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Supporting Information for

"Whole Atmosphere Model Simulations of 3-day Kelvin Wave Effects in the Ionosphere and Thermosphere"

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Introduction

This study focuses on ultra-fast Kelvin waves simulated by the whole atmosphere model GAIA (=Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy) as well as those observed by the GOCE (=Gravity field and steady-state Ocean Circulation Explorer) satellite. The supplementary figures cover results not necessarily included in the paper but useful to understand the complete picture.

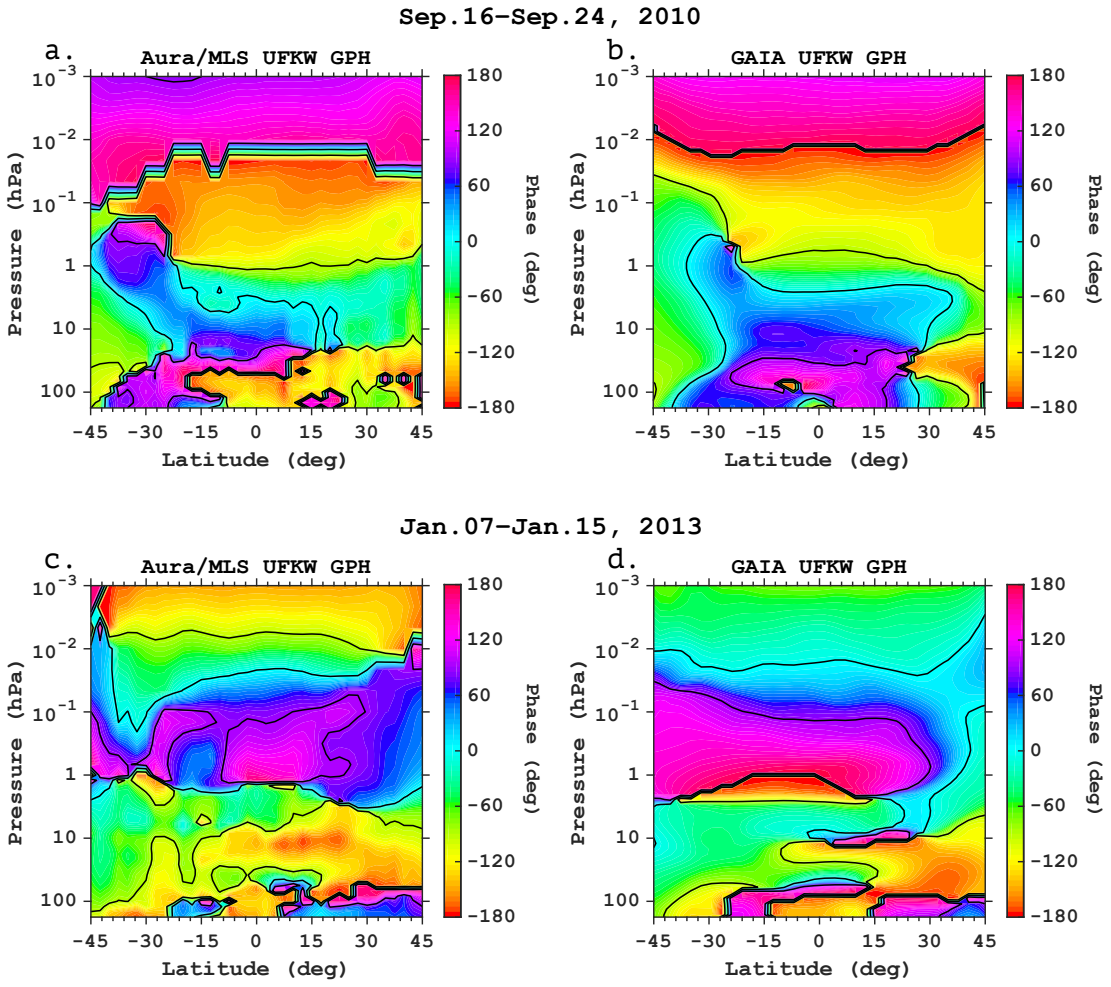

Figure S1. Latitude versus height structures of the ultra-fast Kelvin wave (UFKW) phase in the geopotential height (GPH) during the September 2010 event (a, b) and the December 2012–January 2013 event (c, d). The left panels are from the Aura Microwave Limb Sounder (MLS) measurements while the right panels are from the GAIA model.

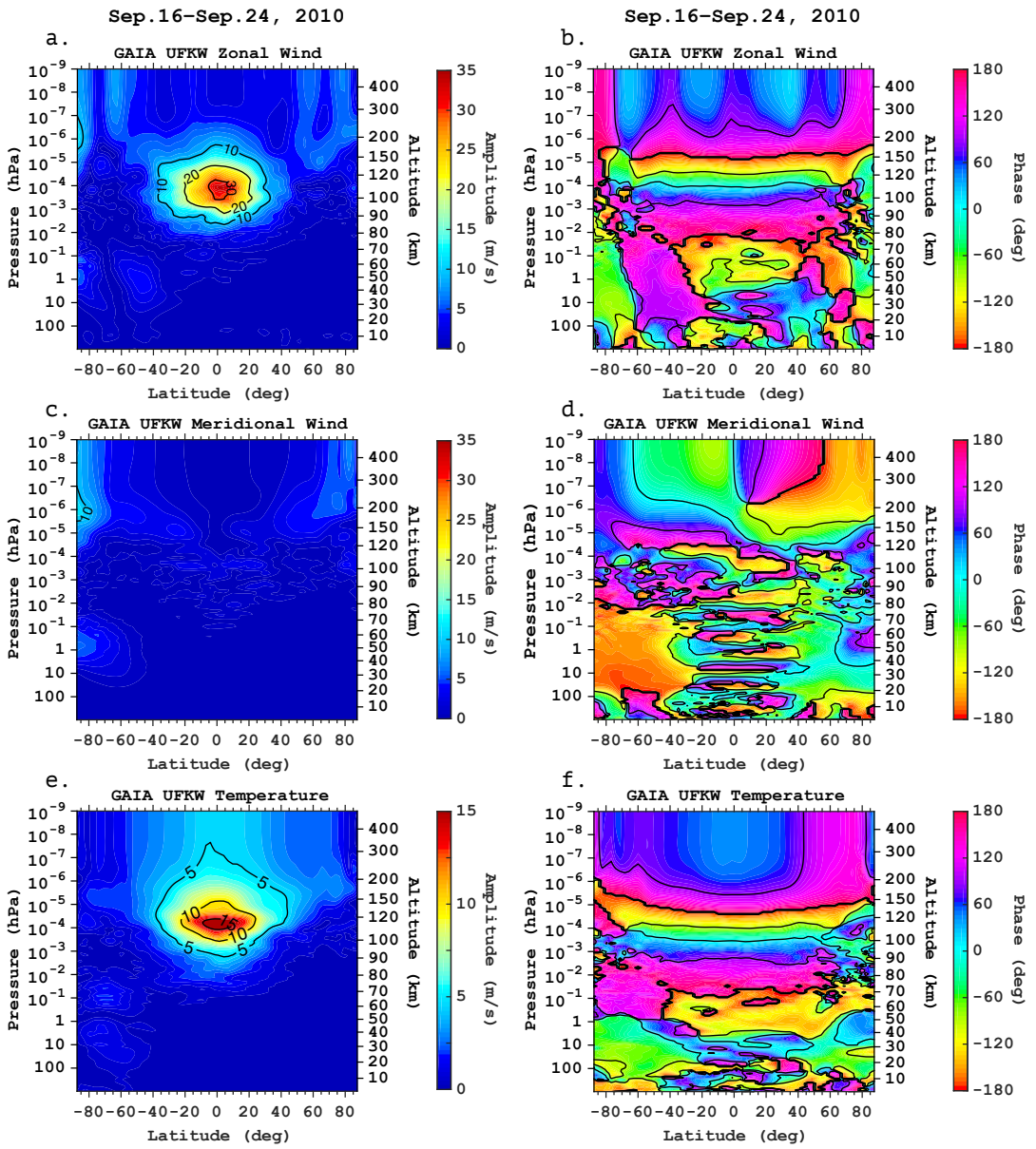

Figure S2. Latitude versus height structures of the ultra-fast Kelvin wave (UFKW) in the zonal wind (a, b), meridional wind (c, d), and temperature (e, f) derived from the GAIA model during the September 2010 event. The left and right panels show wave amplitudes and phases, respectively. The UFKW here is defined as the eastward-propagating waves with a period of 2.5 days and zonal wavenumber 1.

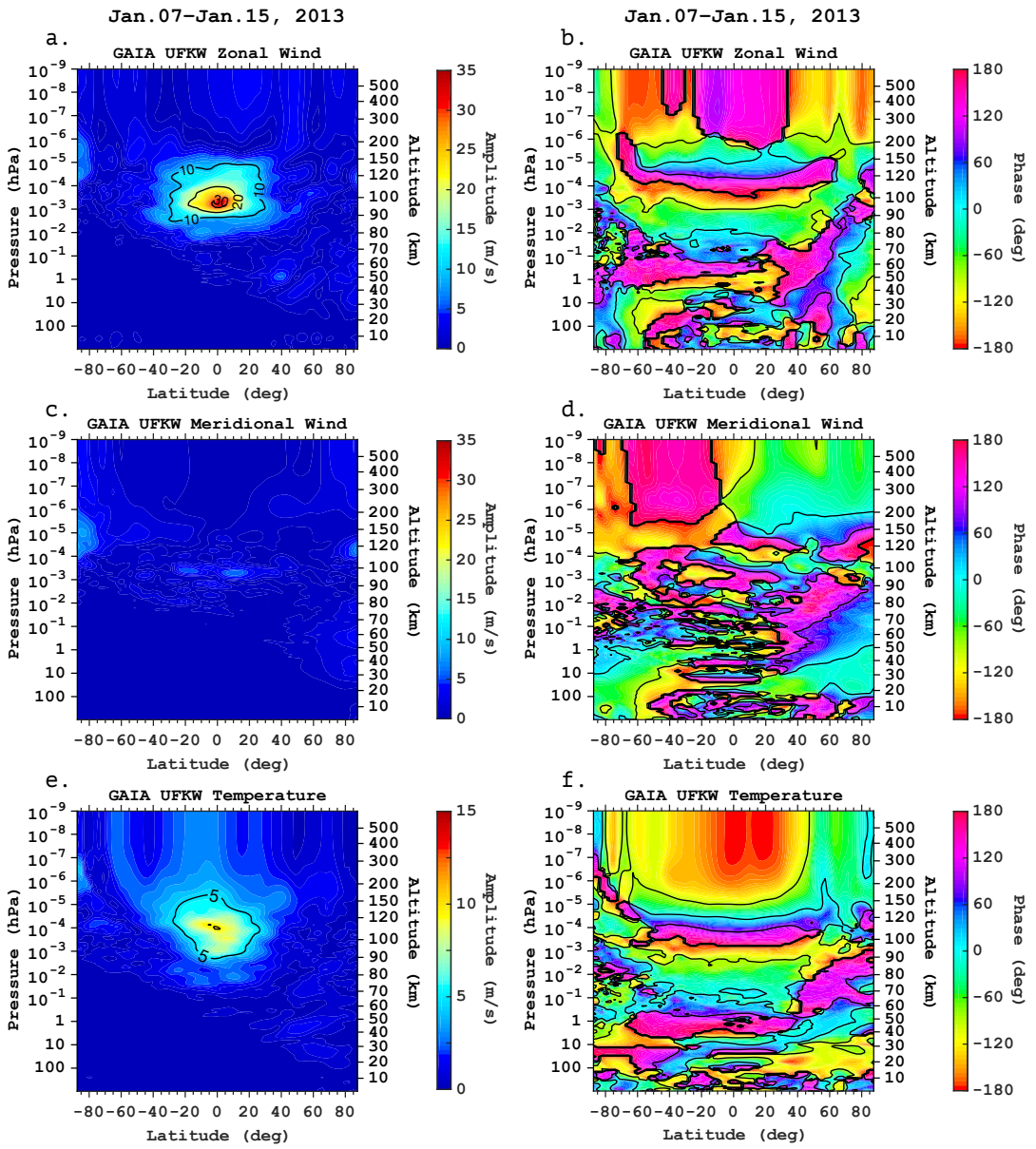

Figure S3. Same as Figure S2 except for the December 2012–January 2013 event. The UFKW here is defined as the eastward-propagating waves with a period of 3.0 days and zonal wavenumber 1.

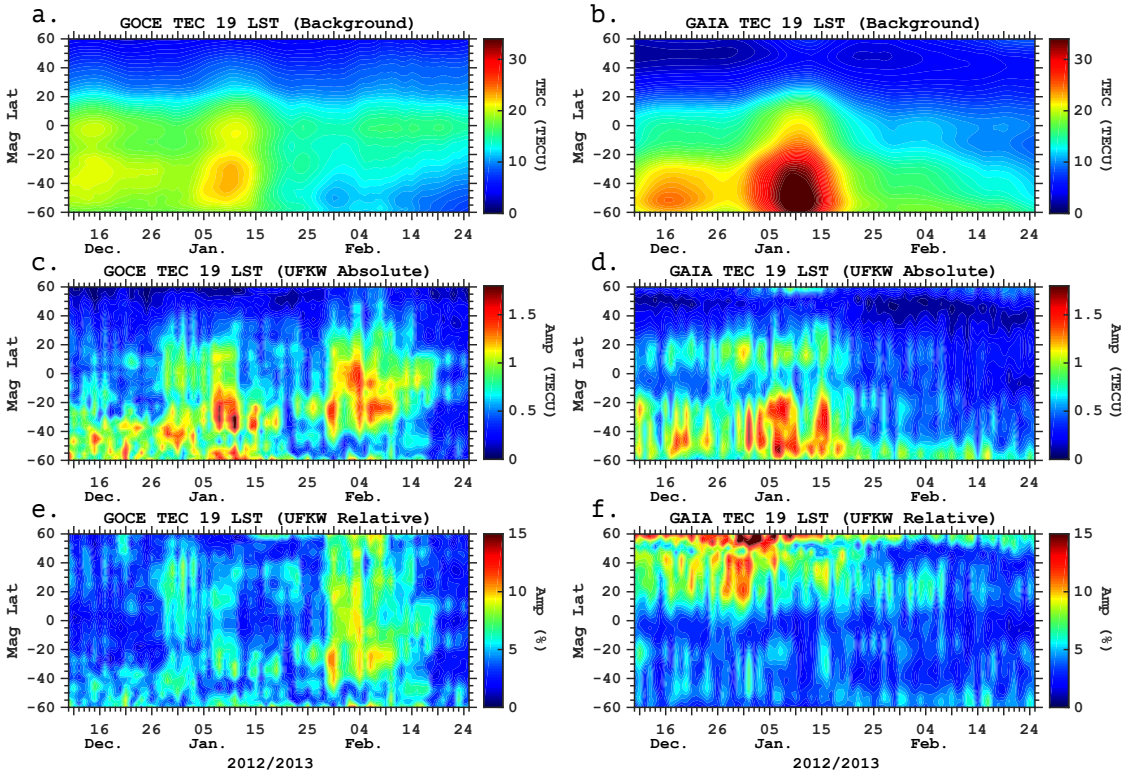

Figure S4. Comparison of the total electron content (TEC) at 7 a.m. local solar time derived from the GOCE measurements (a, c, e) and the GAIA model (b, d, f). The panels (a, b) show the background total electron content (TEC) as defined here as the temporal and zonal mean calculated at each latitude using the 9-day moving window. The panels (c, d) show the amplitude of the ultra-fast Kelvin wave (UFKW) in TEC calculated at each latitude using the 9-day moving window. The UFKW amplitude is defined as the largest amplitude of the eastward-propagating waves with zonal wavenumber 1 within periods 2.25–3.75 days. The panels (e, f) show the relative amplitude of the UFKW in TEC with respect to the corresponding background TEC value. Note that color scales are different for different panels.

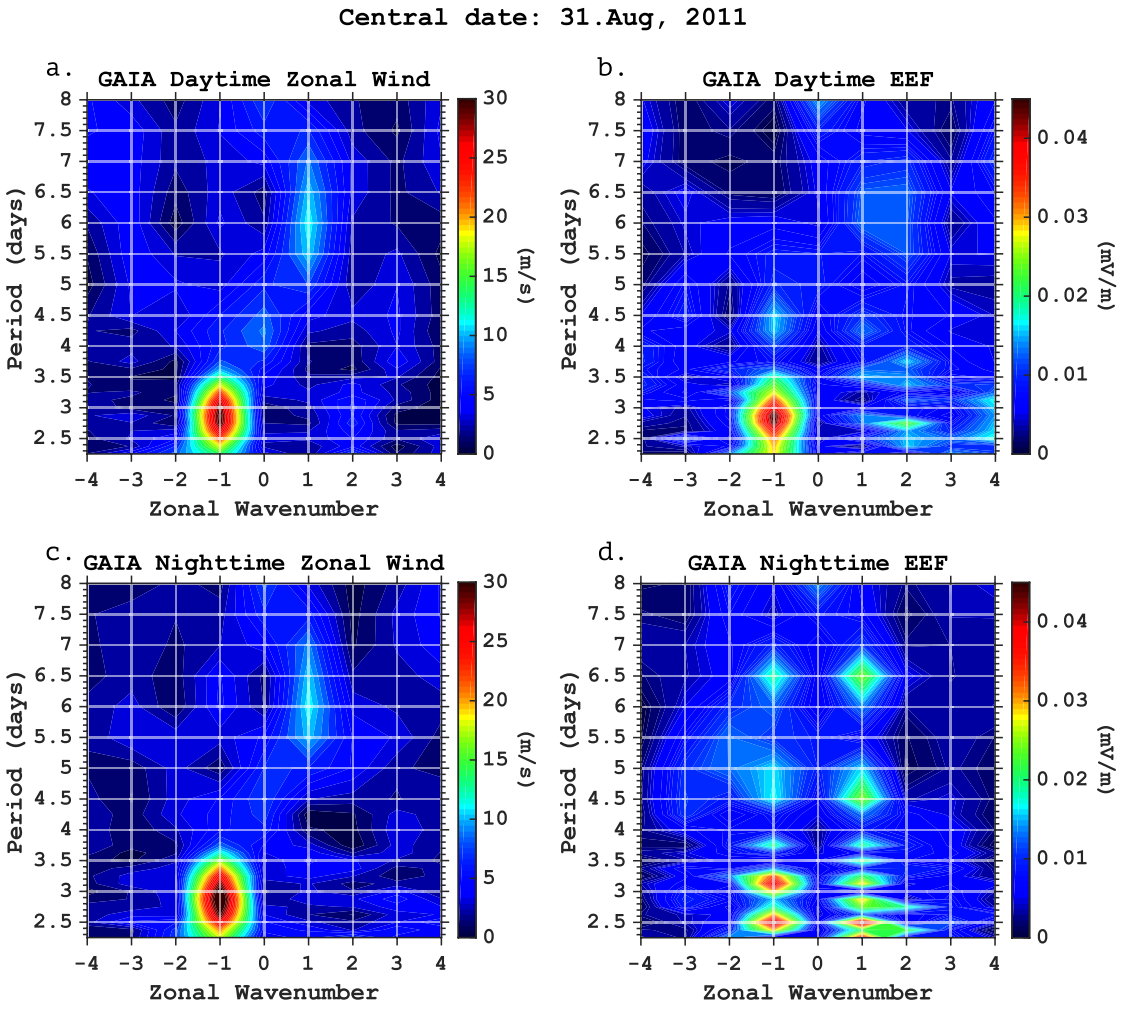

Figure S5. Wavenumber versus period spectra derived from GAIA during the ultra-fast Kelvin wave event of August–September 2011. The panel (a) is for the equatorial zonal wind at 110 km altitude during the daytime between 6 a.m. and 6 p.m. local solar time. The panel (b) is for the equatorial zonal electric field (EEF) at 110 km altitude during the daytime between 6 a.m. and 6 p.m. local solar time. The panel (c) is the same as panel (a) except for the nighttime from 6 p.m. to 6 a.m. local solar time. The panel (d) is the same as panel (b) except for the nighttime from 6 p.m. to 6 a.m. local solar time.