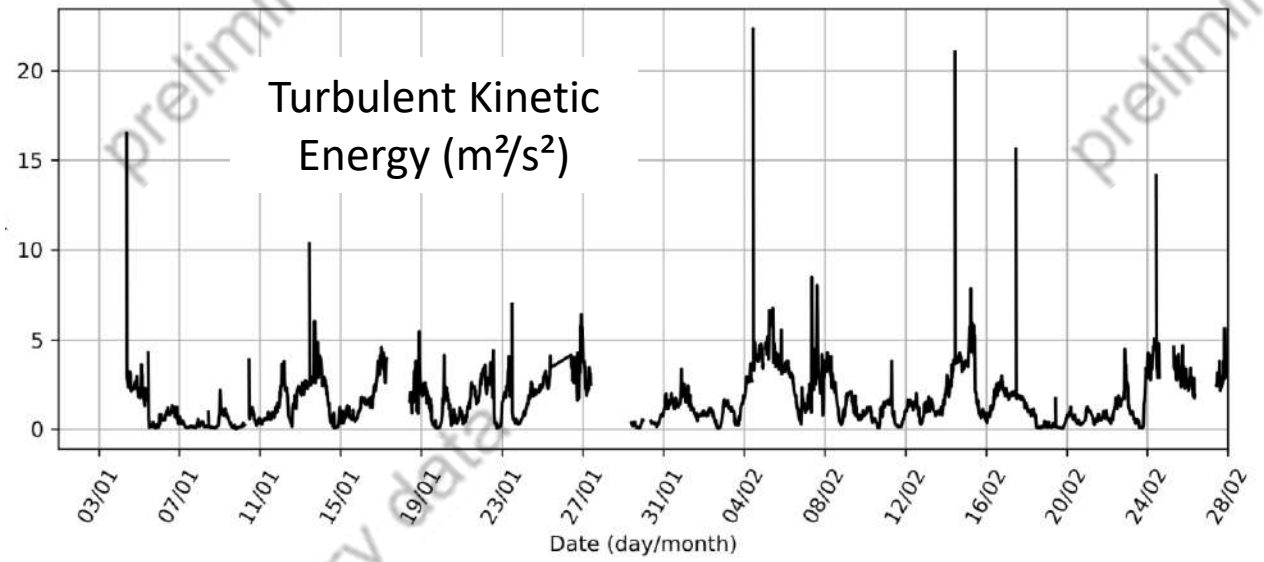
Roughless length

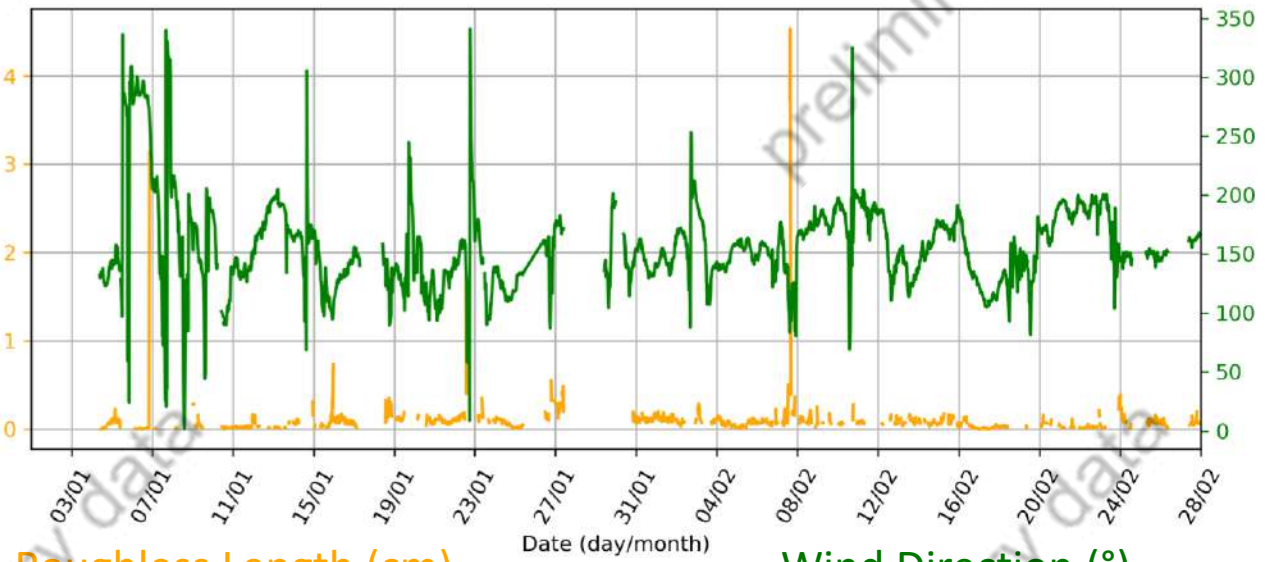
$$z_0 = H\, exp\left(-\frac{\kappa\, |U|}{u_*}\right)$$

Sonic anemometer preliminary results (D17 Jan-Feb)









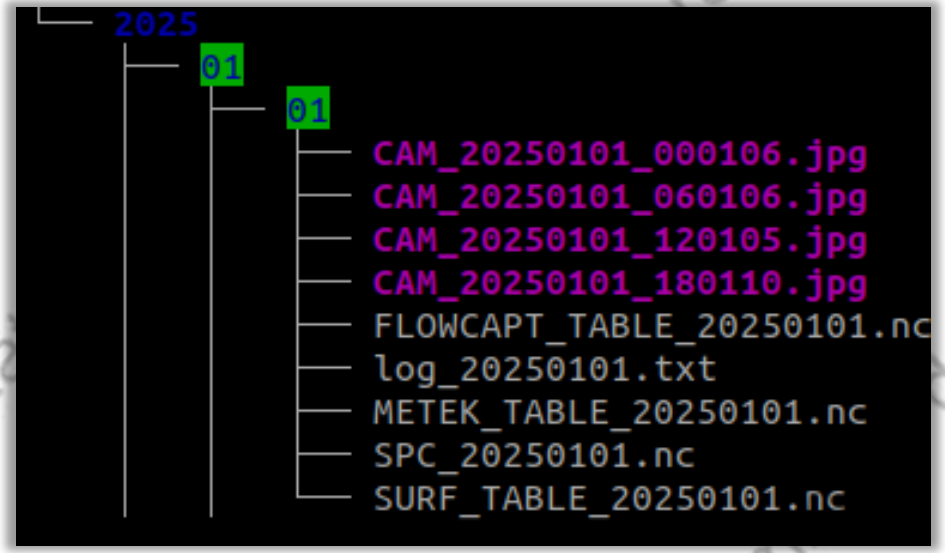
Operating condition of the instruments

- Data received daily

On spirit/spiritx :
/bdd/AWACA/TRANSECT/awacasurf/

- Daily monitoring of the instruments

d17 d47 d85 dmc



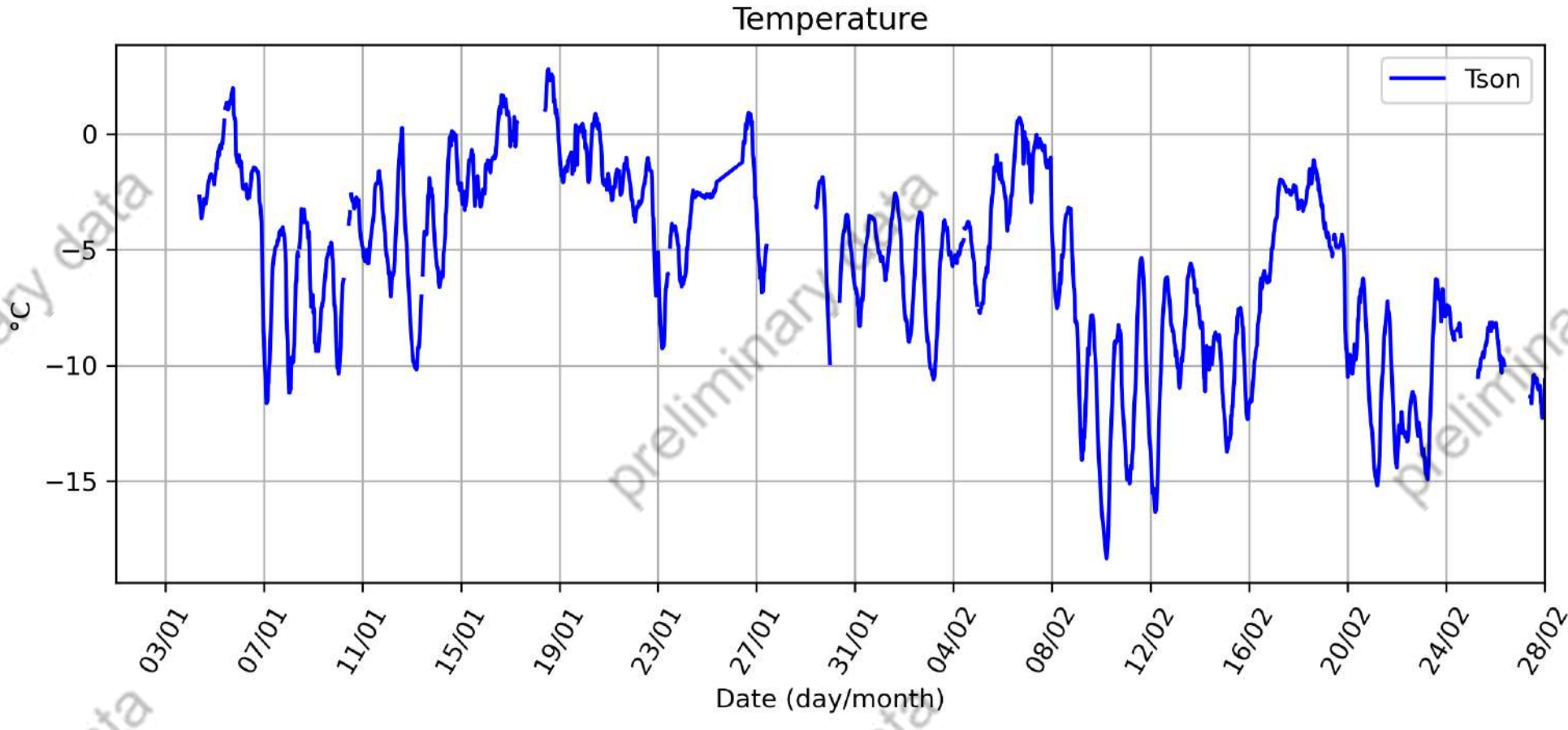
Everything works!

Except one SPC with which contact is lost
(D17 station, last contact on 24/02/2025)

Thanks for your attention !

Image: Installation of weather sensors on the tower at D85 by Felipe and Théophile (T. Lauwers)

Sonic anemometer preliminary results



Sonic anemometer preliminary results