Abstract

Ground-based solar observations are strongly affected by optical turbulence. The concept of a new instrument which allows one to measure both spatial and temporal parameters of atmospheric turbulence has been proposed in the late 1990s. The instrument MISOLFA (Moniteur d'Images Solaire Franco-Algerien) is based on this concept and has been developed over the past 10 years in the framework of a ground-based solar astrometry programme and in parallel to the development of several night time turbulence monitors at Calern Observatory, south of France. In this paper, we first describe its instrumental concept, the technical choices that were made to meet the specifications and discuss the difficulties encountered. Using numerical simulations, we present and test the methods that can be used in order to estimate the turbulence parameters from both MISOLFA image and pupil planes. The effect of finite outer scale on Fried parameter estimation from a simple estimate of the angle-of-arrival variance is clearly shown. Finally, we present the first results obtained with the instrument fully operating in its two observing planes. We obtained a mean value of angle-of-arrival coherence time of 5.3 ms, and good agreement is found between spatial parameters obtained with image and pupil planes. First estimates of the atmospheric structure constant C-n(2)(h) and outer scale L-0(h) profiles are also presented which illustrates the profiling capacities of the new instrument.