MMM SEMINAR SERIES

Observation of Gravity Waves in the Tropical Tropopause Layer using Superpressure Balloons

Milena Corcos

NWRA (NorthWest Research Associates)

Tropical mesoscale gravity waves are of interest for their effects on climate, weather and aviation. They impact a wide range of processes, from influencing synoptic systems, being an essential driver of the Quasi-Biennial Oscillation (QBO), to modulating cirrus clouds life cycle, which impacts the local dynamics and the global climate.

Convective tropical gravity wave activity is investigated using in-situ, quasi-Lagrangian observations of momentum fluxes and phase speeds, gathered during the two first campaigns of Strateole-2. The dataset consists of 8 and 16 superpressure balloon flights, during boreal winter 2019-2020 and 2021-2022, at 18 and 20 km of altitude. Each balloon flew up to several months, giving observations at a temporal resolution of 30s, in an intrinsic frame, unique to this type of measurement platform.

First, the relation between gravity waves and deep convection is investigated using geostationary satellite data from the NOAA/NCEP GPM_MERGIR satellite data product, at 1h resolution. The amplitude of gravity wave momentum fluxes shows a clear dependence on the distance to the nearest convective system, with a strong decay as distance to convection increases. The sensitivity of the wave flux to distance from convection is stronger for high frequency gravity waves (periods shorter than 60 min). Lower frequency waves tend to a non-zero, background value, far from convection. The large scale variation of gravity-wave intermittency within the equatorial belt is also studied. The results highlight spatial variations of gravity wave activity, with the highest momentum flux recorded over land.

Then, we focus on describing the importance of the component of the gravity waves that is stationary with respect to the convective cells. This component is triggered by convection acting like a barrier to the background flow and is not currently parameterized in climate models. It is investigated here, using the theory of Beres et al. (2004) and observations of intrinsic phase speed and momentum fluxes from the balloons. These waves are observed to have a wide range of intrinsic frequencies, but have mainly smaller than average horizontal scales, closer to the convective systems scale. They represent a small portion of our observations, but when the overall observed gravity waves seem to contribute more than half of the QBO forcing, this stationary component is responsible for a non negligible part of it.

Thursday, 12 September 2024, 2:00PM

Refreshments 1:45PM

Please also join colleagues for refreshments and informal discussion after the seminar until 3:30pm

NCAR-Foothills Laboratory, 3450 Mitchell Lane

FL2-1022, Large Seminar

Seminar will also be live webcast ***https://operations.ucar.edu/live-mmm***

Participants may ask questions during the seminar via Slido.