Dynamics Lecture

Title: From momentum equations to thermal wind relationships: Understanding the impact of global warming on extreme events

Abstract: This lecture explains the basic dynamics of atmospheric motions, focusing on the concepts of geostrophic wind and thermal wind, as well as their implications in the context of global warming. We begin by deriving the geostrophic wind from the horizontal momentum equations through scale analysis, illustrating how the balance between the pressure gradient force and the Coriolis force governs large-scale wind patterns. This lecture will then delve into the thermal wind relationship, demonstrating how changes in temperature gradients affect upper-level westerlies. Understanding the thermal wind relationship is important in the context of global warming, as changes in meridional temperature gradients under global warming can significantly impact upper-level westerlies. The introduction will then cover the mechanism of Arctic warming amplification, its role in reducing meridional temperature gradients, and the implications of these changes for extreme events.

Speaker biography:

Dr. Eun-Soon Im currently holds a joint position as an Associate Professor in the Department of Civil and Environmental Engineering and the Division of Environment and Sustainability at the Hong Kong University of Science Technology. She has dedicated her career to the development and improvement of the Regional Climate Model (RCM) and has conducted extensive research on regional climate changes across various regions worldwide. She has also plenty of credible experience in working with impact assessment teams, fostering interdisciplinary collaborations between climate science and impact sectors through the application of RCM simulations to various impact models (e.g. hydrology, agriculture, energy). The value and novelty of her work are well demonstrated by the relevant publications in leading journals in the field of climate research.