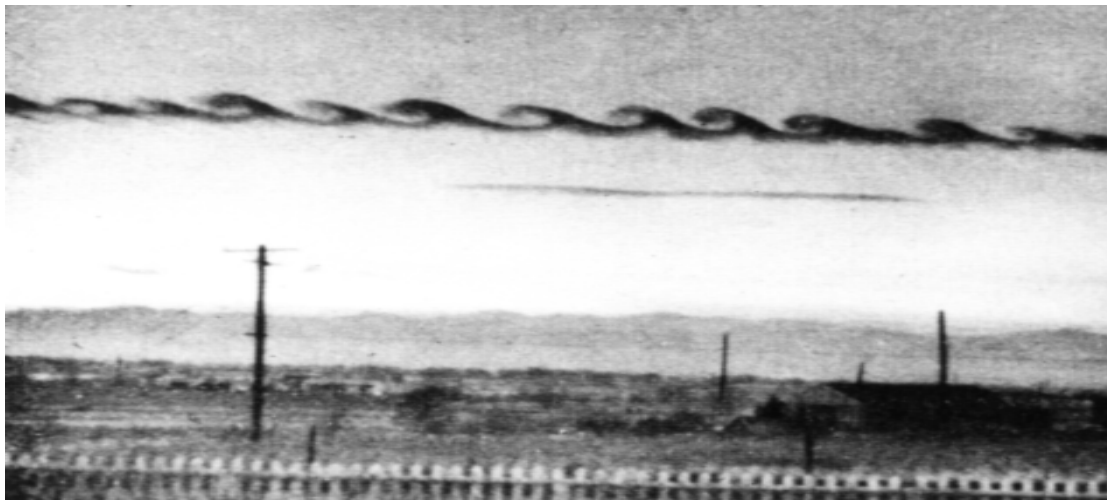

Climate Variability Model for Two-Phase Fluid with Free Boundary and Variable Interphase Circulating Around the Earth

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ABSTRACT

In this proposal, a two-dimensional model of longitudinal two-phase atmospheric motion around the earth is used to describe the Kelvin-Helmholtz instability in the tropopause. The stratopause is regarded as unknown free boundary and the tropopause is considered as unknown contact discontinuity surface. The main goal of the proposal is to investigate the criteria for instability and efficiency of mixing.

There are two key reasons for focusing on mixing in the atmosphere: mixing plays an important role in climate variability and mixing is the most uncertain component of the modern general circulation model. From the practical standpoint, understanding the mixing processes in the atmosphere is also important because, e.g., the mixing produced by internal waves disperses pollutants in the atmosphere. Additionally, irregularities in the earth's upper atmosphere may have significant effects on communication systems that use radiowaves.

The long term goals in this proposal are the following:

- Investigate numerically the influence of mixing on formation of solitary wave-like solutions for the free boundary and the contact discontinuity. To this end, the fractional step method will be employed (by our collaborator from University of Texas at Arlington);
 - The potential energy available for mixing in the atmosphere will be determined analytically;
 - To understand how the variations of the free surface affect the mixing processes in the atmosphere, the results will be compared to the case of the "rigid lid approximation".
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