Improved Skill in Asian Monsoon Seasonal Forecasts Derived from Multi-satellite Snow Data Assimilation in Ungauged Eurasia

Professor Zong-Liang Yang

Director, CIESS and Jackson Chair in Earth System Sciences
Department of Geological Sciences, Jackson School of Geosciences
The University of Texas at Austin

Our group has recently developed a multisensor and multivariate global land data assimilation (DA) system based on the Community Land Model 4 (CLM4) and the Data Assimilation Research Testbed (DART). The coupled CLM4/DART system is capable of assimilating MODIS snow cover fraction, GRACE terrestrial water storage (TWS), and AMSR-E low- and high-frequency brightness temperature (T_B), thereby producing an eight-year land product for use in hydroclimate hindcasts with a robust global snow and soil moisture estimation. We have also been developing a high-resolution version for the Tibetan region as well as developing a global land DA system using the Noah land surface model with multi-parameterization (Noah-MP) options.

In this presentation, we will first evaluate the snow and soil moisture DA product using *in situ* and satellite observations as well as outputs from other models. Our DA product is from a suite of eight modeling experiments that assimilate individual or multiple satellite observations. This evaluation is conducted both for the Tibetan Region and for the global land, which offers a unique insight into the complementary roles of multiple satellites from the perspective of land DA.

To quantify how multisensor and multivariate land DA improves subseasonal to seasonal (S2S) climate prediction, we run a series of ensemble-based land–atmosphere modeling experiments with CLM4–CAM5 in which land state variables (such as snow and/or soil moisture) are initialized using the eight-year offline DA product. We will present the coupled model simulations for surface air temperature, precipitation, and runoff. Our results show that the Tibetan Plateau (TP) and its surrounding river basins, high latitudes (e.g. Siberia), and south Asian monsoon areas benefit most from snow DA. In particular, our results confirmed snow DA as an important yet underutilized source of the Asian monsoon predictability on subseasonal to seasonal time scales. The most robust and pronounced improvement is seen over the central north India, which has profound agricultural and economic implications. More importantly, we show that different satellite observations (e.g., MODIS vs. GRACE) and different ungauged Eurasian regions (e.g., Tibet vs. higher-latitude Eurasia) are important to the forecast at different lead times. The findings are important for the choice of satellites and the choice of region-of-focus tailored for the Asian monsoon forecast.

22 March 2019

11:30 a.m.

Conference Room, 3/F, Mong Man Wai Building

EARTH SYSTEM SCIENCE PROGRAMME

Enquires: 3943 9624 essc@cuhk.edu.hk