ICTS Fluid Dynamics Seminar

Title   : Stability Analysis of Shallow Water equations

Speaker   : Mukesh Singh Raghav (ICTS -TIFR, Bengaluru)

Date   : Monday, 12th August 2024

Time   : 10:00 AM (IST)

Abstract : We examine the linear stability characteristics of atmospheric waves in the framework of rotating shallow water equations (RSWE). Both modal and non-modal approaches for stability analysis have been considered.

For modal analysis, the stability of equatorial easterly (EE) and westerly (EW) mean shear flow, modelled as Gaussian profiles is analysed under the beta-plane approximation and in spherical coordinates. Mixed Rossby-gravity and Rossby waves are found to be considerably affected by shear. While these flows are always neutrally stable on sphere, exponentially unstable modes are found to be excited on beta-plane bringing into question the suitability of the widely used beta-plane approximation

The governing linearised RSWE operator on the beta-plane turns out to be normal in the absence of mean flow in contrast to the corresponding operator in spherical coordinates, which is non-normal. Such non-normal systems, under suitable conditions, are known to go through an initial period of perturbation energy amplification. This amplification of perturbation energy can be large enough such that the linear analysis ceases to hold and the system transitions into the non-linear regime. The structure of the initial conditions which lead to such a large growth, and its subsequent evolution, will be discussed.

Venue   : Online
Zoom link: https://icts-res-in.zoom.us/j/95113267599?pwd=UnFpM3dseVVBWFNQWkFuUGx3UDFnQT09
Meeting ID: 951 1326 7599
Passcode: 110011