Supplemental Material

Supplemental material to the paper "Doppler lidar measurements of wind variability and LLJ properties in Central Oklahoma during the August 2017 Land–Atmosphere Feedback Experiment"

Journal of Applied Meteorology and Climatology
https://doi.org/10.1175/JAMC-D-22-0128.1

For many August days in 2017 the normal summertime pattern of high pressure from the extension of the subtropical Bermuda high pressure system westward over the southern Great Plains brought southerly winds, and southerly LLJs at night, to central Oklahoma; cooler air occupied the north central states. On an unusually large number of other days, the subtropical high's influence weakened in this area, and cooler air pushed southward over the region, bringing northeasterly flow and LLJs. An indicator of this weakening influence was a large number of hurricanes and tropical storms in the western Gulf of Mexico, which was not seen in other years.

On 20 August, for example, winds over the southern Great Plains were strong from the south at the surface according to surface charts (Fig.S1) because of a high-pressure system and southeasterly flow over the Gulf of Mexico. Directly north of Oklahoma a convergence of flows toward a surface low occurred along a cold front–warm front boundary (Fig.S1), and a convective outflow boundary was noted near Oklahoma at 1200 UTC for this day. The combination of these features is important for setting up the background conditions conducive to producing the nocturnal wind profiles observed at this time. Upper-air charts at the same time (250 hPa) show a tightening of the geopotential gradients over central CONUS between the extratropical trough hosting the fronts and the offshore high-pressure system over the Gulf of Mexico (Fig.S2). This clearly enhances the background wind structure.

An example of a northerly LLJ case occurring on 28 August points to the interaction of flows from a tropical cyclone over the Gulf of Mexico with high pressure developing over central CONUS. This flow configuration was a significant factor in producing the departures from the typically seen SGP southerly flow in summer (see surface chart for that day; Fig.S2). Interestingly, the 2017 hurricane season featured more hurricanes over the Gulf of Mexico when compared with other years. See the hurricane tracks for 2016–19 below (Fig.S3).

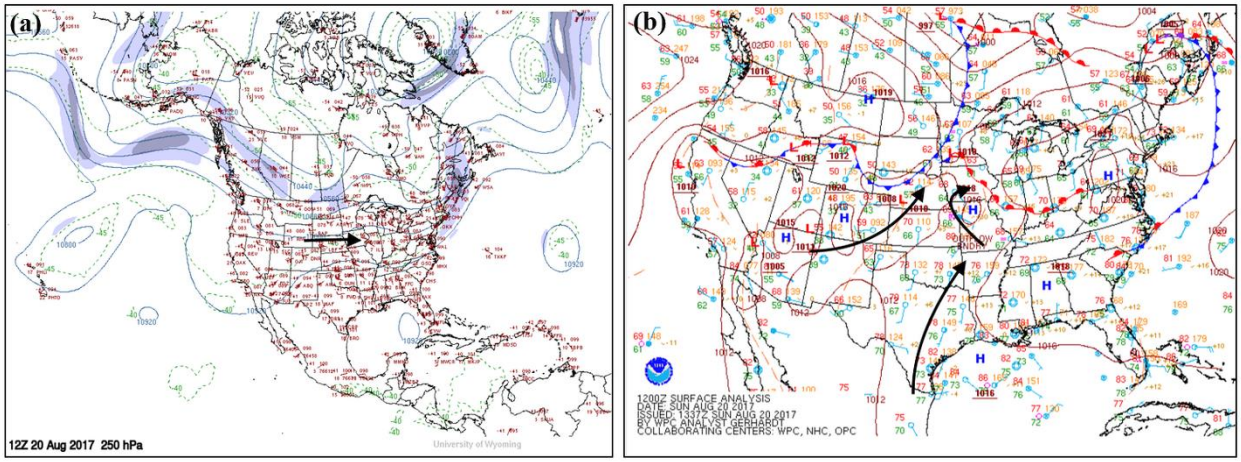

Figure S1. Flow configuration for 20 Aug 2017 for (a) 250 hPa and (b) the surface at 1200 UTC.

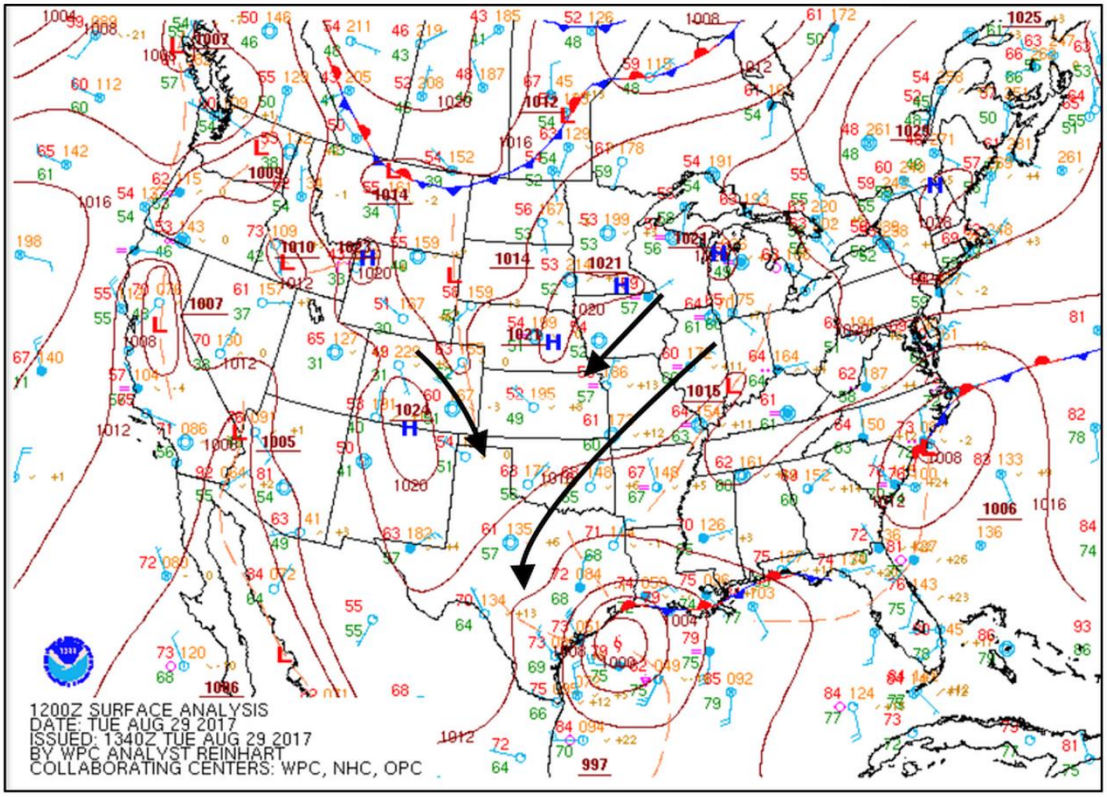

Figure S2. Flow configuration for 28 Aug 2017 for the surface at 1200 UTC.

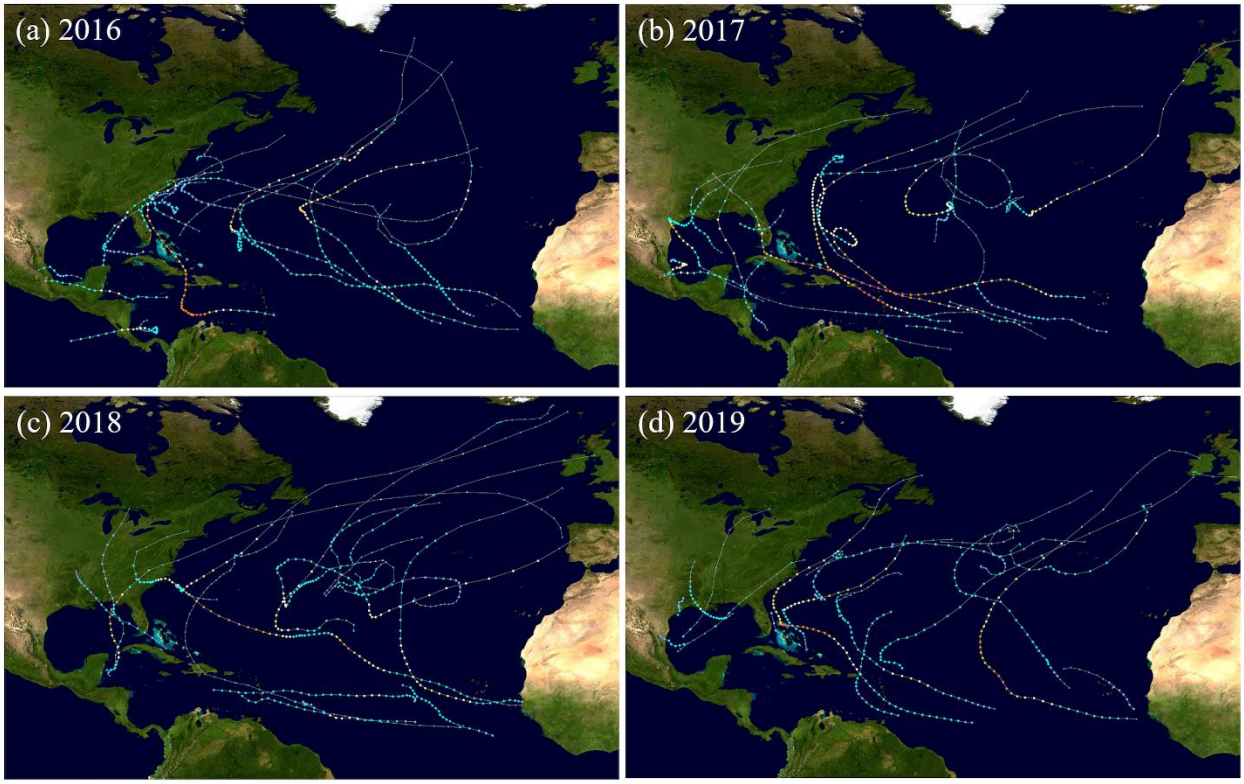

Figure S3. Hurricane tracks for (a) 2016, (b) 2017, (c) 2018, and (d) 2019. Note that 2017 has more tracks over the Gulf of Mexico (closer to SGP) than other years; 2019 is close behind 2017.