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# Emulating atmospheric surface layer conditions with a forced convector for optical turbulence studies

Pablo Garrido<sup>\*1</sup>, Darío Pérez<sup>1</sup>, Gabriel Torrealba<sup>2</sup>, Diego Carrasco<sup>2</sup>, and Aarón Cofré<sup>2,3,4,5</sup>

<sup>1</sup>Pontificia Universidad Católica de Valparaíso – Chile

<sup>2</sup>Pontificia Universidad Católica de Valparaíso – Chile

<sup>3</sup>Universidad de la frontera [Tecumo, Chile] = University of La Frontera [Tecumo, Chile] = Université de La Frontera [Tecumo, Chili] – Chile

<sup>4</sup>Universidad de Chile – Chile

<sup>5</sup>Universidad Miguel Hernández [Elche] – Spain

## Abstract

Atmospheric turbulence, particularly at extremely large telescopes (ELTs), presents significant challenges due to its chaotic nature and its impact on the quality of astronomical observations. In this study, we have developed a forced convector designed to emulate conditions found at the surface boundary layer or at observatory enclosures.

Our device consists of a set of fans and heaters that generate a controlled flow of hot air, which passes through a honeycomb structure to ensure an initial laminar flow. Temperature measurements are taken at different heights above the honeycomb exit using high-speed fiber-optic thermometers. These probes were synchronized with a set of four high-speed cameras observing extended targets behind the convector, which allowed us to study phase and irradiance fluctuations under different turbulence configurations.

This experiment provides a better understanding of the interaction between thermal and optical turbulence. It not only provides a tool to characterize turbulence under controlled conditions but also offers valuable information to improve observations on ELTs. The data obtained can be used to optimize turbulence correction techniques, such as adaptive optics, thereby improving the quality of astronomical images.

**Keywords:** Atmospheric turbulence, Extremely large telescopes (ELTs), Surface boundary layer, Forced convector, Turbulence characterization

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\*Speaker