The AWACA Project

Atmospheric WAter Cycle over Antarctica

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I. Context

Precipitations accumulating over Antarctica are equivalent to 5.5mm/yr of sea-level fall *(Agosta et al, 2019)*, and while they seem to increase in response to higher temperatures (*Frieler et al, 2015*), loss terms for the polar cap which contribute to sea-level rise such as ice calving intensify.

In order to predict Antarctica's future, global climate models calibration and optimization need extensive observation datasets. However, due to the extreme conditions of the coldest, windiest and highest continent on Earth, *in-situ* observations remain scarce, mainly coastal and during summertime.

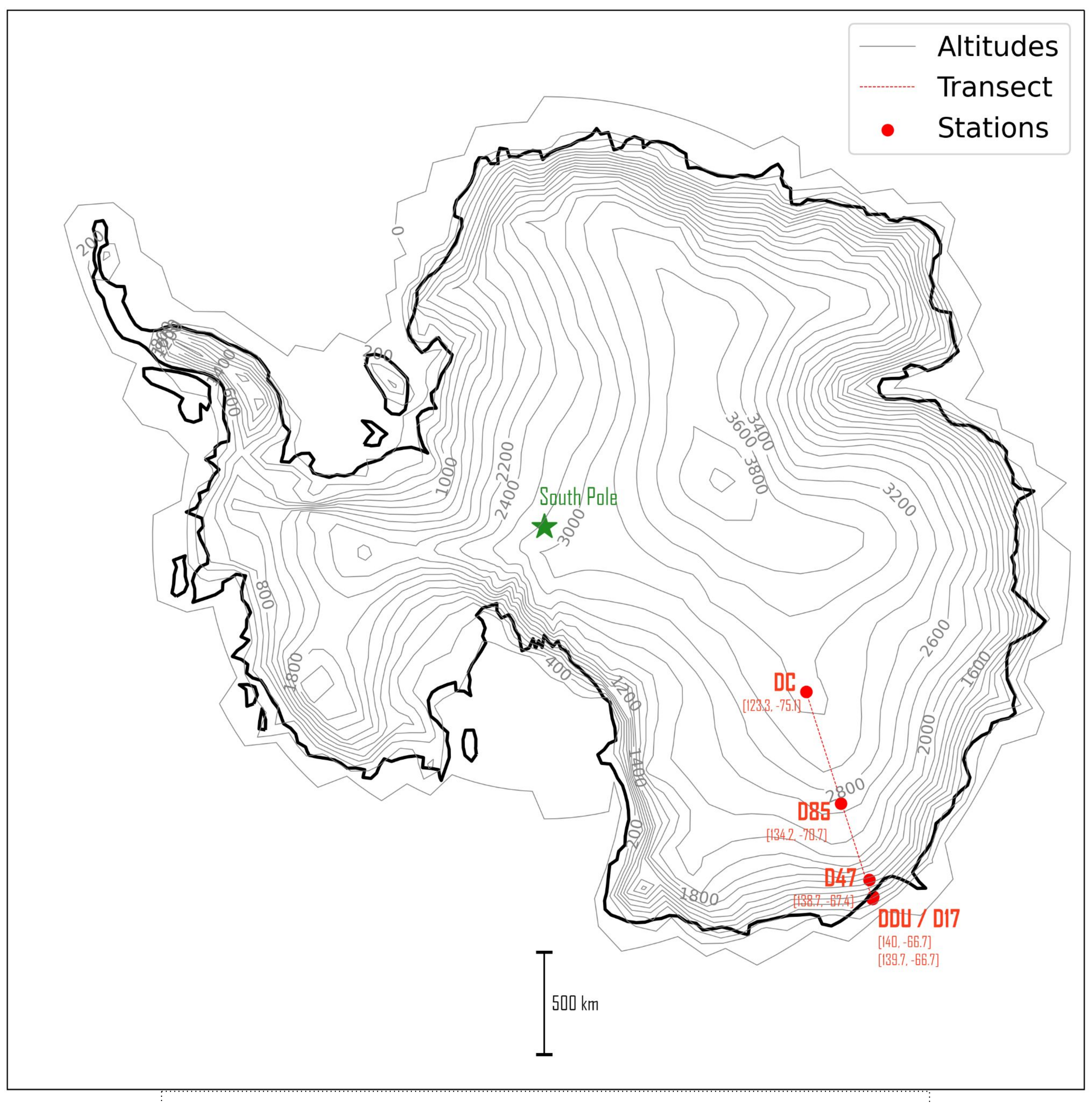

Figure 1 : The AWACA transect.

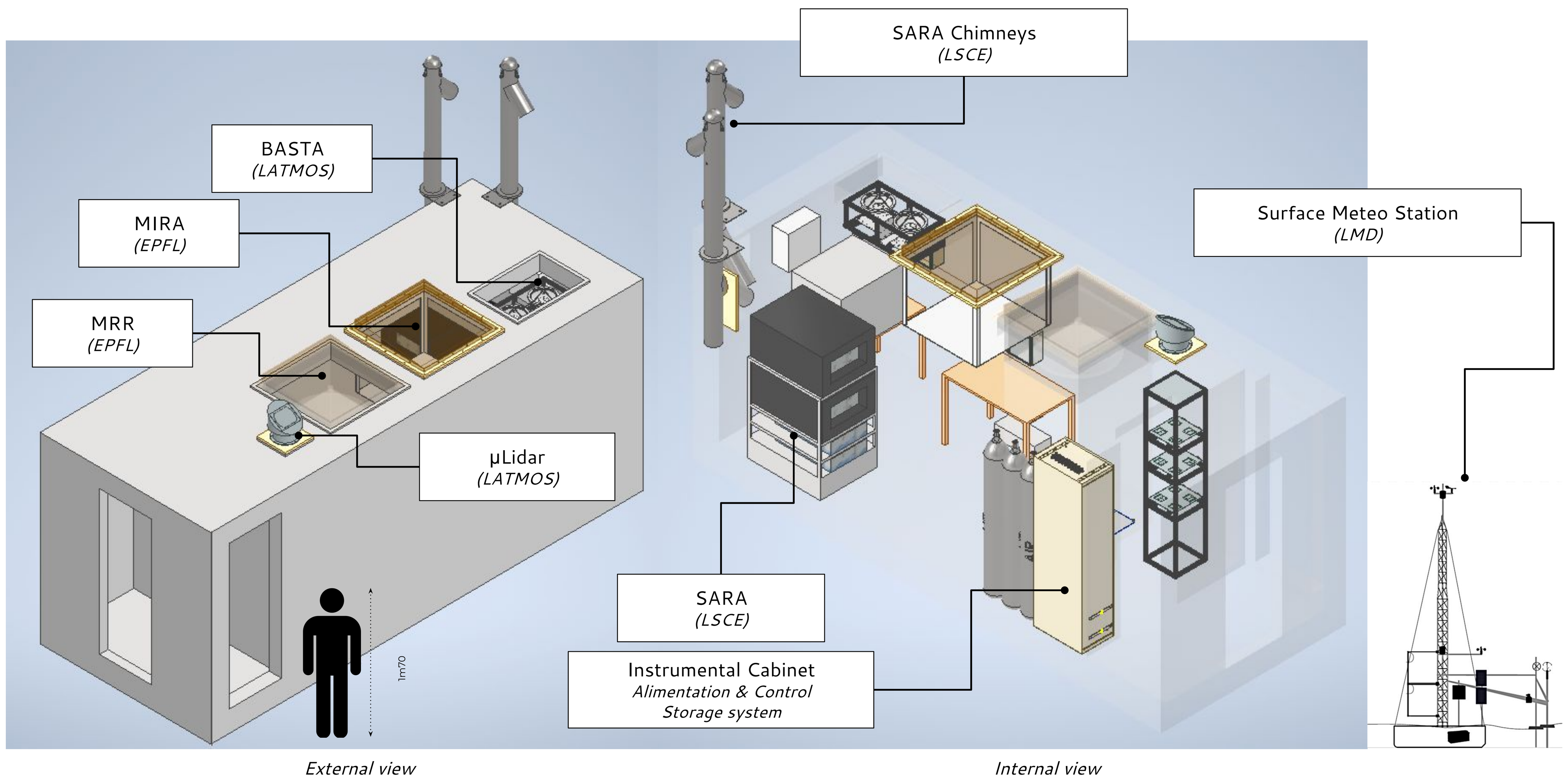

Figure 2 : The Instrumental OPU.

II. Project

The AWACA project aims at instrumenting 5 sites from Adélie Land at the coast to 1000 km inland on the plateau (see figure 1).

Clouds, aerosols and precipitations will be investigated by 4 radars of different wavelengths, whereas water isotopes measurements will be used to improve ice-cores transfer functions calibration for recent past (<1000 years). Surface meteorology towers will also be deployed to capture boundary layer processes and heat and mass fluxes between the atmosphere and the snow layer.

III. Shelters

3 of those sites (D17, D47 and D85) are located off-station and will therefore be energy self-sufficient. OPUs (*Operational Platform Units*, see figure 2) have been designed to shelter the various instruments, data processing and storage equipments and the energy system.

Portholes on the roof will allow radar beams to pass through, and a vacuum chimney will provide the infrared spectrometer with water vapor and snowflakes in order to measure water isotopes. The isotopes analysers needing a near-constant temperature to work correctly, a thermoregulation of the shelter will be applied.

Each remote site includes an instrumental shelter (see figure 2), an energy shelter equipped with solar panels, wind turbines and methanol fuel cells (not shown) supplying 1kW, and a surface meteorology tower (see figure 3), all three being set on movable sledges. The large range of meteorological conditions along the transect have been taken into account in the OPUs' design and thermoregulation.

IV. Surface Meteorology

Apart from standard meteorological measurements (wind, temperature and humidity) at two levels (2 and 7m), the surface meteo towers will monitor visible and infrared net radiations (*SN500SS*), drifting snow fluxes using an acoustic device (*FlowCapt-FC4*) and atmospheric turbulence using a sonic anemometer (*METEK uSonic-3_Omni*). A steel offset structure will be set up to limit tower perturbations on several instruments.
A first test deployment of a surface meteorology tower will be carried out during next austral summer 2022-2023 at the D47 site.

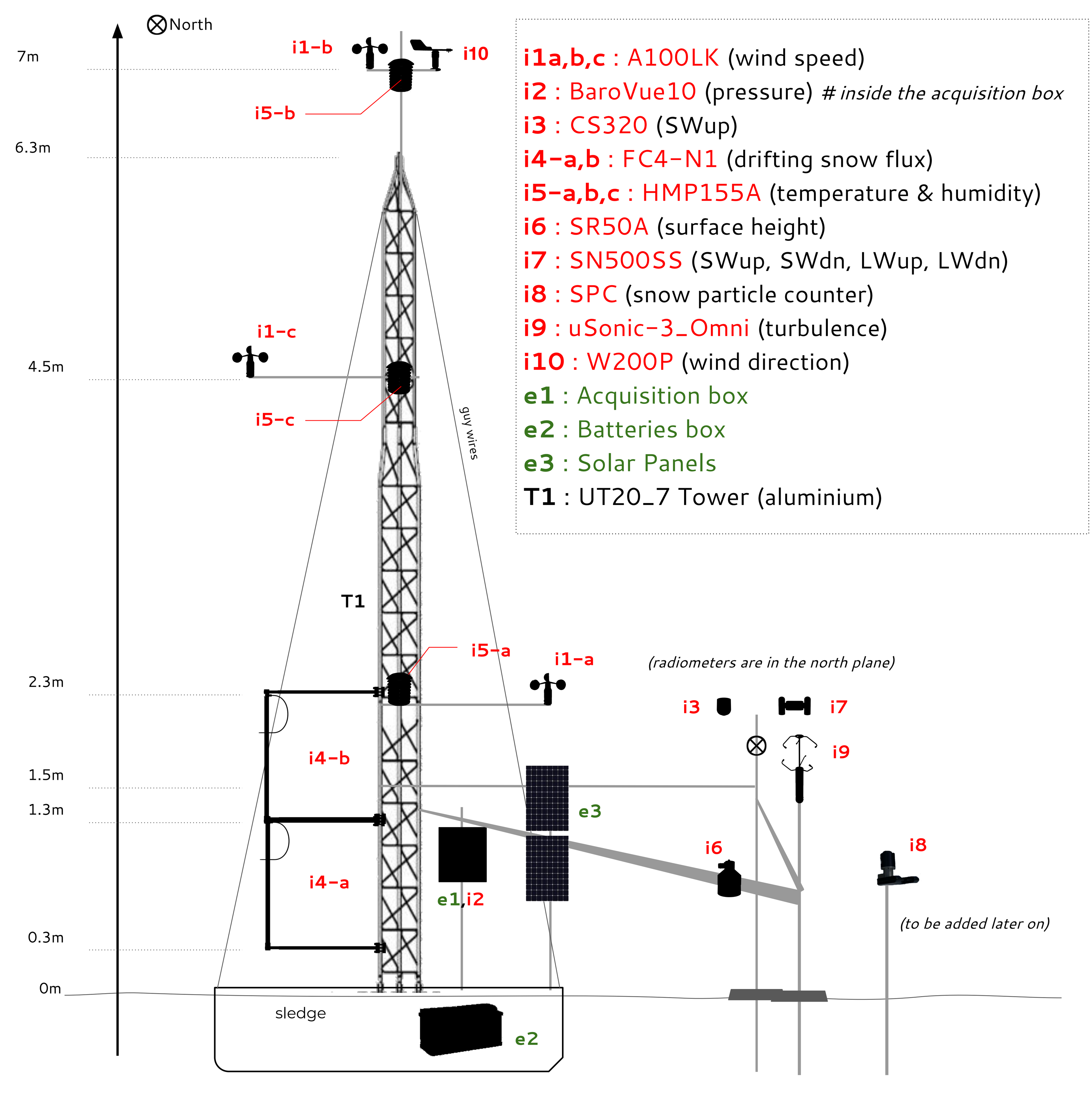

Figure 3 : The Surface Meteo Tower.