Oceanography Department Seminar

SOON-II AN

PROFESSOR
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"Can a reduction in CO2 emissions alleviate a damage by climate change? Hysteresis and irreversibility of climate change)"

Net zero emission of CO2 or even its negative emission is highly demanded in near future to avoid climate crisis. However, the carbon imprint on Earth climate may live longer than expecting due to the inertial effect of earth climate system. Thus, the transient response of climate system to a decrease in CO2 emissions may not be simply symmetric with an increase of CO2 emissions because of its hysteretic behavior. Here, we explored the hysteresis and irreversibility of the global & regional climates by using CESM under idealized climate change scenarios where the atmospheric CO2 concentration is gradually increased to four times the present-day level and then reduced back to the present-day level along the same path. A novel quantification method that visualizes the global pattern of hysteresis and irreversibility is developed. The results showed that 89% of the global area experiences irreversible changes in surface temperature, especially being stronger over Southern Ocean, the Arctic, and the North Atlantic Ocean. On one hand, the cold blob over the Northern north Atlantic Ocean is observed during CO2 ramp-up, while the warm blob appears during CO2 ramp-down, which leads a clear hysteresis feature. On the other hand, the gradual cooling over the Southern Hemisphere, coupled with AMOC response, induces a robust hysteresis in ITCZ. This, in turn, becomes a contributing factor to the hysteresis observed in monsoons, ENSO, IOD, Hadley circulation, tropical cyclones, and even midlatitude weather systems. Dynamical interpretations on the hysteresis behavior of climate phenomena will be discussed during the talk.

Thursday January 18th, 2024 3:00p.m. MSB #100