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Ground-Based Network Observations of the Upper Atmosphere using Optical and Radio Instruments

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We are carrying out routine observations of airglow using Optical Mesosphere Thermosphere Imagers (OMTIs) to investigate the dynamics of the mesosphere, thermosphere, and ionosphere at an altitude of 80-350 km. The OMTIs consist of five sky-scanning Fabry-Perot interferometers (FPIs), 13 all-sky CCD imagers, three tilting photometers, a spectral airglow temperature imager (SATI), and three airglow temperature photometers to measure two-dimensional airglow images and neutral winds and temperatures. The OMTIs are located at several key points around the world: Shigaraki, Rikubetsu, and Sata in Japan; Chiang Mai in Thailand; Darwin in Australia; Kototabang in Indonesia; Resolute Bay and Athabasca in Canada; Magadan and Paratunka in Russia, Tromsoe in Norway, and Hawaii in U.S.A. Using these OMTI instruments, we obtained various interesting results, e.g., finger-like aurora structures, concentric gravity waves expanding from the typhoon, and the characteristics of nighttime medium-scale traveling ionospheric disturbances in the vicinity of their equatorward boundary. We are planning to install all-sky imagers, FPIs, magnetometers, and GNSS receivers in Africa (Nigeria and Ethiopia) and Russian Far East for global observation of the upper atmosphere under the project of ”Coupling process in the solar-terrestrial system”. We also plan to install a VHF radar at magnetic equator in Thailand to study generation mechanisms of plasma irregularities. These studies could contribute to mitigation of ionospheric effects on GNSS and satellite communication.

Keywords: ionosphere, thermosphere, mesosphere, upper atmosphere, airglow, radar