

Detailed Study of 200 mbar Wind Speed at the Canary Island

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ABSTRACT

We present a comprehensive and reliable statistics of 200 mbar wind speeds at the Canary Islands based on long term climate diagnostics archive data and balloon measurements. The results demonstrate the remarkable stability of the Canarian sky, with low mean values of $V_{200}=22.12 \text{ ms}^{-1}$ at the Roque de los Muchachos Observatory (ORM, La Palma, Spain) and provide independent confirmation of the potential of Canary Islands for adaptive optics. A comparison of V_{200} values from a climatological database and in situ measurements with radiosondes launched from Santa Cruz de Tenerife (Tenerife Island, Spain) reveals an excellent level of agreement, which lends confidence to the claim that climate diagnostics measurements provide an useful tool for astronomical site assessment, although a rigorous control of data quality, analysis and cross comparison needs to be performed before the method becomes extensively used. Moreover, the correlation of results for La Palma and Tenerife confirms the homogeneity of the Canarian sky at the tropopause level. The analysis of frequencies and variability of V_{200} led us to propose a seasonal periodicity of V_{200} . We also compare the results obtained at La Palma with those from Mauna Kea, Paranal, and La Silla.

Keywords: Astronomical Observatories, Site Testing, Site Selection, Wind Speed, Instrumentation: Adaptive Optics

1. INTRODUCTION

Traditional selection criteria for astronomical observatories were based on quality and stability of weather conditions and useful time at observing sites. These parameters are still essential, but the excellent image quality requirements of future very large telescopes need more strict constraints on site-quality and hence, new specific parameters are being proposed for site characterization (see e.g. Muñoz-Tuñón, Vernin & Sarazin this proceedings and references therein for a compilation of relevant parameters for selecting astronomical sites).

The wind speed at 200 mbar pressure level is one of the parameters recently proposed for site evaluation (Sarazin & Tokovinin 2002). This parameter is based on the idea that the maximum wind speed at a particular location, and hence the greatest potential for turbulence generation, occurs at approximately the tropopause level (~ 200 mbar pressure level). In fact, Sarazin & Tokovinin (2002) found a good correlation between V_{200} and the average velocity of turbulence V_0 , $V_0=0.4 V_{200}$, at Paranal and Cerro Pachón. Although this relation has not yet been tested at other sites, it has been assumed that it is valid everywhere, and hence it could serve to parametrize the most relevant parameters for adaptive optics in terms of V_{200} , such as coherence time and isoplanatic angle.

The long-term data available in climatological databases constitute a very useful source to study the behaviour and statistics of many meteorological parameters, such as V_{200} . Several statistical works of the wind speed at 200 mbar have been recently presented to rank existing and potential sites by using data from climatological databases (Sarazin et al. 2002, 2003; Sarazin 2002a,b). The poor results of V_{200} statistics on the cited works for Roque de los Muchachos site on the island of La Palma, Canary Islands, Spain (ORM hereafter) were in clear contradiction with its indisputable excellent image quality (Muñoz-Tuñón 2002; Wilson et al. 1999; Muñoz-Tuñón, Varela, & Mahoney 1998; Muñoz-Tuñón, Vernin, & Varela 1997). This discrepancy may suggest that

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