NASA Heliophysics research cites aurora as possible cause for the *Weddel Sea Anomaly* in the ionosphere

Typically, the density of electrons is highest in the upper layer of the ionosphere, where X-rays and ultraviolet rays are most intense. This upper layer also tends to be most dense during the day when the sunlight is most intense. But in **the Weddell Sea Anomaly,** a region near the tip of South America in the southeast Pacific Ocean, the electron density is highest not at midday but at midnight.

The odd reversal was discovered in the 1950s by a team of scientists in Antarctica who sent high-frequency radio signals into the ionosphere and recorded the return signals, a measurement called an *ionogram.* New research explaining the anomaly could help scientists better understand a wide array of ionospheric anomalies, which can, at their worst, cause major interruptions to worldwide radio and satellite signals.

Researchers have attributed the location of the Weddell Sea Anomaly to the changing angle of the Earth's magnetic fields, which enhances the effectiveness of the neutral winds in that region. But a **JGR paper written by Richards et al.** doubted this was a complete explanation, in part because the changes in the magnetic fields' angle are relatively small and often cancel each other out.

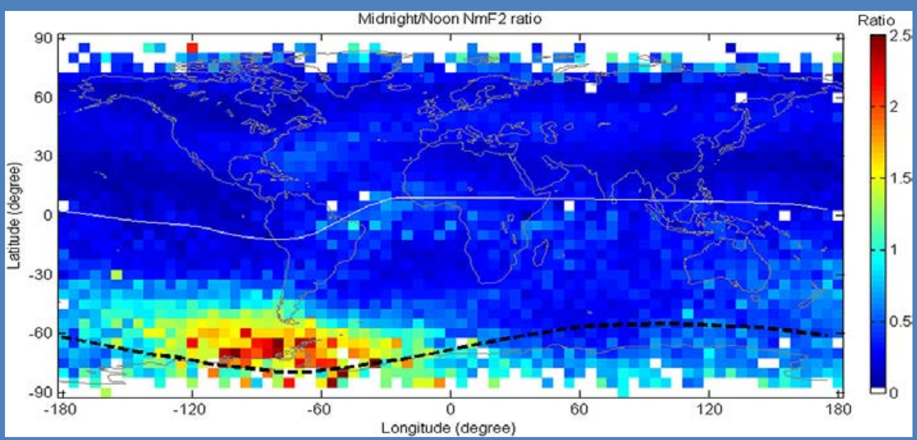

Figure 1 shows the global ratio of the peak ionosphere density from midnight to midday taken from FORMOSAT-3/ COSMIC satellite constellation radio occultation data. The WSA clearly stands out in the Southern Hemisphere between about 30°W and 150°W longitude.

To look for alternative explanations**, the team combined more than 50 years of ionosonde recordings with satellite data** from the *Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC),* a joint Taiwan-U.S. mission consisting of six microsatellites. They fed these and other data into what's known as the field line interhemispheric model, which simulates how Earth's magnetic field affects the physics and chemistry of the ionosphere.

The team found that the anomaly is not confined to this region due to changes in the angle of magnetic field, but because of longitudinal changes in the neutral winds and neutral densities in the anomaly area. The longitudinal changes are attributed to the varying latitudinal distance from the auroral zone energy input.

**This highlight was adapted from:* Underwood, E. (2017), Auroras may explain an anomaly in Earth's ionosphere, Eos, 98, https://doi.org/10.1029/2017EO078387. 07 August 2017.

The two next-to-launch **NASA Heliophysics missions, ICON and GOLD**, will also explore the physics of the ionosphere and provide data to help scientists better understand anomalies like this one, helping us better understand this near-Earth region of space and someday better predict when we can expect interrupted radio and communications signals.