Dallas
Masters
Spire Global
Vu Nguyen, Spire Global
Vladimir Irisov, Spire Global
Oleguer Nogues-Correig, Spire Global
Linus Tan, Spire Global
Takayuki Yuasa, Spire Global
Joshua Ringer, Spire Global
Christian Rocken
Michael Gorbunov, Spire Global
Oral

Over the last few years, Spire has grown from a small start-up company to the third largest constellation of satellites and the largest commercial producer of satellite-based GNSS Earth observation products. As of January 2021, Spire operates 112, 3U Cubesats in a variety of orbit planes, with many more launches planned through the end of 2021 and beyond.

Spire currently produces over 10,000 quality-controlled RO profiles and millions of TEC observations each day. Due to its agility and rapid launch cycle, Spire has the unique ability to improve performance and add capabilities on-orbit that are impossible with traditional, agency-led satellite missions. In a first for commercial RO and to compensate for lack of aircraft atmospheric data during the COVID-19 pandemic, Spire offered the world's large institutional weather forecasting centers access to Spire's full operational RO data stream for assimilation. The ECMWF, UK MetOffice, and the US Air Force (USAF) accepted the offer. After only five weeks of testing, the ECMWF began assimilation of over 5,000 daily Spire RO profiles into the operational ECMWF forecast system. The ECMWF continued assimilation of Spire data from mid-May 2020 to the end of September 2020, when Spire ended the free data provision. The ECMWF reported a significant increase in FSOI scores when assimilating Spire RO, with similar feedback from the UK MetOffice and the USAF.

Also of significance were five separate, independent validation studies of Spire RO performed by the UK MetOffice, ESA (in cooperation with EUMETSAT and Wegener Center for Climate and Global Change at the University of Graz), NASA, NOAA, and the US Naval Research Laboratory (NRL). The UK MetOffice performed an impact study using three months of Spire RO from October to December of 2019 (with over 5,000 daily profiles provided) and concluded that "there is a substantial forecast benefit from assimilating Spire data." Most significantly, the UK Met Office replaced Metop-C RO data with comparable quantities of Spire RO data and showed that Spire and Metop-C data "are of similar quality."1 Likewise, NASA concluded that Spire RO "penetration depths were assessed as being particularly good. In fact, they were determined to exceed those of heritage RO observing systems (e.g., COSMIC-1) and as comparable to those of modern RO science missions (e.g., COSMIC-2)."2

In our talk, we will overview the status and capabilities of the Spire satellites and describe the collection of RO profiles from the GPS, GLONASS, Galileo, and QZSS constellations. We will also show the results of these numerous third-party evaluations and operational assimilation of Spire RO. Finally, we will outline our plans for expanding the Spire constellation in the future, including new payload instruments.

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