Conjugated quasi-periodic ELF/VLF emissions between the Arase satellite and both Van Allen Probes

*Claudia Martinez Calderon¹,², Frantisek Nemec³, Kazuo Shiokawa², Yuto Katoh¹, Yoshiya Kasahara⁴, Shoya Matsuda², Fuminori Tsuchiya¹, Atsushi Kumamoto¹, Mariko Teramoto², Ayako Matsuoka⁵, Yoshizumi Miyoshi², Ondrej Santolik⁶,³, George Hospodarsky⁷

1. Dept. Geophys., Grad. Sch. Sci., Tohoku University, 2. Institute for Space-Earth Environmental Research, Nagoya University, 3. Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic, 4. Kanazawa University, 5. Japan Aerospace Exploration Agency, 6. Institute of Atmospheric Physics, Prague, Czech Republic, 7. Department of Physics and Astronomy, University of Iowa, USA

Extremely Low (ELF) and Very Low Frequency (VLF) emissions are naturally occurring magnetospheric plasma waves in the frequencies of 3 Hz to 30 kHz. They play a fundamental role in radiation belt dynamics, accelerating or scattering electrons through wave-particle interactions. We report the first quasi-periodic (QP) emission simultaneously observed by the Arase (ERG) satellite and both Van Allen Probes (RBSP). This is one of few known conjugated satellite events where the waves show very similar spectral and temporal features. The event was observed on November 29, 2018 from approximately 11 to 13:30 UT by both RBSP, while ERG observed it from 12 to 14 UT. Using wave analysis, propagation parameters, and intensities simultaneously measured at several locations we will discuss the approximate location of the source region. We will also discuss the eventual timing differences between QP periodicity at different locations. Some slight variation in the spectral shapes is observed. We will discuss possible relationships with the variations of plasma number density, magnetic field, and energetic electron distribution.

Keywords: conjugated event, VLF, QP, Arase, RBSP, plasma waves