

# ICON at AGU 2022 Fall Meeting

AGU Fall Meeting – Chicago, IL and online Everywhere 12-16 December 2022

Below are ICON or ICON-GOLD science-related sessions, talks and posters listed chronologically (posters listed separately on each day).

Note: ICON will be represented at the [NASA Heliophysics booth](#) on Weds Dec. 14 from 10-12 CST

## Monday 12 December

### Posters

#### A15I-1358 - Large-scale Gravity Waves in Daytime ICON-MIGHTI Data

*Colin Charles Triplett et al*

14:45-18:15 CST

McCormick Place - Poster Hall, Hall - A (South, Level 3)

The Michelson Interferometer for Global High-resolution Thermospheric Imaging (MIGHTI) onboard the NASA Ionospheric Connection Explorer (ICON) has retrieved profiles of wind and temperature in the 90-300 km range. As part of these limb-viewing measurements, MIGHTI also retrieves a relative volume emission rate (VER) of two atomic oxygen (OI) emissions in the same altitude range. Generally, the VER variations do not correlate with the retrieved winds or temperatures. However, there are time periods of observations where variations in the VER observations are strongly correlated with the wind and temperature observations, showing unexpectedly prominent, common large-scale structures. We present a method to extract wave parameters from these structures and show their properties over the entire year of 2020. These large-scale waves consistently have vertical-to-horizontal slopes of 0.01 km/km, an upper-limit of ~3000 km for horizontal wavelengths and of ~35 km for vertical wavelengths. Currently we interpret these waves as inertia gravity waves. While observational evidence for such waves is not new, the unprecedented, global, long-term observations of these waves from 100 to 300 km by ICON allow for the most comprehensive characterization of their climatology to date.

Tuesday 13 December

[SA22A - Space Weather Challenges in the Near-Earth Geospace I Oral](#)

09:00 – 10:30 CST

McCormick Place - S402a (South, Level 4)

Disturbances in the ionosphere, thermosphere and mesosphere (ITM) are the source of many space weather effects in the near Earth geospace, such as disruption in trans-ionosphere radio signals due to absorption, scintillation and changes in propagation path as well as LEO satellite position errors due to variations in atmospheric drag. It is well known that the ITM state is driven by high latitude energy and momentum inputs and lower atmosphere tides and waves (including natural disasters, such as earthquake and volcano). However, improvement is still needed in quantifying the drivers and ITM response. It remains a challenge to accurately predict the ITM state and associated space weather effects during either non-storm or storm-time, especially during intense storms caused by CME events. This session welcomes papers on observation and modeling that address the ITM disturbances and related space weather effects, especially the future effort.

[SA22A-09 - Daytime E-region Disturbance Winds – Observations vs. Simulations](#)

10:20 – 10:30 CST

McCormick Place - S402a (South, Level 4)

*Thomas J Immel et al*

The Ionospheric Connection Explorer (ICON) mission provides the first complete and nearly continuous measurements of thermosphere winds in the daytime E-region. From this database we identify dozens of geomagnetic events by the appearance of transients in meridional winds measured in the ionospheric F-region. These travel north or south along magnetic meridians from the poles to the equator. The development of the daytime ionosphere can be strongly affected by stormtime winds if they reach down to altitudes of the daytime peak in Hall and Pedersen conductivity, around 110 and 130 km altitude respectively. The most effective disturbance will be generated if the momentum forcing leads to a prevailing westward surge in winds around these altitudes. This can come naturally from Coriolis forces on air transported in bulk from high to low latitudes and downward coupling of this momentum. Here we report that of all the dozens of thermospheric storms observed in 2021-2022, significant changes in E-region zonal winds are observed only once. Thus, it has to be considered that almost none of the disturbances of the daytime ionosphere in 2020-2021 could be attributed to an enhanced disturbance dynamo. Two questions to address are 1) why this storm may have been unique, and 2) why the ICON Thermosphere Ionosphere Electrodynamics Circulation Model run for the 2-year period reports much more frequent occurrences of E-region zonal wind disturbances in the same period.

Wednesday, 14 December

## NASA Heliophysics Booth

10:00 – 12:00 CST

*Thomas J Immel et al*

*NASA will have an exhibit at the conference from December 12-15. This year, the Heliophysics Division is approaching our exhibit presence a little differently. We want to create an environment of inclusivity and truly demonstrate that those who partner with us on Heliophysics missions are a part of our team. These missions would not be possible without the hard work and dedication from all of our partners. We are one team and we want our presence at the NASA exhibit to reflect that.*

*There will be two 6-foot tables next to each other in the NASA booth that are dedicated to heliophysics. One of those tables will be used for general heliophysics information, presented by heliophysics outreach personnel and division representatives, where we will have handouts, displays, and other general heliophysics information about programs and missions. The other table is for specific mission representatives (that's you!).*

## Session 5A35A

### SA35A - Atmosphere-Ionosphere Response to the 2022 Hunga Tonga- Hunga Ha'apai Volcanic Eruption III Oral

14:45 – 16:15 CST

McCormick Place - S402a (South, Level 4)

*Primary Convener: Claudio Cesaroni*

The 15 January 2022 Tonga underwater volcanic eruption was an unprecedented event that ejected a huge amount of energy into the atmosphere. The eruption generated strong perturbations in the atmosphere and ionosphere layers that induced Travelling Ionospheric Disturbances (TIDs) propagating for several hours, and even days, after the eruption. The eruption also generated a tsunami. The Tonga eruption was a unique event allowing us to study the Lithosphere-Atmosphere-Ionosphere coupling processes at a global level.

The session welcomes contributions on observations and modelling of the atmospheric and ionospheric disturbances induced by the Tonga eruption, encouraging multi-instrumental and multi-disciplinary approaches to the physical mechanisms behind the coupling of the different layers of the Earth system.

(continued on next page)

SA35A-02 Impacts of the Tonga Eruption on the Ionospheric Dynamo: ICON-MIGHTI and Swarm Observations of Extreme Neutral Winds and Currents Brian J Harding (Invited)

Brian J Harding

14:55 - 15:05 CST

*McCormick Place - S402a (South, Level 4)*

The eruption of the Hunga Tonga-Hunga Ha'apai volcano on 15 January 2022 triggered atmospheric waves at all altitudes. The NASA Ionospheric Connection Explorer (ICON) and ESA Swarm satellites were well placed to observe its impact on the ionospheric wind dynamo. Here we focus on the far-field volcanogenic disturbance, after  $\sim 10$  hr and  $\sim 10,000$  km of wave propagation. When the wave entered the dayside, Swarm A observed an eastward and then westward equatorial electrojet (EEJ) on two consecutive orbits, each with magnitudes exceeding the 99.9th percentile of typically observed values. ICON simultaneously observed the neutral wind (90–300 km altitude) at approximately the same distance from Tonga. The observed neutral winds were also extreme ( $>99.9$ th percentile at some altitudes). The covariation of EEJ and winds is consistent with recent theoretical and observational results, indicating that the westward electrojet is driven by strong westward winds in the Pedersen region ( $\sim 120$ – $150$  km). These observations imply that the dynamo is a key mechanism in the ionospheric response to the Tonga disturbance. This work also suggests an apparent discrepancy: In the far-field, ICON observes dominant horizontal wavelengths of 3,000–5,000 km, while reports from GNSS TEC observations suggest dominant wave scales are much smaller.

SA35A-04 Volcanic Modification of the E-Region Dynamo: ICON Observations of the Recent Tonga Eruption Liliias Claire Gasque

Liliias Claire Gasque

15:15-15:25 CST

*McCormick Place - S402a (South, Level 4)*

The Hunga Tonga-Hunga Ha'apai (hereafter called 'Tonga') volcano erupted at  $\sim 4:15$ UT on 15 January 2022, driving atmospheric pressure waves around the globe. These waves then propagated into space, producing traveling ionospheric disturbances (TIDs) which persisted for several days after the eruption. While direct modification of the ionosphere has been associated with the passage of atmospheric waves originating in the lithosphere and lower atmosphere, the potentially larger electrodynamic effects on the plasma have only recently been considered. In this work, we present observations from NASA's Ionospheric Connection Explorer (ICON) satellite, tracing the volcano's effect on the E-region dynamo in the first several hours after the event. We report extreme zonal and vertical ExB ion drifts  $\sim 4000$ km away from Tonga within an hour of the eruption, well before the arrival of any atmospheric wave. The measured drifts were magnetically connected to the ionospheric E-region just 400km from Tonga, suggesting that the wavefront expanding from Tonga created strong electric potentials which were then transmitted along Earth's magnetic field via Alfvén waves. In subsequent orbits, we compare neutral wind measurements with plasma drifts, revealing a combination of dynamo forcing and direct drag acting on the ionosphere. These observations are the first direct detection in space of the immediate electrodynamic effects of a volcanic eruption and will help constrain future models of impulsive lower atmospheric events.

## [SA35A-08 Ionosphere/Thermosphere Modeling of the Tonga event with SAMI3/HIAMCM](#)

Joseph D Huba

15:55 – 16:05 CST

McCormick Place - S402a (South, Level 4)

The Hunga Tonga-Hunga Ha'apai volcanic eruption occurred on 15 January 2022 at 04:14 UT and was estimated to have released roughly 9 - 37 megatons of TNT equivalent. The eruption generated a massive atmospheric disturbance that caused major effects in the ionosphere worldwide. In this talk we report results from high-resolution simulations of the ionosphere/thermosphere system using the ionosphere/plasmasphere model SAMI3 and the whole atmosphere model HIAMCM (which includes body forces from gravity wave (GW) sources and ray tracing of the primary GWs using the MESORAC model). We find that the atmospheric gravity waves associated with the Tonga eruption strongly modify the neutral wind system. This in turn modifies the  $E \times B$  drift which generates a large depletion in the electron density in the western Pacific that persists for several hours and has a relative decrease of up to four orders-of-magnitude. Furthermore, a large equatorial plasma bubble (EPB) develops that rises to very high altitudes (over 4000 km). We compare the simulation results to available data.

## Thursday 15 December

### [NG46A-06 - On the Variation of Column O/N<sub>2</sub> in the upper atmosphere using Principal Component Analysis in 2-dimensional images](#)

17:40-17:51 CST

McCormick Place - S105a (South, Level 1)

Presenting Author: Yen-Jung Joanne Wu

Principal Component Analysis (PCA) is performed on thermospheric O/N<sub>2</sub> column density ratio from NASA's Global-scale Observations of the Limb and Disk (GOLD) mission from days 81 to 135 of 2020. The daily weights of each principal component (PC) are investigated. Correlation analysis of the daily weights to Kp index and Interplanetary Magnetic Field (IMF) strength is performed. PC1 shows a strong correlation to Kp index and IMF. Geomagnetic storm effects are seen in the wavelet analysis PC1's weights. PC5 shows a strong quasi-6-day oscillation (Q6DO). The present work suggests geomagnetic activity is a major source of variability in O/N<sub>2</sub>, followed by meteorological driving from the lower atmosphere. The capabilities and limitations of PCA are discussed for future potential research in day-to-day variability of global-scale observations of thermospheric O/N<sub>2</sub>.

## Friday 16 December

Session 5A25B

### [SA52B - Dynamics of the Thermosphere and Ionosphere System at Low and Middle Latitudes Due to the External and Internal Forcing I Oral](#)

Primary Convener – Quan Gan

Early Career Convener – Yen-Jung Joanne Wu

09:00-10:30 CST

McCormick Place - S402a (South, Level 4)

The GOLD, COSMIC-2 and ICON missions, along with existing ground-based and space-based observations as well as advances in numerical modeling capabilities, provide an exciting opportunity to study the variability in the thermosphere and ionosphere system due to various forcing from above and below. Topics of interest include, but are not limited to, the changes of the winds, composition, and thermal structure in the thermosphere, as well as electric field and electron density in the ionosphere due to geomagnetic activity, waves arising from the lower atmosphere and sudden stratospheric warmings, etc. We solicit presentations that address scientific issues with respect to variability in the thermosphere and ionosphere using observations, numerical simulations, and general circulation models.

#### [SA52B-03 - Day-to-day variability of the neutral wind from 90 to 300 km: Second-order statistics from ICON-MIGHTI and WACCM-X](#)

09:22 – 09:32 CST

McCormick Place - S402a (South, Level 4)

*Brian J Harding*

The day-to-day variability of the thermosphere-ionosphere system during quiet times is thought to be driven by gravity waves, tides, planetary waves, and other global-scale wave forcing from the lower atmosphere. Modern first-principles numerical models are beginning to capture many of these drivers, but such models have not been validated against thermospheric data, especially in the critical 100-200 km altitude region. In this work we compare day-to-day variability of thermospheric winds modeled by WACCM-X and observed in the first year of ICON-MIGHTI data. A generalized covariance analysis is used to quantify variability without using assumptions or fitting specific waves. The results indicate that total zonal wind variability matches the data well, while the meridional wind variability is significantly smaller than the data.

#### [SA52B-04 - Connection between daytime vertical zonal wind gradient and zonal current at low latitude using ICON and Swarm observations.](#)

09:32 - 09:42 CST

McCormick Place - S402a (South, Level 4)

*Astrid I Maute et al*

The E-region wind is highly variable due to a complex spectrum of atmospheric solar tides propagating up from the lower atmosphere. In the E-region where the neutral and plasma density is large the neutral wind tends to push the plasma through the Earth's magnetic field

which sets up electric fields and ionospheric current. We often divide conceptually the daytime middle to equatorial ionospheric current system into three parts: the large scale Sq current, the normally eastward equatorial electrojet (EEJ), and a westward return current off the magnetic equator. The strongest daytime current signal is in general due to the EEJ. When the Sq current is subtracted from the total ionospheric current system a current opposite to the eastward EEJ is present most times, which is located 3-6 degrees north and south of the geomagnetic equator and is called "return current". Both the EEJ and the "return current" are highly variable in strength and strongly depend on the neutral wind in the E- and lower F-region where ionospheric conductivities are large. We still lack a full understanding of how changes in the neutral wind modify this low latitude current system.

In this presentation, we combine neutral wind observations from the ICON/MIGHTI instrument with EEJ current density from the Swarm satellites at daytime low latitude conjunction to study how the vertical gradient in the zonal wind affects the "return current" strength. Our study is based on work by Fambitakoye et al. (1975) who demonstrated with a physics-based model that the increasingly westward neutral wind with altitude at low latitude in the E- and lower F-region are related to the strength of the "return current". Our study highlights the value of having neutral wind observations together with EEJ to improve our understanding of the variability of the daytime low latitude current system.

[SA56A-05 - Cross-validation of the ionospheric electric field measurements on ICON/IVM, SWARM and ground-based radar in the Jicamarca Radio Observatory](#)

17:30-17:40 CST

McCormick Place - S402a (South, Level 4)

Presenting author Yen-Jung Joanne Wu

The Ion Velocity Meter (IVM) on NASA's Ionospheric Connection Explorer (ICON) reports the in-situ ion density, ion temperature and 3-component ion drift velocity, retrieved from the measurement by a retarding potential analyzer and an ion drift meter. The uncertainty of the drift velocity is known to be influenced by the ion density and  $O^+$  fraction, according to the pre-flight performance test. ICON was launched into a deep solar minimum in late 2019, followed by a solar quiet ( $F10.7 < 80$ ) period until September 2020. To quantify the uncertainty of the IVM's drift velocity in the low plasma density environment, the cross-comparisons among equatorial electric field (EEF) as obtained from Swarm's electrojet (EEJ) current measurements, the vertical drift from ground-based JULIA coherent radar, and IVM's meridional drift (vertical component at the equator) is presented in this study. Three main results are discussed in this presentation: 1) SWARM's EEF is in good agreement ( $R > 0.8$ ) with the zonal electric field derived from the JULIA's vertical drift regardless of F10.7 value. 2) The zonal electric field derived from the IVM's meridional drift is in good agreement with SWARM's EEF in 2021, whereas the distribution is highly scattered in the deep solar minimum in 2020. 3) An ad hoc IVM correction based on the 24-hour running mean of meridional drift can bring the IVM data into better agreement with Swarm and JULIA. An additional quality control based on  $O^+$  density and  $O^+$  fractional composition may be needed to interpret IVM's meridional drift.

(continued on next page)

[SA52B-06 - Climatology of Thermospheric Mean Winds and Circulation based on ICON/MIGHTI Observations](#)

Erdal Yiğit

09:52 – 10:02 CST

McCormick Place - S402a (South, Level 4)

Neutral winds play an important dynamical and thermodynamical role in the energy and momentum budget of the whole atmosphere system. Using the horizontal neutral wind observations from the MIGHTI instrument onboard NASA's ICON (Ionospheric Connection Explorer) spacecraft with continuous coverage, we produce a climatology of the mean zonal and meridional winds and the associated mean horizontal circulation at low- to middle latitudes (10°S--45°N) for Northern Hemisphere solstice conditions between 90 km and 200 km altitudes, specifically on 20 June 2020 solstice as well as for a one-month period from 8 June-7 July 2020. The data are averaged within appropriate altitude, longitude, latitude, solar zenith angle, and local time bins to produce a wind climatology. The geographical distributions and local time variations of the mean horizontal circulation are evaluated. The instantaneous horizontal winds exhibit a significant degree of spatiotemporal variability often exceeding  $\sim 150 \text{ m s}^{-1}$  in magnitude. The daily averaged zonal mean winds demonstrate day-to-day variability, which could be due to a combination of orbital variations and as well as intrinsic variability of thermospheric winds. Eastward zonal winds and northward (winter-to-summer) meridional winds are prevalent in the lower thermosphere, which provides indirect observational evidence of the eastward momentum deposition by propagating gravity waves. The mean neutral winds and circulation exhibit smaller scale structures in the lower thermosphere (90-120 km), while they are more homogeneous in the upper thermosphere, indicating the increasingly dissipative nature of the thermosphere. Comparison of the ICON mean winds and circulation with previous observations and modeling demonstrates reasonable agreement. The mean wind and circulation patterns inferred from ICON/MIGHTI measurements serve as a valuable dataset and can be used to drive, constrain, and validate numerical models of the atmosphere.

[SA52B-08 - Longitude and Apex Height Variations in Low Latitude Plasma Motions observed by ICON.](#)

Roderick A Heelis

10:12 – 10:22

McCormick Place - S402a (South, Level 4)

The ICON satellite samples the topside ionosphere at altitude near 600 km between +26° and -26° geographic latitude, allowing longitude and apex height variations in the plasma motions to be described at all local times. Continuous operation of the satellite has revealed variations that are dependent on season and solar activity. During low levels of solar activity, the appearance of longitude variations produced by the dynamo action of E-region winds is most apparent. These variations are produced by longitude variations in the wind itself and by the offset between the geomagnetic and geographic equators. As solar activity levels increase, the increasing influence of the F-region dynamo is manifest in the more regular appearance of the pre-reversal enhancement in the vertical ion drift at the equator. This feature also displays seasonal and longitudinal variations related to the offset between the geomagnetic and geographic equators. This presentation illustrates the relative influence of these drivers as solar activity increases in the period 2020 to 2022.



## Session

### SA53A - Integration of Ground- and Space-Based Observations to Study the Structure and Dynamics of the Atmosphere-Ionosphere System: Current Results and Future Opportunities I Oral

Understanding the underlying physics responsible for small-to-large scale (100 to 1000 km) and interhemispheric phenomena in the Earth's atmosphere-ionosphere system has proved challenging due to the sparsity of coordinated measurements at the appropriate scales. Recent advances in relatively low-cost and/or mass-deployable ground-based instrumentation (GNSS, magnetometers, ionosondes, etc), in satellite-based instrumentation (radio occultation, airglow, plasma insitu), and in modeling capabilities have significantly improved our knowledge of these regions. For example, significant progress has been made in the methods and techniques to observe and interpret airglow measurements from networks of ground-based all-sky imagers (OMTI, MANGO) and satellite-based instruments (ICON, GOLD, SSUSI, SULI, GUVI). These advances are foundational to the exploration and specification of the atmosphere-ionosphere coupled dynamics and chemistry. We invite results from current experimental and modeling studies that address small-to-large scale and interhemispheric phenomena in the atmosphere-ionosphere system. Also of interest are contributions that highlight potential collaborations between modeling and observations by discussing the necessary measurements needed to study phenomena such as interhemispheric neutral dynamics, traveling ionospheric disturbances, equatorial and auroral electrojets, etc. from a modeling standpoint.

#### SA53A-06 - Longitudinal Patterns in the Daytime Ionosphere Observed from ICON

11:50 - 12:00 CST

McCormick Place - S402a (South, Level 4)

*Andrew W Stephan et al*

The NASA Ionospheric Connection Explorer (ICON) includes an Extreme Ultraviolet (EUV) imaging spectrograph that measures the daytime ionospheric O<sup>+</sup> via altitude profiles of the OII 83.4 and 61.7 nm airglow emissions. The low-inclination orbit allows measurements across all local times, but also precesses such that low and equatorial latitude measurements are sampled at different local times over a 45-day period. In this presentation, we will examine some of the daily global patterns in ionospheric HmF2 and NmF2 obtained from the first two years of ICON EUV measurements, specifically highlighting longitudinal patterns in these parameters that demonstrate persistent wave-4 characteristics. We will also examine the potential for combining these measurements with new methods for obtaining thermospheric densities to enhance the depth and wealth of information on the ionosphere-thermosphere system that can be self-consistently obtained from the ICON EUV measurements.

## Posters

### SA54A - Dynamics of the Thermosphere and Ionosphere System at Low and Middle Latitudes Due to the External and Internal Forcing II Online Poster Discussion

13:45-14:45 CST

Online only

Yen-Jung Joanne Wu is a chair

The GOLD, COSMIC-2 and ICON missions, along with existing ground-based and space-based observations as well as advances in numerical modeling capabilities, provide an exciting opportunity to study the variability in the thermosphere and ionosphere system due to various forcing from above and below. Topics of interest include, but are not limited to, the changes of the winds, composition, and thermal structure in the thermosphere, as well as electric field and electron density in the ionosphere due to geomagnetic activity, waves arising from the lower atmosphere and sudden stratospheric warmings, etc. We solicit presentations that address scientific issues with respect to variability in the thermosphere and ionosphere using observations, numerical simulations, and general circulation models.

### SA55B - Dynamics of the Thermosphere and Ionosphere System at Low and Middle Latitudes Due to the External and Internal Forcing III Poster

14:45-18:15 CST

McCormick Place - Poster Hall, Hall A (South, Level 3)

Yen-Jung Joanne Wu

The GOLD, COSMIC-2 and ICON missions, along with existing ground-based and space-based observations as well as advances in numerical modeling capabilities, provide an exciting opportunity to study the variability in the thermosphere and ionosphere system due to various forcing from above and below. Topics of interest include, but are not limited to, the changes of the winds, composition, and thermal structure in the thermosphere, as well as electric field and electron density in the ionosphere due to geomagnetic activity, waves arising from the lower atmosphere and sudden stratospheric warmings, etc. We solicit presentations that address scientific issues with respect to variability in the thermosphere and ionosphere using observations, numerical simulations, and general circulation models.

### [SA55B-1396 - Instabilities near the turbo-pause \(~100 km\) indicated by the Richardson number \(Ri\) measured by the MIGHTI instrument on the ICON satellite.](#)

First Author Gary R. Sweson

14:45-18:15 CST

*McCormick Place - Poster Hall, Hall - A (South, Level 3)*

The vertical flux of heat and constituents near the 100 km region of the lower thermosphere is due to mixing associated with atmospheric instabilities as well as breaking gravity waves. The Richardson number (Ri), which combines the convective state of the atmosphere with wind shear, describes a criterion which leads to Kelvin-Helmholtz instabilities (KHI) which results in turbulence for the condition when  $Ri < 0.25$ , assuming laminar flow. Parametric instabilities, associated with wave-wave coupling and resonance where  $-1 < Ri < 1$ , also leads to vertical mixing.

The analysis described herein is an intra-annual study of middle to equatorial latitudes of the Brunt-Väisälä frequency ( $N^2$ ), the wind shear squared, and the distribution of the  $Ri$  in the upper turbo-pause region. The NASA ICON satellite is instrumented with the MIGHTI (Michelson Interferometer for Global High-resolution Thermosphere Imaging) instruments which measure Doppler winds and independently, rotational temperatures from the O<sub>2</sub> A-band. These observations were used to determine the  $Ri$  above 98 km, a region where turbulence generated eddy diffusion competes with molecular diffusion, a defining region coupling the O reservoir in the MLT upward, to the thermosphere. This analysis is for the year 2020, where the intra-annual, diurnal, and latitudinal variations for four zones between 12°S and 36°N are determined.

SA55B-1402 - Survey of Extended Strong Vertical Shear Regions of Horizontal Winds from the MIGHTI Experiment on the ICON Mission.

*Kenneth David Marr et al*

14:45-18:15 CST

*McCormick Place - Poster Hall, Hall - A (South, Level 3)*

The MIGHTI instrument on the ICON Explorer Mission measures horizontal winds in the upper atmosphere between 90 - 300 km. These vertical wind profiles, at times, exhibit strong shears, which can extend over several kilometers. Here we present a survey of these extended strong shear regions as measured between mission launch in 2019 through 2022. We examine the shear regions by season, latitude, and longitude.

SA55B-1404 - Vertical and latitudinal structure of quasi-6 day waves in neutral wind and temperature and their corresponding oscillation in column O/N<sub>2</sub>

First Author Yen-Jung Joanne Wu

14:45-18:15 CST

*McCormick Place - Poster Hall, Hall - A (South, Level 3)*

The quasi-6-day wave (Q6DW) is the planetary wave (PW) with period around 6 days. The creation of the Q6DW is related to the background atmosphere and amplifications of atmospheric instability. The signature of the Q6DW has been observed in the neutral atmosphere and ionosphere, which demonstrates mesosphere-ionosphere-thermosphere coupling. This study focuses on a period in April 2020, with a significant Q6DW both the neutral winds and temperature observed by the Ionospheric Connection Explorer (ICON). We report the continuous vertical structure of the Q6DW from 90 to 180 km in zonal wind for the first time. The upward propagating feature is identified in zonal wind and temperature but not in meridional wind. The latitudinal structure of the wind and the temperature is consistent with the gravest symmetric wave number 1 Rossby (1,1) mode. During the same period, column O/N<sub>2</sub> ratio from Global-scale Observations of the Limb and Disk (GOLD) shows a quasi-6-day oscillation (Q6DO) at mid-high latitude. The latitudinal structure of column O/N<sub>2</sub> ratio suggests that the vertical wind perturbation of a Q6DW also follows the prediction of the Hough function solution.

(continued on next page)

SA55C-1407 - Variability of the ICON-MIGHTI Green and Red Line Volume Emission Rates

*Colin Charles Triplett et al*

14:45-18:15 CST

*McCormick Place - Poster Hall, Hall - A (South, Level 3)*

The Michelson Interferometer for Global High-resolution Thermospheric Imaging (MIGHTI) onboard NASA's Ionospheric Connection Explorer (ICON) uses observations of both the atomic oxygen green line (557.7 nm) and red line (630.0 nm) airglow emissions to measure wind velocities in the upper mesosphere/thermosphere between 90 and 300 km. Although not absolutely calibrated, the green and red volume emission rate (VER) observed by MIGHTI provided high-precision information on spatial and temporal variations. Since it is a limb viewing instrument, MIGHTI resolves the altitudinal structure of these emissions while ground-based

instruments integrate along the vertical dimension. From MIGHTI's vantage point the morphology and variability of the green and red lines are explored in both annual variations as well as shorter time frames where the VER values are much brighter than their annual means. Connections are made between these anomalies and the simultaneously measured wind structures.