Seeing at La Silla: LASSCA 86

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At the end of January 1986, a team of ten observers gathered at the observatory for a two week experiment of a new kind. Their aim was not to explore remote and fascinating stellar objects. They wanted to track a lifelong enemy, and also inevitable companion of every astronomer: the seeing.

The La Silla Seeing Campaign (LASSCA) was scheduled within the framework of the VLT working group for site evaluation, chaired by H. Van der Laan. The scientific community had immediately agreed to reserve simultaneous observing time on three telescopes. Proverbially, it was obviously necessary to look in detail at what was happening at our own front door before making comparisons with other places. Lassca was certainly the first experiment of this size dedicated to scientific analysis of atmospheric turbulence.

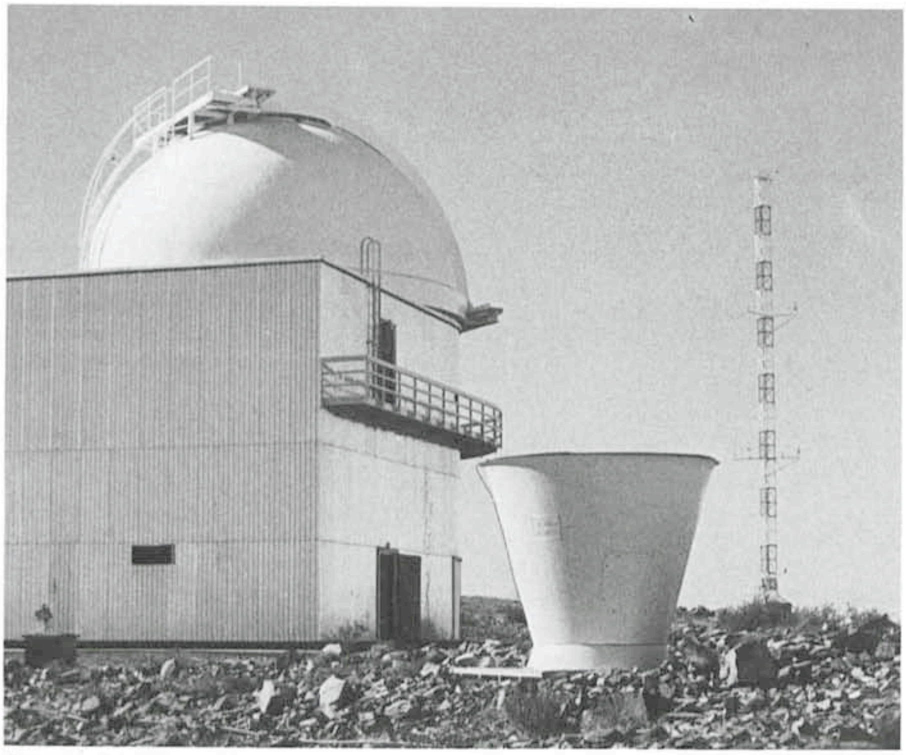

Figure 1: *SODAR antenna and meteo mast near the 1-m telescope at La Silla.*

The permanent site monitoring instrumentation includes a meteorological station and an acoustic sounder also named SODAR (Sound detection and ranging [Fig. 1]). To these devices was added a radar for tracking tropospheric balloons, on loan from the Centre National de Recherches Météorologiques (CNRM, Toulouse [Fig. 2]). A full monitoring of the atmosphere from the ground to more than 20 km altitude was then possible: The acoustic sounder displays the invisible microthermal perturbations which affect starlight between 30 m and 800 m altitude over the site (Fig. 3). It is an ideal tool for understanding the sudden changes in image quality during the course of an observing run. The conversion of its output into equivalent image width is relatively straightforward.

The analysis of the free atmosphere with free balloons permits the detection of any particularity of the site. An example is the Jet Stream whose 200 km wide core sometimes stays over the observatory at 12 km altitude (Fig. 4). The wind velocity there may reach 200 km/h and models are being developed to relate wind shear and temperature gradient to thermal turbulence and thus, to seeing.

Leaving aside the increase in image size, the high atmosphere is also responsible for shortening the lifetime of speckles (by increasing their number and their agitation) and for reducing the isoplanatic angle (solid angle in which two stars may be considered as coherent sources). Such parameters decide the efficiency of interferometric

Figure 2: *Radiosonde tracking system.*

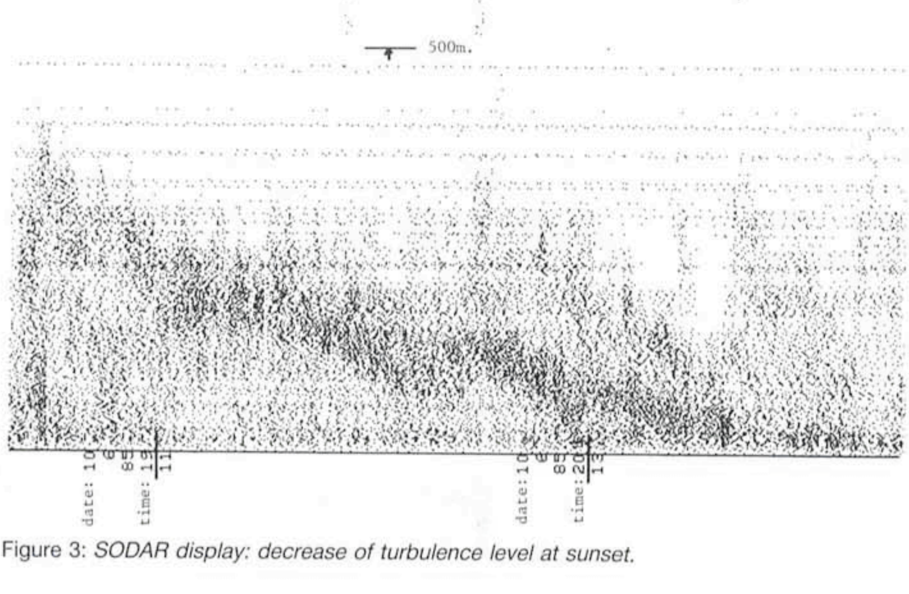

Figure 3: *SODAR display: decrease of turbulence level at sunset.*

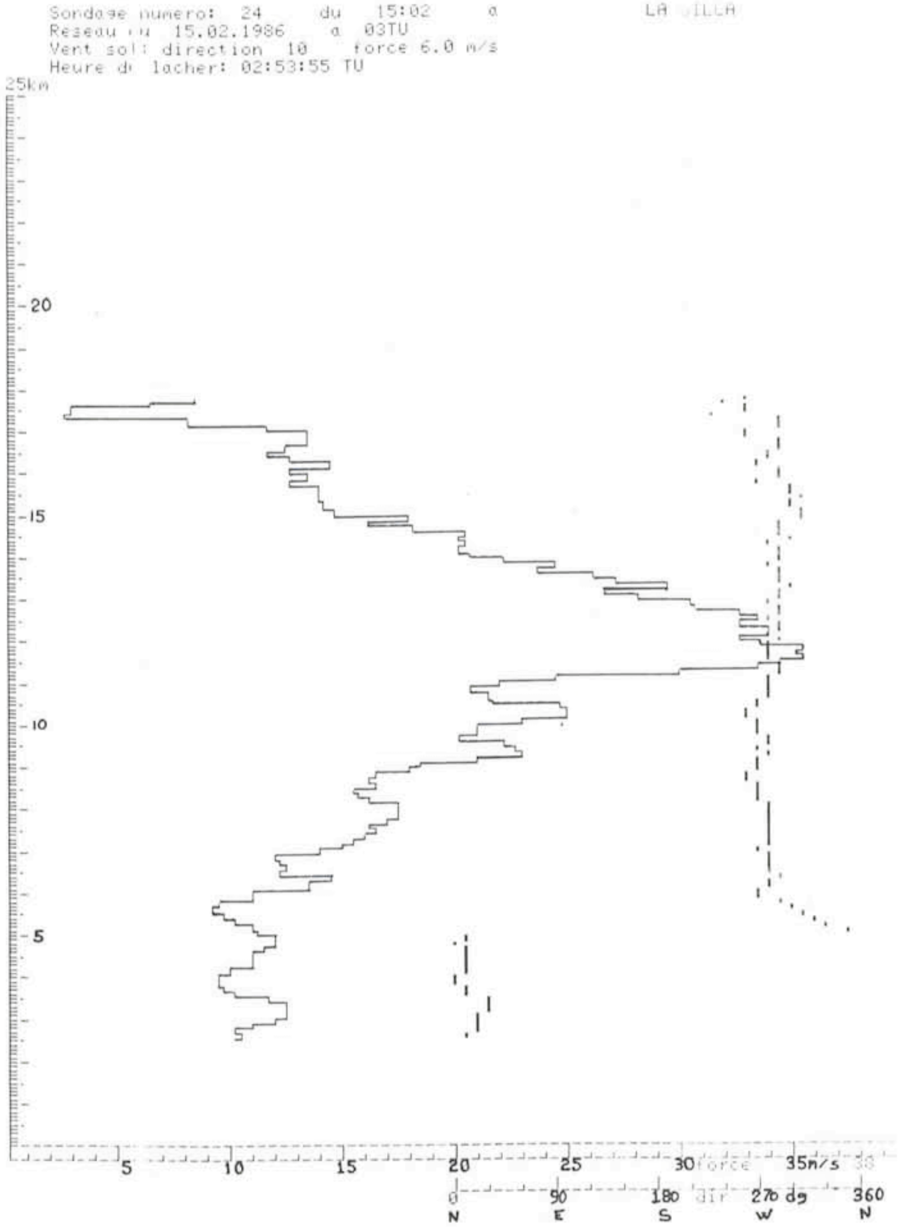

Figure 4: *Tropospheric sounding output in presence of the jet stream.*

methods and are of prime importance for the development of adaptive optics systems foreseen for the VLT.

Speckle lifetime, isoplanatic patch, image size with and without image motion were simultaneously monitored by G. Weigelt, G. Baier and P. Koller at the 2.2-m telescope. Thousands of speckle interferograms from single and double stars have been recorded using ICCD or a movie camera.

From the 1.52-m ESO telescope, J. Vernin and M. Azouit have been observing the scintillation characteristics of the same stellar sources with the SCIDAR technique (Scintillation Detection and Ranging). They could derive the vertical profiles of refractive index inhomogeneities from 1 km up to 10 or even 30 km over the site, according to double star angular separation.

Last but not least, the shearing interferometer of F. and C. Roddier was installed at the focus of the 50-cm ESO telescope. This device is considered as an absolute calibrator for the determination of the atmospheric point spread function since it is not sensitive to telescope optical aberrations or misfocusing.

Processing data and delivering conclusions is not the smallest part of the work but preliminary results allow us to hope that the analysis will be complete by the end of the year. Besides the increase in the knowledge of our observing environment, these measurements will allow some estimation of dome seeing. They also have been of great help for the calibration of the site testing seeing monitor, scheduled to start routine operation in August.

Very Large Telescope: Recent Developments

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Readers may feel badly informed about the development of the Very Large Telescope project, since no article appeared in the *Messenger* after December 1983 – a time when the VLT concept was still wide open. Since then, a concept – the linear array – has been presented at the IAU Conference in April 1984 at Garching. The internal study group was firmly established and began a thorough investigation of the array concept towards the end of 1984. Quite a number of studies – most of them feasibility studies of critical aspects – have been performed and a synthesis report of this initial phase, roughly equivalent to the phase A of space projects, has recently been issued.

The ESO base-line concept, called the linear array, consists of 4 independent 8-metre telescopes, with alt-azimuth mounts, operating in the open air but protected, when not observing, by removable shelters. The maximum operating wind speed in the free flow has been provisionally set to 9 m/sec which corresponds to about two thirds of the night time conditions at La Silla. For stronger winds, a wind screen is erected and reduces the average wind velocity in the region of the telescope by about 50 %. Because strong winds in Chile are effectively blowing from the same direction (north-south) the wind screen can be fixed independent of the telescope. An aerodynamic numerical analysis has shown that a promising concept would consist of a platform covering the space between the wind screen and the telescope and located at about 10 metres above the ground. Low air layers are captured beneath the platform thus creating a depression behind the wind screen. The result, illustrated by Figure 1, shows that the wind load on the telescope and particularly in the region of the primary mirror is greatly reduced, whereas the air stream is accel-