

Single Star Scidar first light from Dôme C

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1. Introduction

In the recent years, a lot of instruments have been put into operation during the polar summer at Dôme C., Then, during the first polar night when the Astro-Concordia station was open for the first time during winter, about 40 balloons (Azouit & Vernin (2005)) instrumented to measure optical turbulence profiles and 2 Differential Image Motion Monitors (DIMM) were setup. The main results from this first important campaign are found in Agabi *et al.* (2006). It appears from this first night time observations that almost all the optical turbulence was concentrated in the first 30 m above the ice. At an elevation of 8.5 m above the ice the seeing is about $1''.4$, while above an elevation of 30 m the seeing drops down to $0''.36$. This last figure is coherent with the estimation from Lawrence *et al.* (2004) if one takes into account that they were not sensitive to the first 30 m., which corresponds to the turbulent surface layer.

For the second winter, we decided to implement the so-called Single Star Scidar (for SSS see Habib *et al.* 2005, 2006) in order to assess continuously the vertical profiles of both the optical turbulence and the wind speed. Indeed, a balloon gives a cut of the atmosphere with a very good vertical resolution but it traverses optical turbulent layers in few seconds. The SSS technique is able to retrieve both $C_N^2(h)$ and $\mathbf{V}(h)$ vertical profiles from the ground up to 25–30 km each 15 s, during hours. At Dôme C, and tracking Canopus bright star, it becomes possible to monitor $C_N^2(h)$ and $\mathbf{V}(h)$ during days almost continuously.

2. First light

During spring 2005 began the construction of the Antarctic SSS which was sent to Dôme C during the fall of the same year. Then the instrument was setup on top of a 8.5 m high plateform (see Fig. 1) by one of the authors (MC) with the precious help of E. Aristidi, and, on February 4th, we got the first light from this 40 cm telescope (see <<http://www-luan.unice.fr/CHADID/chadid-aristidi.htm>>).

Then, night time measurements were performed by E. Aristidi during the whole winter, from March to August. Thousands of profiles were obtained during almost 400 hr of observations. From this huge set of measurements, only a small part have been processed yet in our laboratory, since only few minutes of observations can be sent by e-mail per day.

3. First profiles

To imagine what will be the installation of a large telescope at Dôme C, and what will be the consequences of an interaction between such a building and the optical turbulence concentrated in the surface layer, it was of major importance to have the detailed structure of both $C_N^2(h)$ and $\mathbf{V}(h)$ profiles. But the vertical resolution of the SSS is around one km. Thus we decided to leave the Simulated Annealing method to reconstruct four

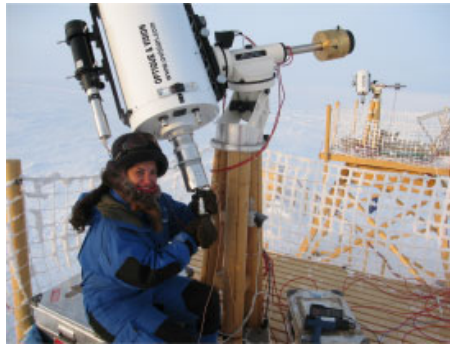


Figure 1. Installation of the Single Star Scidar on a 8.5 m high platform at Dôme C during summer 2005.

arbitrary layers at ice level, and the other layers distributed every 1 km. Of course, SSS is not able to distinguish between the altitude of the first four layers, but we assumed that the wind speed is increasing from the bottom to the top of the surface layer, and thus it became possible to sort the four first layers with increasing speed.

As we already know that most of the optical turbulence is concentrated within the first 30 m, and that we are very interested in the $C_N^2(h)$ and $\mathbf{V}(h)$ profiles within those 30 m, we left the SA algorithm to reconstruct four layers within the SL. In Fig. 2 one can see the rapid decrease of the optical turbulence intensity and the rapid increase of the wind speed. The seeing deduced from the optical turbulence profile is $0''.56$, very close to the $0''.6$ – $0''.7$ measured by the DIMM at the same time.

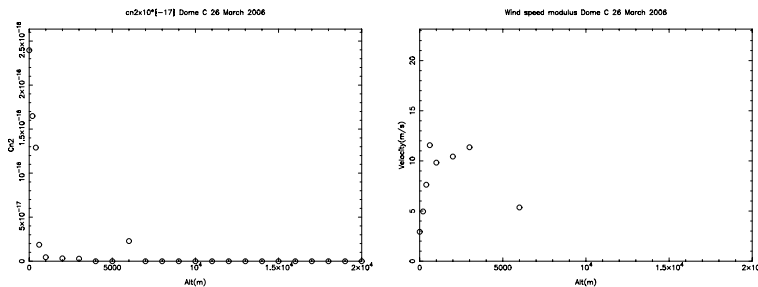


Figure 2. *Left:* Optical turbulence profile. Rapid decrease of the C_N^2 in the surface layer and a layer at 6 km. *Right:* Wind speed rapidly increases from 3 to 13 ms^{-1} in the SL.

4. Conclusion

The Antarctica Single Star Scidar was installed at Dôme C during January–February 2006 and ran almost continuously from March to August giving thousands $C_N^2(h)$ and $\mathbf{V}(h)$ profiles. This will help to have a better knowledge of the optical turbulence within the surface layer as well as the free atmosphere.

References

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