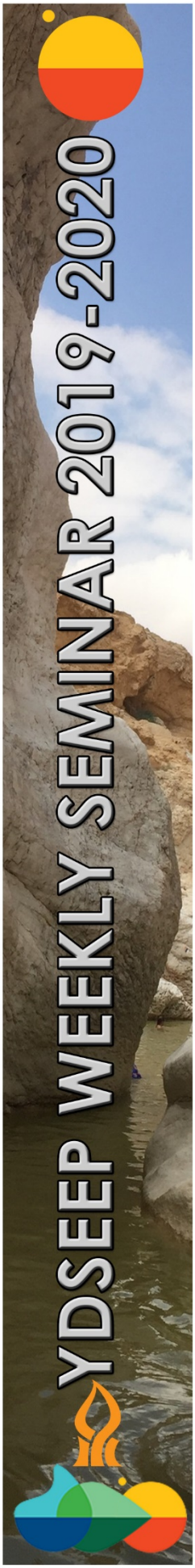

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Warm climate surprises: from enhanced frequency of Sudden Stratospheric Warming events to a wet future California

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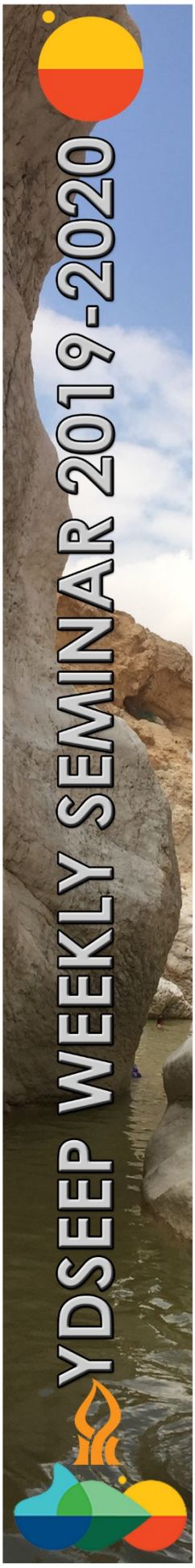
Abstract:

First half: major Sudden Stratospheric Warming events (SSWs) occur in the Arctic stratosphere during winter at a frequency of about six events per decade. An SSW features a distorted or completely reversed stratospheric polar vortex, as well as tens of degrees of warming within several days. SSW events affect the Arctic Oscillation (AO)/ Northern Annular Mode (NAM), and are related to extreme winter weather events in North America and Europe. We suggest that the expected strengthening of the tropical tropospheric variability known as the Madden-Julian Oscillation (MJO), which is currently the dominant atmospheric variability in intraseasonal time scales (20–40 days), may lead to an increase in the frequency of future SSW events, and discuss the mechanism.

Second half: the early-to mid-Pliocene (5.3–3 Ma), characterized by warmer temperatures and similar CO2 concentrations to present day, is considered a useful analog for future warming scenarios. Geological evidence suggests that during the Pliocene, many modern-day desert regions such as the South-West United States received higher levels of rainfall and supported large lakes and wetter vegetation types. These wetter conditions have been difficult to reconcile with model predictions of 21st century drying over the same areas. We show that this discrepancy between past evidence and future projections may be due to the models missing important feedback: Increasing sea surface temperature (SST) due to a weakening of the California upwelling leads to wetter conditions over nearby land, and wetter land leads to a weakening of the wind that forces the upwelling. The mechanism and consequences are discussed.

Date & Location:

Tuesday, December 7, 2021, 11:00
Lecture room, Physics Building (ground floor)



Suggested readings:

W. Kang and E. Tziperman. The MJO-SSW teleconnection: interaction between MJO-forced waves and the mid-latitude jet. Geophys. Res. Lett., 45 (https://doi.org/10.1029/2018GL077937):4400–4409, 2018. http://www.seas.harvard.edu/climate/eli/reprints/Kang-Tziperman-2018b.pdf

Minmin Fu, Mark Cane, Peter Molnar, and E. Tziperman. Warmer Pliocene upwelling site SST leads to wetter subtropical coastal areas, and to a positive feedback on SST. Submitted, 2021. https://groups.seas.harvard.edu/climate/eli/reprints/Fu-Cane-Molnar-Tziperman-2021b-preprint.pdf

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