The Use of Spire Radio Occultation Measurements in the GEOS Atmospheric Data Assimilation System

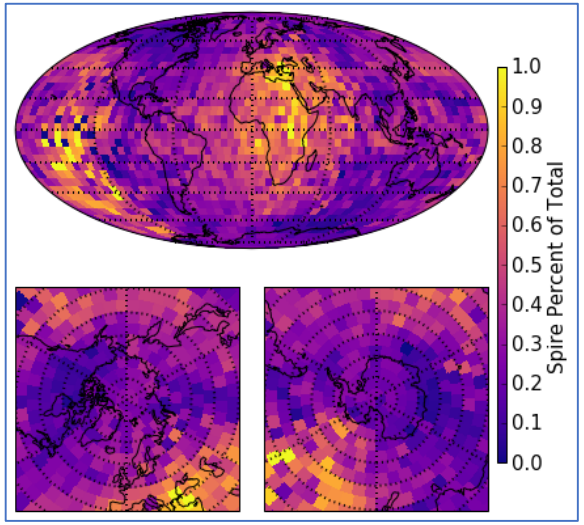
Will McCarty, NASA Goddard Space Flight Center

Purpose: Combine all available atmospheric observations via the Goddard Earth Observing System (GEOS) Atmospheric Data Assimilation System (ADAS) to produce the best multidimensional analysis of the atmospheric dynamic and thermodynamic state

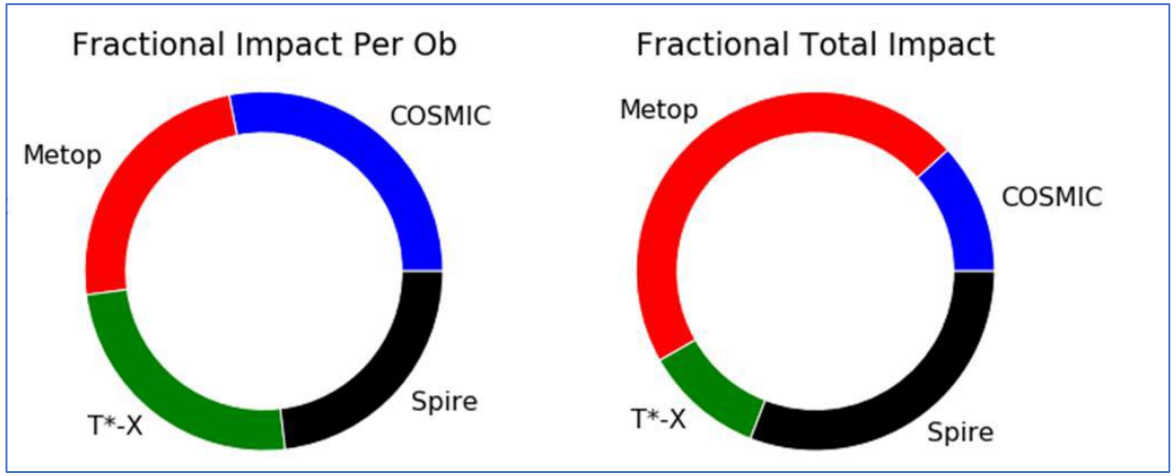
Study Objective: Evaluate the Spire Level 2 bending angle profiles in the context of the GEOS ADAS and other RO observing systems

Imagery: Spire Level 2 retrievals of Bending Angle

Findings: The Spire observations were found to be generally consistent and complementary to existing radio occultation observing systems. In terms of quantity, the Spire observations accounted for ~20-40% of the total RO observing system. Additionally, these observations were complementary to the other GNSS-RO observing systems in that they filled spatial data voids due to their broad global sampling (top). Statistically, the observations were found to be comparable to other RO observing systems, though there was a noted tropospheric bias in those observations derived from the GLONASS GNSS signals. Their impacts on forecast were found to be comparable to other RO observing systems. No statistically significant impact on medium range forecast (2+ days) was seen, but there was a quantifiable reduction on short-term (24 hour) forecast error via the FSOI metric (bottom). This was comparable to other RO observations when normalized per-observation. Thus, the constellation carried a total error reduction that scaled with the observation counts.



Distribution of the Spire data relative to the other RO observing systems illustrates that they are filling data voids (shown, observations at 00 UTC ± 3 hr).



Contribution of Spire, relative to the rest of the GNSS-RO observing system, to the reduction of 24 hour forecast error within the GEOS atmospheric data assimilation system.