1. Science Objectives

1.1. Dynamics of the Equatorial Stratosphere
- Observations of gravity waves (GW) momentum fluxes in the tropics are needed for waves of all scales as well as the intermittency of their occurrence. The use of the combined balloon and satellite observations (v, v', p, and z') based on the GW polarization relationship.

1.2. The Kelvin wave amplitude determined by STR
- Temperature perturbations for all individual STR profiles, after one day vs 2019/12-22, producing ~750 profiles in total.
- Temperature residuals after subtracting the long period variation show a
- The Kelvin wave amplitude determined by STR averaged within ±10 km of the balloon, is comparable to the peak amplitude determined by COSMIC-2 with ±2° latitude of the equator.
- Balloons determine the intrinsic periods of the waves from the Lagrangian measurement platform, as opposed to the Eulerian measurements from COSMIC-2 and radiosondes.

2. Balloon-borne Radio Occultation (RO)

2.1. Geomety of Balloon-borne Radio Occultation
- The RO receiver is located near the tangent point, on the COSMIC-2 satellite.

3. Strato-e2e Super-Balloon Pressure Campaign

3.1. ROC2 Black Diagram
- ROC2 contains a full-ERTM OEM board with two side-looking wiasics GNSS antennas.

4. Characteristics of ROC2 Balloon-borne RO

4.1. String of Pearls
- A sequence of ROC2 balloon-borne RO profiles were retrieved over 17 days from 2019-12-08 to 2019-12-22, producing ~750 profiles in total.
- The profiles are sorted according to the vertical positions determined by the orbital planes of the rising and setting satellites. The 400-500 km horizontal drift of the tangent points provides 3D sampling.

5. Tropical Waves Captured by Balloon-borne RO

5.1. ROC2 Receiver
- The receiver tracks all GNSS signals (GPS, GLONASS, Galileo, Beidou), however no GPS signals were recorded continuously in 2019-2020. Faster satellite data rates in the upcoming 2021-2022 campaign will enable transmission of occultations from all balloon campaigns.

6. Summary
- The RO2C data are being used to drive:
  - Precise positions for Quasi-lagrangian gravity wave measurements that correspond to shorter periods than are possible with Tethered Balloon GPS and Vertical profiles of temperature variations associated with equatorial waves at different scales, continuously along the trajectories of the balloons.
- The dense, high vertical resolution STR-2 RO profiles show excellent agreement with collocated radiosonde and spaceborne RODB.
- Over the 17-day dataset, STR-2 RO and ERA-5 reanalysis show a 0.2% mean and 1% 95% percentile difference in refractivity.
- The amplitude of Kelvin waves of 4.6 km vertical wavelength was larger than that observed from spaceborne RO, likely due to higher vertical resolution and denser sampling.
- Consecutive sampling from STR-2 RO also resolved westward propagating inertia-gravity waves with 3-4 day intrinsic periods, and the 2.5 km vertical wavelength that are not resolved with the temporal sampling of COSMIC-2.
- RO2C will fly on 5 balloons in the 2021 Strato-e2e Science campaign in 2021-2022 for a more comprehensive sampling of equatorial wave.