

East Antarctic hydrological cycle:

What drives the isotopic composition of vapor, precipitation and surface snow in a coastal site of Adelie Land

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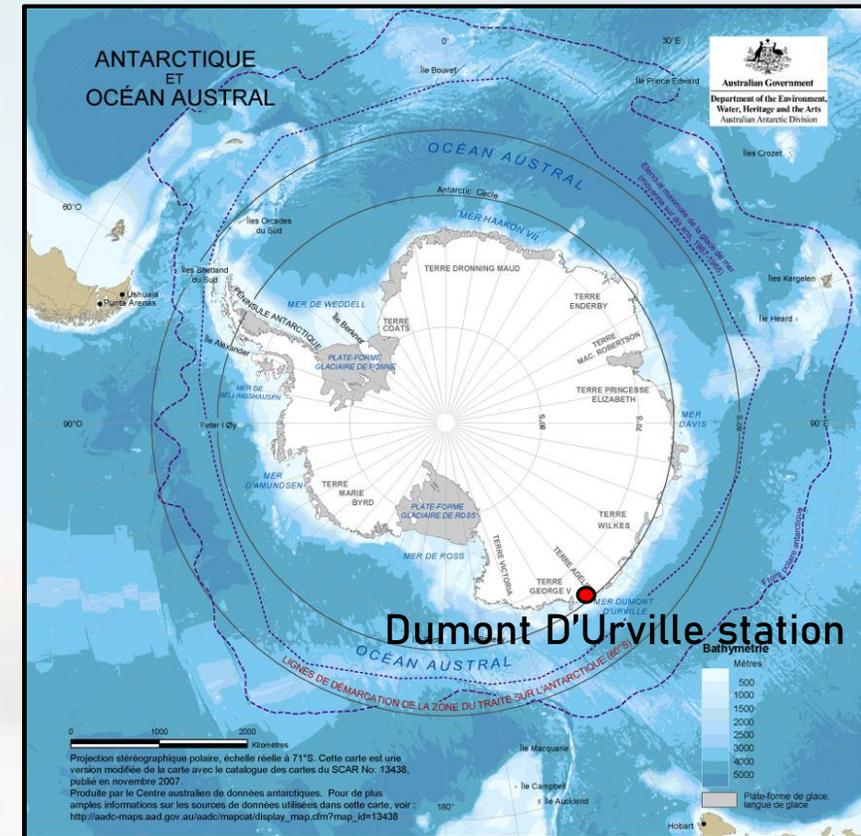
Scientific context : Understanding climate variability and the hydrological cycle

- Surface Mass Balance in East Antarctica

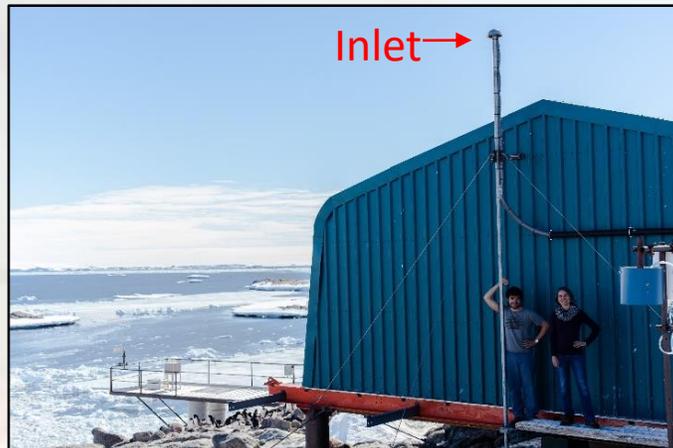
- + Precipitation
- Sublimation
- Melt
- + Refreeze

- Recent climate variability: Moisture sources

⇒ study of the hydrological cycle
with continuous measurements
of water isotopes



DDU (Dumont D'Urville station)



Specificity:

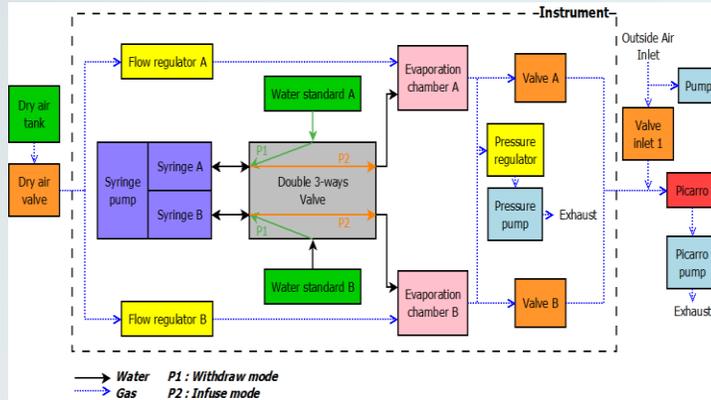
- Coastal (sea-ice influence)
- High accumulation rate (30cm w.e./ year)
- Strong katabatic wind

Measurement since December 2018:

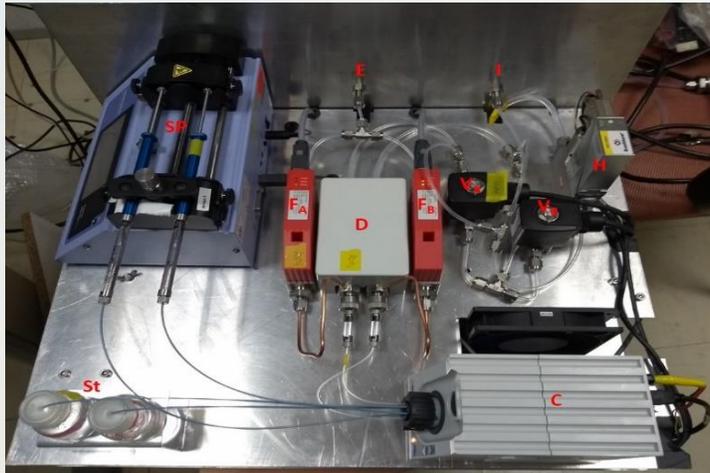
- Continuous monitoring of water isotopic composition
- Snow sample collection:
 - Precipitation (1/event)
 - Blowing snow (1/event)
 - Surface snow (1/week)
- Meteorological observatory (Meteo France)

Measurement: Low humidity calibration challenge

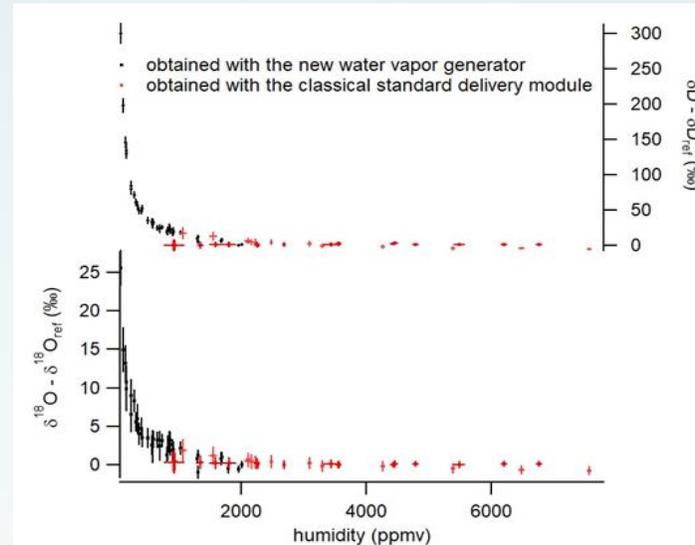
Specific low humidity generator developed



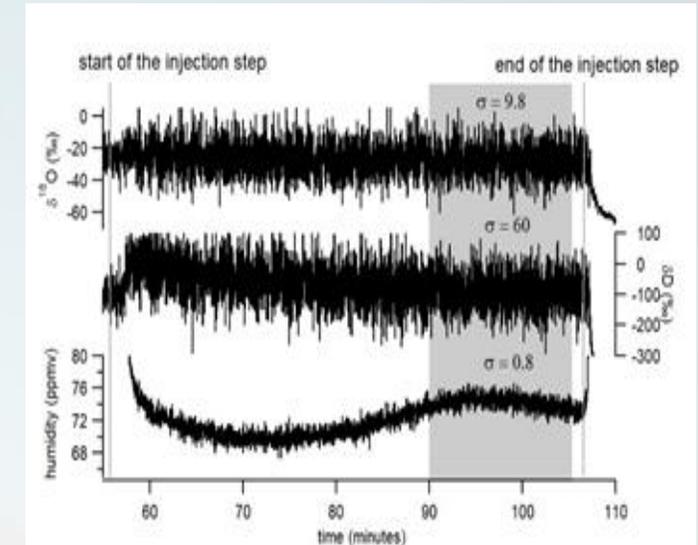
Humidity generator schematic diagram



Picture of the upper stage of the instrument with the main fluidic parts



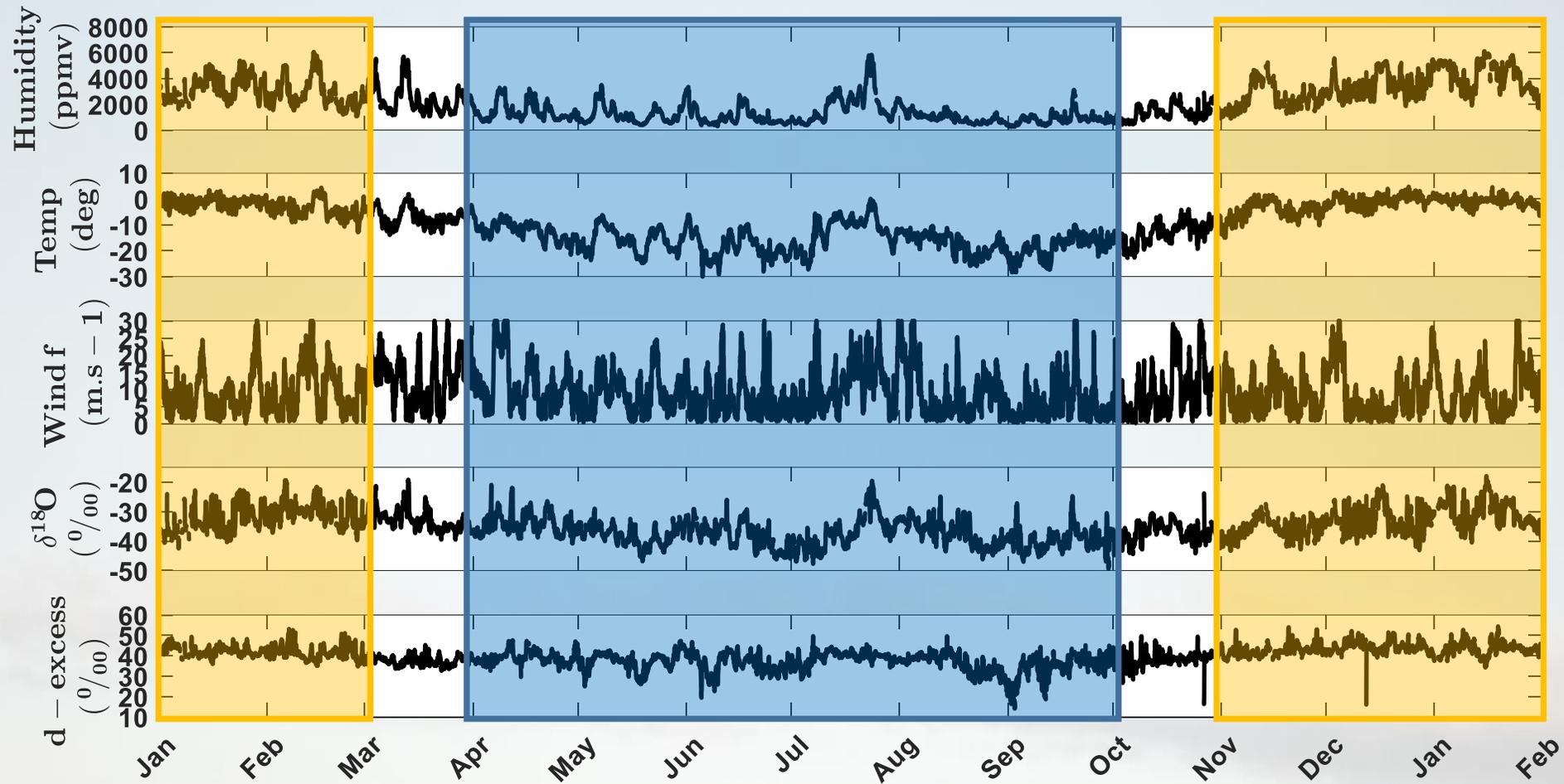
Influence of humidity on the isotopic composition ($d^{18}O$ and dD) of the vapor obtained with a standard delivery module (red) and with our new water vapor generator (black).



Records of $d^{18}O$, dD and humidity over a 72 ppmv humidity plateau obtained with the humidity generator.

C. Leroy-Dos Santos et al., A dedicated robust instrument for water vapor generation at low humidity for deployment of laser spectroscopy instrument in cold and dry polar regions, in preparation

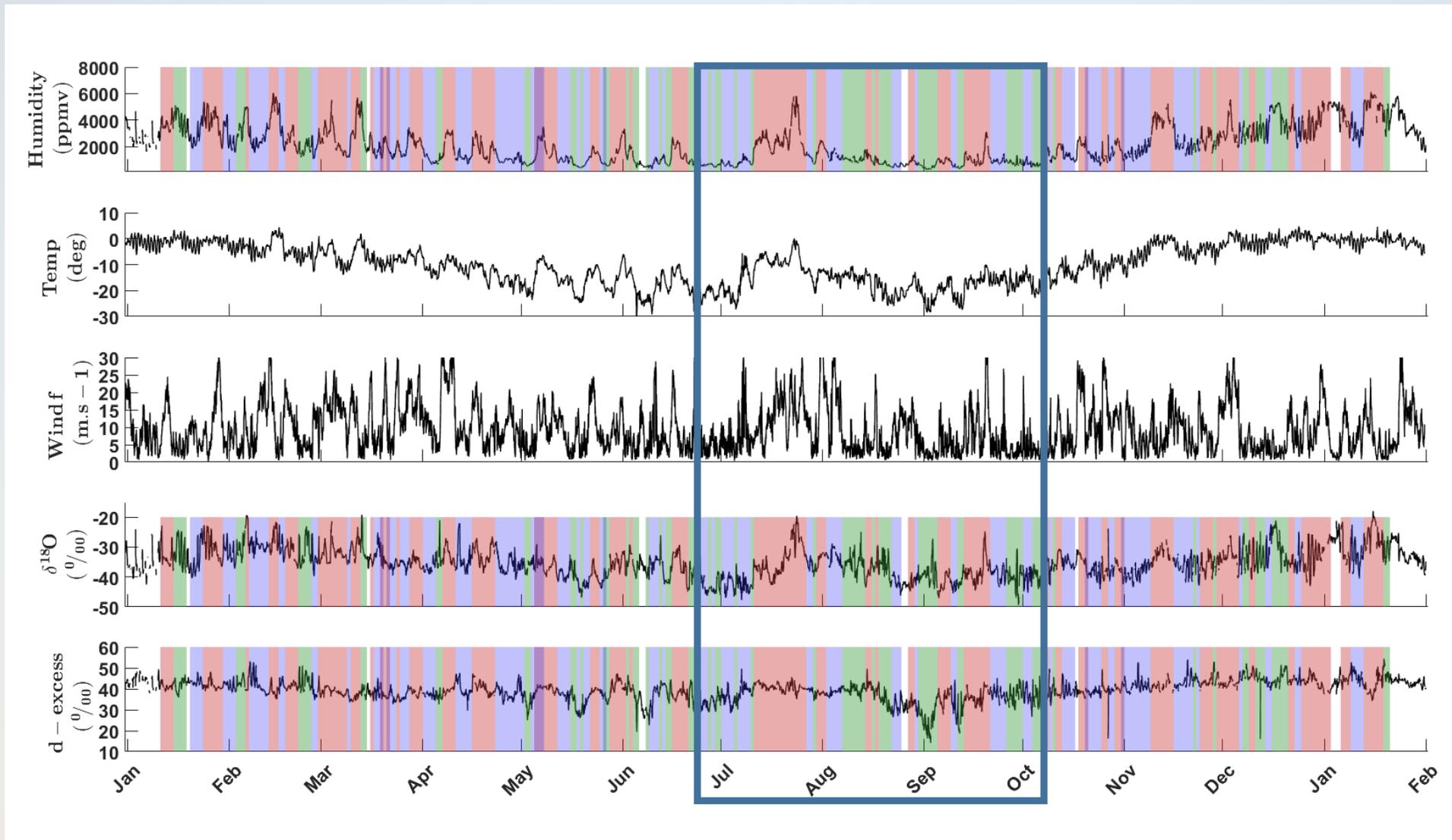
Results: 13 months of measurements in 2019/2020



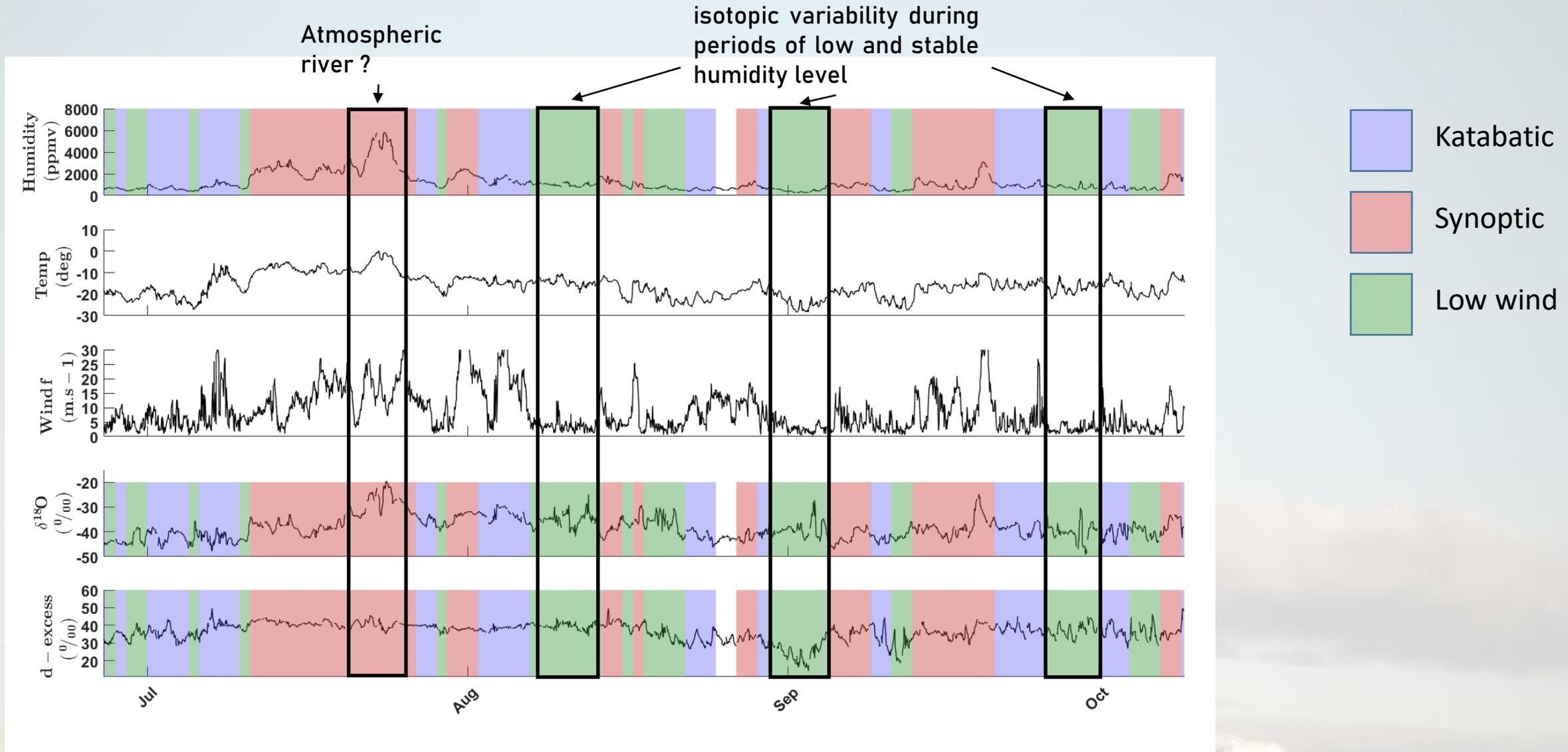
Summer weather regime:
diurnal + synoptic

Winter weather regime:
synoptic

Results: Meteorological classification

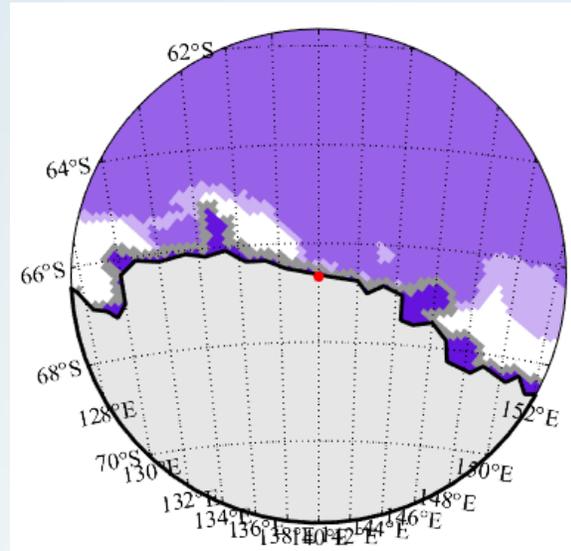


Results: Specific cases to study

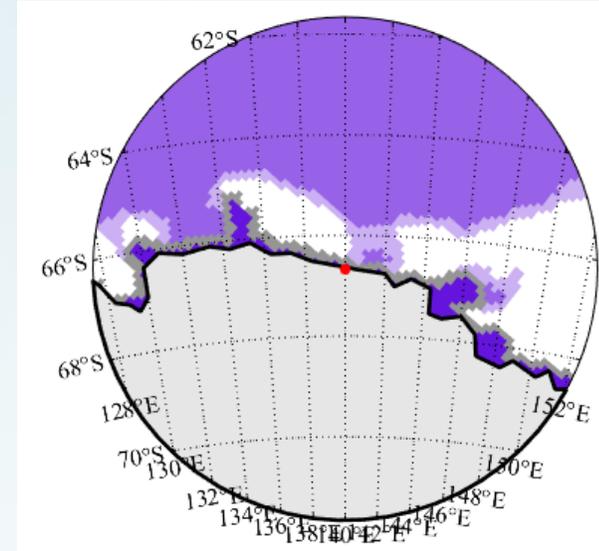


Perspectives

- Sea-ice edge influence



January 2019



January 2020

- Comparison with snow sample isotopic composition
- Radar information on precipitation formation height
- Back-trajectory diagnostic tool (as in C. Leroy-Dos Santos et al., JGR, submitted, 2020)
- Application to ice core water isotopic profiles