

# Sodium layer variability, measured with the UBC lidar

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Modern astronomical instrumentation employs adaptive optics (AO) systems that correct for atmospheric distortion in real time in order to produce sharper images. The design and performance of these systems relies on the knowledge of the atmosphere both at low and high altitude. The use of laser guide stars (LGS) increases sky coverage and the field of view, but relies on resonantly excited sodium atoms in the mesosphere. Upper atmospheric dynamics causes varying sodium density, which produces focus-induced wavefront errors in LGS AO systems. We equipped the University of British Columbia 6-m Large Zenith Telescope in Vancouver with a lidar system to record high-resolution sodium layer data.

After introducing the system details, I will focus on results from three years of lidar measurements revealing large spatial variability, strong nightly variations and meteor spikes in sodium density on sub-second time scales. Subsequently I will discuss recent upgrades that enable us to measure horizontal variations, which lead to differential focus errors, an important aspect for multi-laser guide star facilities and multi-object adaptive optics.