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Title: Accuracy of MASS turbulence profiles at Paranal

Abstract:

Adaptive optics observations at Paranal are supported by several turbulence profiling instruments that measure the vertical profile of atmospheric turbulence. These include a multi-aperture scintillation sensor (MASS), which measures the turbulence strength in 6 altitude resolution elements centred at 0.5, 1, 2, 4, 8 and 16 km, and a stereo scintillation detection and ranging (S-SCIDAR) instrument which measures the complete profile with a resolution of several hundred metres.

A layer-by-layer comparison has been made between concurrent S-SCIDAR and MASS measurements by binning the S-SCIDAR profiles according to MASS response functions. MASS is shown to significantly over- or underestimate some layers compared to S-SCIDAR, but the sum of all 6 layers is quite consistent between the two instruments.

An end-to-end Monte Carlo simulation of the MASS instrument has been developed as a tool to investigate the discrepancy. Turbulence profiles have been recovered successfully from simulated MASS data; they do not exhibit the biases observed between MASS and S-SCIDAR. This indicates that the discrepancy does not originate from a flaw in the MASS profile fitting method. Alternative explanations are discussed.