A SIMPLE MODEL FOR ATMOSPHERIC REFRACTIVE INDEX FLUCTUATIONS IN THE TROPICS

Laser beams propagating through the atmosphere are distorted by turbulence. Random fluctuations in atmospheric temperature (and consequently refractive index) lead to scintillations and signal attenuation and could adversely affect wireless optical communication, laser remote sensing, and optical astronomy. It is essential to quantify the fluctuations in refractive index to model and build these optical systems. However, due to the complexity and cost of the sensors involved, it is not an easy task. A common approach followed is to make use of existing models. But, due to the abundance of solar radiation and the resulting stronger surface layer dynamics in the tropics, these models fail to provide accurate values in the tropics as compared to the locations from where they were developed. This points to the need for developing region-specific models. Using three-year weather station measurements from a semi-arid location in the Deccan Plateau, researchers from IISER Thiruvananthapuram and Divecha Centre for Climate Change developed a new model which performs better compared to the existing models. This simple model takes into account the two major sources of atmospheric refractive index fluctuations: temperature and wind speed gradients.

Reference: Hegde, R., Anand, N., Satheesh, S.K., Moorthy, K.K. (2024), Modeling the atmospheric refractive index structure parameter using micrometeorological observations, Applied Optics, 63 (16), pp. E10-E17

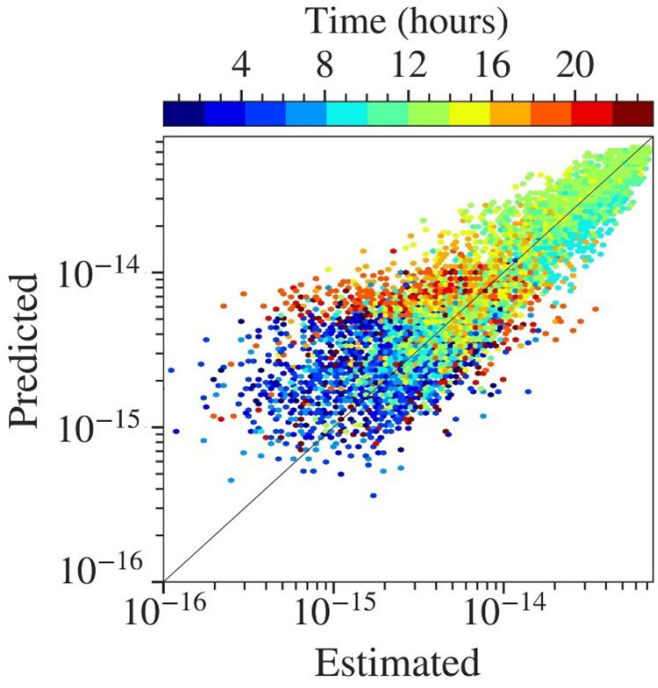

Figure: Comparison of refractive index fluctuations measured using the new simple model (predicted) with a collocated complex sensor (estimated).