Preliminary studies on high frequency wind and temperature measurements over an instrumented profile tower in Dome C Antarctica ; attempting to estimate some turbulent parameters through unstable and stable boundary layer conditions above snow surface.

ABSTRACT : Atmospheric turbulent measurements with sonic anemometers are permanently performed at Dome C, East Antarctica, since 2008 (Genthon et al, Fossat et al). However, parameters such as ustar (u*), sensible heat fluxes (shf) and turbulent kinetic energy (tke) have never been estimated above the Antarctic plateau at such a distance from the coast. We will focuse on the very first attempts to estimate these quantities during the austral summer (December 2009 - January 2010) throughout the Concordiasi campaign, part of which took place in the permanent French and Italian multi-scientific base “Concordia” (75.1◦ S, 123.3◦ E, 3233 m).

During these two months, the turbulent behaviour of wind and temperature is used to determine sensible heat flux (SHF) ranging from –5 to 15 W m^{-2}, the friction velocity (U*) between 0.05 and 0.2 m s^{-1}, and the turbulent kinetic energy (TKE) oscillating between 0.1 and 0.4 m^2 s^2. The three have a true diurnal evolution with a maximum at noon, a minimum while the sun is very low (“night”). At the end of the afternoon (16h LST), the observed daily weak convection is removed with stable stratification setup. Very often, strong changes in temperature and wind vertical gradient are observed (at 6h LST : +10°C and +10 m s^{-1} in the first 35 meters). Since high frequency measurements are performed up to 45 meters through 6 levels the variation of turbulence with the height can be investigated : the median diurnal cycle of SHF for each level is nearly similar with a slight discrepancy at “night” between the 8m-level and 45m-level (4 W m^{-2}). U* is slightly decreasing with height (-0.05 m s^{-1}), while TKE and MOL (Monin–Obukhof length) decrease quickly between level1 and the others.
Along with turbulent flux computations with Eddy-Covariance (EC) and Profile methods (PM), model diagnostics from Isba Crocus (Brun et al. 2010), Arome are analyzed and compared with the computed fluxes, with good agreement.