

Turbulence Profiles in the Observatories of the Canary Islands: Preliminary Statistics for Adaptive Optics

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ABSTRACT

Knowledge of vertical structure of the turbulence in a site is an essential input for the requirements, performances and operation of Adaptive Optics systems. The statistics of the turbulence intensity and the coherence time of the layers affect the complexity of the design and implementation of a particular MCAO system. On the other hand, the operation of such systems could be optimised if the height and velocity of the layers were available in real time.

We present statistical results of the SCIDAR turbulence profiles obtained at the observatories Canary Islands. Statistics of characteristic parameters, of special interest for MCAO, are presented here, together with their temporal evolution. The results have been checked with simultaneous meteorological measurements. We have used the balloon sounding meteorological database of the Instituto Nacional de Meteorología of the Santa Cruz station (Tenerife) to evaluate the physical conditions related with the behaviour of the optical propagation. We have compared this study with the database of indirect measurements from satellites. The reliability of these data has been proved in relation to the balloon meteorological database for all height levels on Tenerife.

Keywords: Adaptive Optics, Vertical Turbulence Profiles, Site Characterization

1. INTRODUCTION

The site quality has been traditionally characterised by the seeing size (zero moment of C_n^2), the stability of weather conditions, and useful observing time. Abundant publications give statistical results of sites (e.g. Vernin & Muñoz-Tuñón, 1994 and 1995) for Roque de los Muchachos and Teide Observatories. However, although an experimental knowledge of the spatial and temporal vertical structure of the turbulence is crucial for optimizing the efficiency of adaptive optics systems, not enough effort has been devoted to getting continuous and systematic data. In 2002 November we started a long campaign of observations to characterize the vertical structure of the turbulence above the Roque de los Muchachos and Teide Observatories using generalized-SCIDAR technique.

The classical SCIDAR (**Scintillation Detection And Ranging**) technique was proposed by Vernin & Roddier (1973) and developed over a period of several years (Rocca, A., Roddier, F. & Vernin, J., 1974), but this one did not allow the measurement of the turbulence in the lower atmospheric layers above the telescope dome. In order to overcome this disadvantage, Funchs, Tallon, & Vernin (1994 and 1998) proposed the generalized-SCIDAR version, which has been successfully tested and exploited in the recent years (Ávila, Vernin & Masciadri 1997; Ávila, Vernin & Cuevas 1998;

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