In Situ Measurements of Turbulence Utilizing Radiosondes with Quantification of Relative Estimation Error between NWP Analysis and Measurements

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Introduction

Atmospheric gravity waves are thought to be a cause of clear air turbulence. Gravity waves are oscillations that disturb atmospheric stability. Learning to identify and isolate parameters of these waves, such as temperature, wind speed and wind direction, can help us possibly forecast pockets of clear air turbulence. This periodic movement of air parcels may have great effects on wildfires and airplane travel.

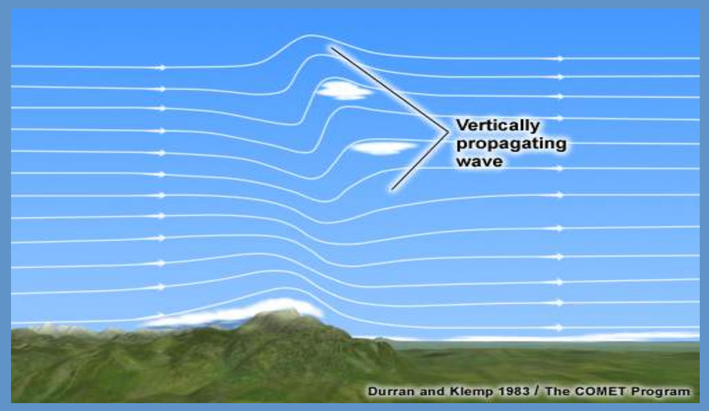

Fig. 1 Shows how clear air turbulence can cause changing pressure zones in the atmosphere

Radiosondes are balloon-borne devices which provide basic atmospheric measurements including temperature, relative humidity, pressure, wind speed, and wind direction. Hence we can measure gravity wave parameters.

Method

- Initialize radiosonde with surface conditions to provide most accurate flight data
- Real-time quality control of collected data during flight
- Initial analysis of data after flight
- Full statistical analysis with uncertainties of flight data to determine applicable parameters.

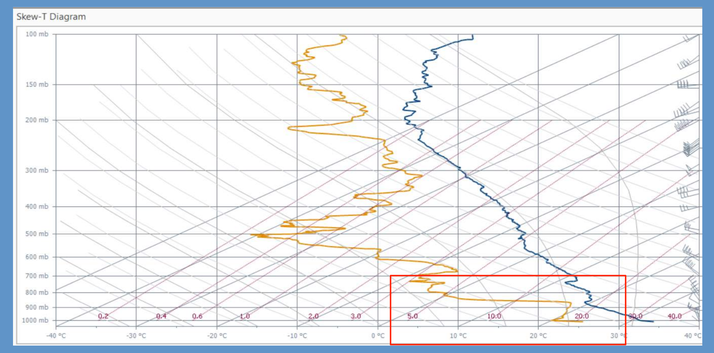

Fig. 3 Shows a Skew-T diagram, plot with the isotherms rotated 45° clockwise to produce greater separation of isotherms and dry adiabats, showing a characteristic feature that may indicate the possibility of a gravity wave.

Conclusion

We have been able to detect certain characteristic features which may indicate the potential for gravity waves using current and historical data (fig. 2 and 3). August 2017 we will compare our current results with data acquired during a total solar eclipse. Additionally we will compare our data against a Numerical weather prediction (NWP), Weather Research and Forecasting (WRF), model for evaluating forecasts with changes in solar radiation.

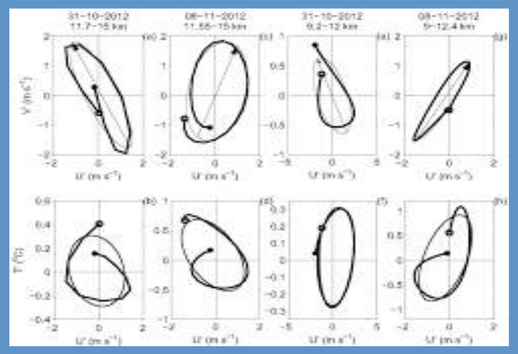

Fig. 2 Hodograph, vertical distribution of the horizontal wind, showing the presence of gravity waves in the atmosphere

Future

- Launch radiosondes during 1st contact, 2nd contact, totality, 3rd contact and 4th contact and on each side of totality of the 2017 total solar eclipse.

- Launch radiosondes over a wide range of the total path through the United states.
- Data validation of WRF.