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Impact of the synoptic circulation on the near surface layer thermal profile

Itamar Lensky (1), Uri Dayan (2), and Oded Guez (1)

(1) Department of Geography and Environment, Bar Ilan University, Ramat-Gan, Israel, (2) Department of Geography, The Hebrew University of Jerusalem, Jerusalem, Israel (msudayan@mscc.huji.ac.il)

We examine the near surface lapse rate, defined as the difference between the skin surface and 2 m air temperatures, retrieved from satellite (MODIS) and 94 meteorological stations over the Eastern Mediterranean (EM). This profile is important for estimation of sensible heat flux, an essential ingredient in the near surface energy balance equation and the water cycle. The lapse rate is enhanced by stronger solar insolation and attenuated by turbulence generated by stronger winds. These parameters vary according to atmospheric conditions e.g. horizontal pressure gradient and cloud cover, which are represented here by different synoptic categories. Strong longitudinal climatic and vegetation gradient over the EM as reflected by MODIS NDVI also lead to a gradual shift in the lapse rate.
Climatological values of the lapse rate show a distinct seasonal signature, whereas fluctuations are attributed to changes in atmospheric flow patterns. Therefore, we assess the role of seasonality, synoptic scale circulation and vegetation cover on the near surface thermal profile.
The effects of circulation on this profile are demonstrated for three synoptic categories covering all seasons. In the first synoptic category, continental conditions lead to larger daytime positive lapse rate over arid regions, and nighttime inversion. These thermal profiles are attenuated over regions with denser vegetation. At summer, a unique circulation system prevails leading to thermal profile signature similar to the seasonal. The windy and cloudy conditions associated with the third synoptic category increase the spatial variability of the thermal profile and delay the built-up of nighttime inversion. Based on knowledge of the atmospheric flow pattern, we will demonstrate retrieval of the near surface layer thermal profile at satellite resolution (MODIS NDVI, 250 m).