2nd URSI AT-RASC, Gran Canaria, 28 May – 1 June 2018

Analysis of the regional ionosphere at low latitudes in support of the Biomass ESA mission

Lucilla Alfonsi*(1), Gabriella Povero(2), Luca Spogli(1,3), Claudio Cesaroni(1), Biagio Forte(4), Cathryn N.Mitchell(4), Robert Burston(4), Sreeja Veettil(5), Marcio Aquino(5), Virginia Klausner(6), Marcio Muella(6), Michael Pezzopane(1), Alessandra Giuntini(1), Ingrid Hunstad(1), Giorgiana De Franceschi(1), Elvira Musicò (1,13), Marco Pini (2), La The Vinh(7), Ta Hai Tung(7), Asnawi Husin(8), Sri Ekawati(8), Charisma Victoria de la Cruz-Cayapan(9) , Mardina Abdullah(10), Noridawaty Mat Daud(10), Minh Le Huy(11), Nicolas Floury(12)
lucilla.alfonsi@ingv.it
(1) Istituto Nazionale di Geofisica e Vulcanologia, Italy
(2) Istituto Superiore Mario Boella, Italy
(3) SpacEarth Technology, Italy
(4) University of Bath, UK
(5) University of Nottingham, UK
(6) Universidade do Vale do Paraíba (UNIVAP), Brazil
(7) Hanoi University of Science and Technology, Vietnam
(8) National Institute of Aeronautics and Space (LAPAN), Indonesia
(9) National Mapping and Resource Information Authority (NAMRIA), The Philippines
(10) Universiti Kebangsaan Malaysia (UKM), Malaysia
(11) Institute of Geophysics, Vietnam Academy of Science and Technology, Vietnam
(12) European Space Agency
(13) University “Sapienza” of Rome, Italy

Biomass is a spaceborn polarimetric P-band (435 MHz) synthetic aperture radar (SAR) in a dawn-dusk low Earth orbit expected to be launched in 2021. Its principal objective is to measure biomass content and change in all the Earth’s forests. The ionosphere introduces Faraday rotation on every pulse emitted by low-frequency SAR and scintillations when the pulse traverses a region of plasma irregularities, consequently impacting the quality of the imaging. Some of these effects are due to Total Electron Content (TEC) and its gradients along the propagation path. An accurate assessment of the ionospheric morphology and dynamics is necessary to properly understand the impact on image quality, especially in the equatorial and tropical regions. To this scope, we have conducted an in-depth investigation of the significant noise budget introduced by the two crests of the Equatorial Ionospheric Anomaly (EIA) over Brazil and South-East Asia. The work is characterized by a novel approach to conceive a SAR-oriented ionospheric assessment, aimed at detecting and identifying spatial and temporal TEC gradients, including scintillation effects and Traveling Ionospheric Disturbances, by means of GNSS ground-based monitoring stations. The novelty of this approach resides in the customization of the information about the impact of the ionosphere on SAR imaging as derived by local dense networks of ground instruments operating during the passes of Biomass spacecraft. The results identify the EIA crests as the regions hosting the bulk of irregularities potentially causing degradation on SAR imaging. Among the most interesting insights we cite an important distinction between the meridional TEC variation and the zonal variation in both regions under investigation.

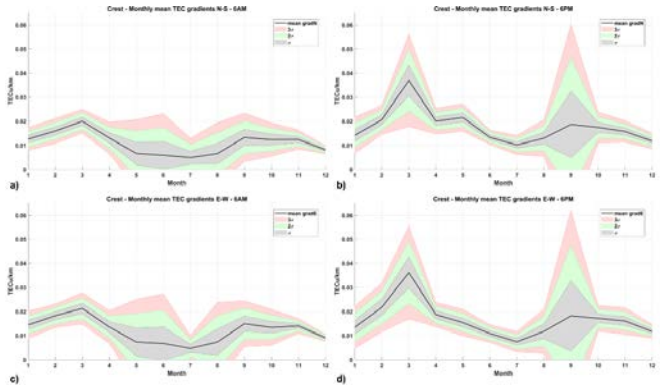

Figure 1. Monthly variation of the hourly mean TEC gradients along North-South (a,b) and East-West (c,d) directions under the EIA southern crest in South-East Asia at 06 AM (a,c) and at 06 PM (b,d).