

## **Progress of Observations Understanding of Thermospheric Planetary Waves and Gravity Waves in the Equatorial and Low Latitude Regions.**

Hisao TAKAHASHI<sup>1#+</sup>, Cristiano WRASSE<sup>1</sup>, Igo PAULINO<sup>2</sup>, Viswanathan LAKSHMI NARAYANAN<sup>3</sup>, Mangalathayil ABDU<sup>4</sup>, Ana PAULINO<sup>5</sup>, Amelia ONOHARA<sup>1</sup>, Jonathan MAKELA<sup>6</sup>, John MERIWETHER<sup>7</sup>, Toshitaka TSUDA<sup>8</sup>

<sup>1</sup> *National Institute for Space Research, Brazil*, <sup>2</sup> *Federal University of Campina Grande, Brazil*, <sup>3</sup> *Indian Institute of Science Education and Research Mohali, India*, <sup>4</sup> *Instituto Nacional de Pesquisas Espaciais, Brazil*, <sup>5</sup> *Paraíba State University, Brazil*, <sup>6</sup> *University of Illinois at Urbana-Champaign, United States*, <sup>7</sup> *Clemson University, United States*, <sup>8</sup> *Kyoto University, Japan*

*#Corresponding author: hisao.takahashi@inpe.br +Presenter*

Optical and radio wave observations of the upper atmosphere in the South American equatorial and low latitude regions made it possible to study planetary waves and gravity waves propagating from the troposphere to mesosphere, thermosphere and ionosphere. Especially the 3-4 day period oscillation was identified as the equatorially trapped Ultra-Fast Kelvin Wave, which was observed in the stratosphere (UKMO temperatures), mesosphere (SABER temperatures) and in the ionosphere (COSMIC Total Electron Contents) with time delay between the layers. Thermospheric gravity wave propagations (the period of 10 to 30 min. and the horizontal wavelength of 100 to 200 km) were also observed by OI 630 nm all sky imagers. We present observational evidence of these wave signatures and to discuss vertical coupling of the atmosphere and ionosphere.