Current status of the Optical Mesosphere Thermosphere Imagers (OMTIs) for imaging measurement of the upper atmosphere and the ionosphere

Kazuo Shiokawa and Yuichi Otsuka
Solar-Terrestrial Environment Laboratory, Nagoya University

The Solar-Terrestrial Environment Laboratory (STEL), Nagoya University, has operated the Optical Mesosphere Thermosphere Imagers (OMTIs) since 1998. The OMTIs consists of thirteen all-sky airglow imagers, five Fabry-Perot interferometers, three scanning photometers, and four airglow temperature photometers. These instruments obtain two-dimensional images, Doppler winds, and temperatures of the upper atmosphere at altitudes of 80-300 km through nocturnal airglow emissions which is invisible weak light emitted from the upper atmosphere. Several airglow emission layers exist in the upper atmosphere, for example, emission from oxygen atom at a wavelength of 557.7 nm at 90-100 km, infrared emission from hydroxyl (OH) at 80-90 km, and 630.0-nm emission from oxygen at 200-300 km, as schematically shown in Figure 1. By changing the filters of the measurement wavelengths, we observe dynamics of the mesosphere, thermosphere, and ionosphere separately. The upper atmosphere is the region where most of the artificial satellites and space stations exist. Thus the measurements of OMTIs contribute to the space use by human beings through understanding the "geospace" environment.

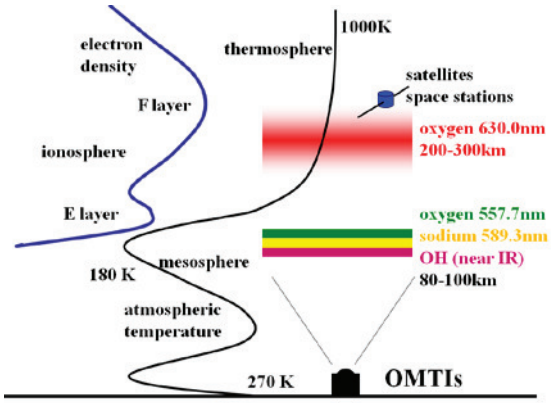

Figure 1. Through nocturnal airglow emissions, OMTIs measures the upper atmosphere where satellites and space stations fly.

Figure 2. A photo of OMTIs installation at Thailand.

The OMTIs instruments are set at 12 ground-based stations in Far-East Russia, Japan, Indonesia, Thailand, Australia, Canada, and Norway, as shown in Figure 3. The installation of OMTIs instruments contributes understanding of space research at these countries and collaborations among international scientists including those in the developing countries. Recently we installed a new Fabry-Perot interferometer at Chiang Mai, Thailand (February 2010), Kototabang, Indonesia (June 2010), and Darwin, Australia (March 2011). They consist two pairs (Indonesia-Thailand and Japan-Australia) of geomagnetic conjugate observations of thermospheric winds and temperatures. Details of OMTIs are available at http://stdb2.stelab.nagoya-u.ac.jp/omti/.

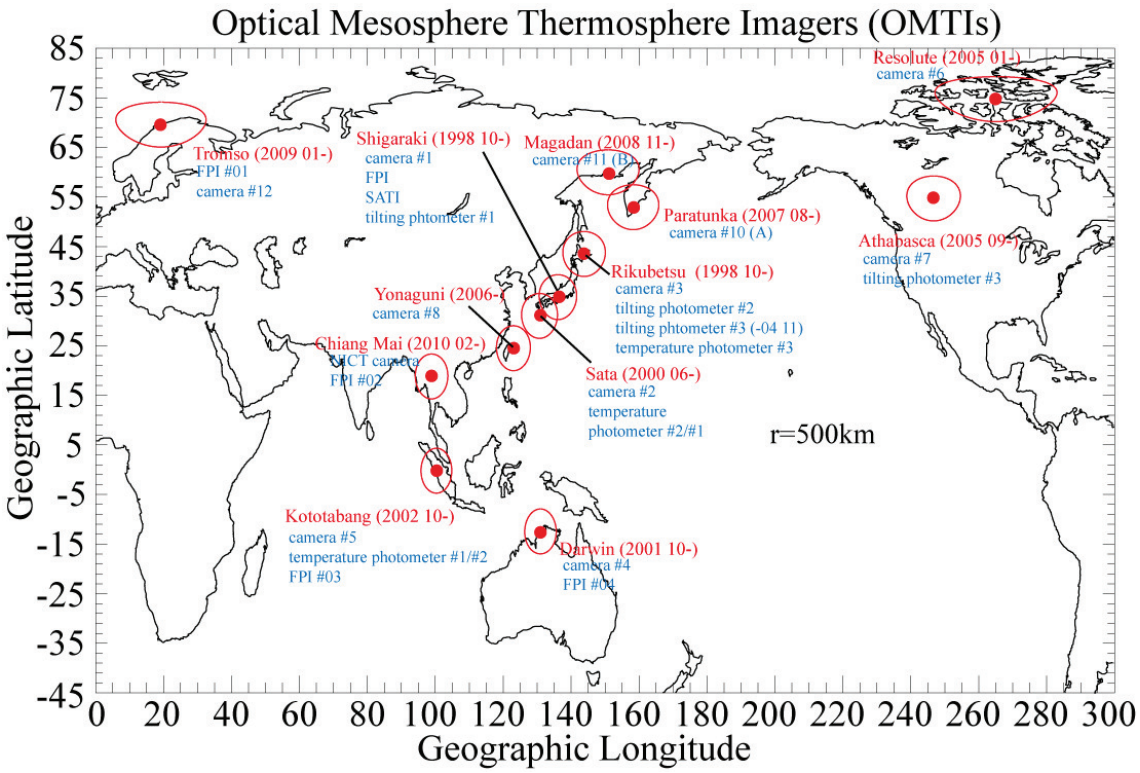

Figure 3. Current stations of the Optical Mesosphere Thermosphere Imagers. The collaborators of these stations are: (1) Paratunka and Magadan: Institute of Cosmophysical Research and Radiowave Propagation (IKIR), Far Eastern Branch of the Russian Academy of Sciences, (2) Shigaraki: Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Japan, (3) Darwin: IPS Radio and Space Services, Australia, (4) Kototabang: Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Japan, and National Institute of Aeronautics and Space (LAPAN), Indonesia, (5) Chiang Mai: Chiang Mai University, Thailand, and National Insitute of Information and Communications Technology (NiCT), Japan, (6) Resolute: SRI International, USA, and University of Calgary, Canada, (7) Athabasca: Athabasca University and University of Calgary, Canada, (8) Yonaguni: Electronic Navigation Research Institute (ENRI), Japan, and National Insitute of Information and Communications Technology (NiCT), Japan, and (9) Norway: EISCAT Scientific Association, and the National Institute of Polar Research, Japan.