

Turbulence Retrievals from Radio Occultations

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The COSMIC project has proven the utility of radio occultation (RO) in extraction of temperature profiles in the global atmosphere for application to numerical weather forecasting, with GPS satellites acting as the source of the occulted radio signals. However, it is also possible to extract information on the location and intensity of turbulence in the global atmosphere using RO. Such information is of considerable societal utility in applications such as aviation safety.

We present and contrast two different methods of turbulence retrieval. The first method depends on identifying non-stable regions of turbulence overturns in the potential temperature profiles extracted using GPS RO and characterizing the dissipation rate of turbulence kinetic energy by suitable assumptions on the overturn scale. This technique is useful at altitudes above 5 km, where humidity effects can be ignored, with vertical resolution being the prime limiting factor. The second technique uses the spectrum of refractive index fluctuations along the signal path to estimate the structure constant of these fluctuations. This method works best at high altitudes.

The principal limitation in understanding turbulence in the global free atmosphere is the extreme dearth of empirical data due to the expense and difficulty of deploying in-situ sensors. A few Stratosphere/Troposphere (ST) radars still in operation around the world do monitor turbulence in the atmospheric column above to altitudes of about 25 km. We identify RO events in COSMIC data archives occurring within a $1/2^\circ$ box encompassing the ST radar at Wales, UK, and compare the turbulence retrievals from the above two techniques to radar-retrieved values.