Figure S1. (a) Wind rose showing the distribution of wind speeds at 98 m AGL for September 2019 to August 2020, using observations from the E06 floating lidar. (b) 24x12 heat map of the frequency of stable conditions at the E06 lidar location, classified in terms of the WRF-based bulk Richardson number calculated between 0 m and 200 m ASL. (c) same but for unstable conditions.
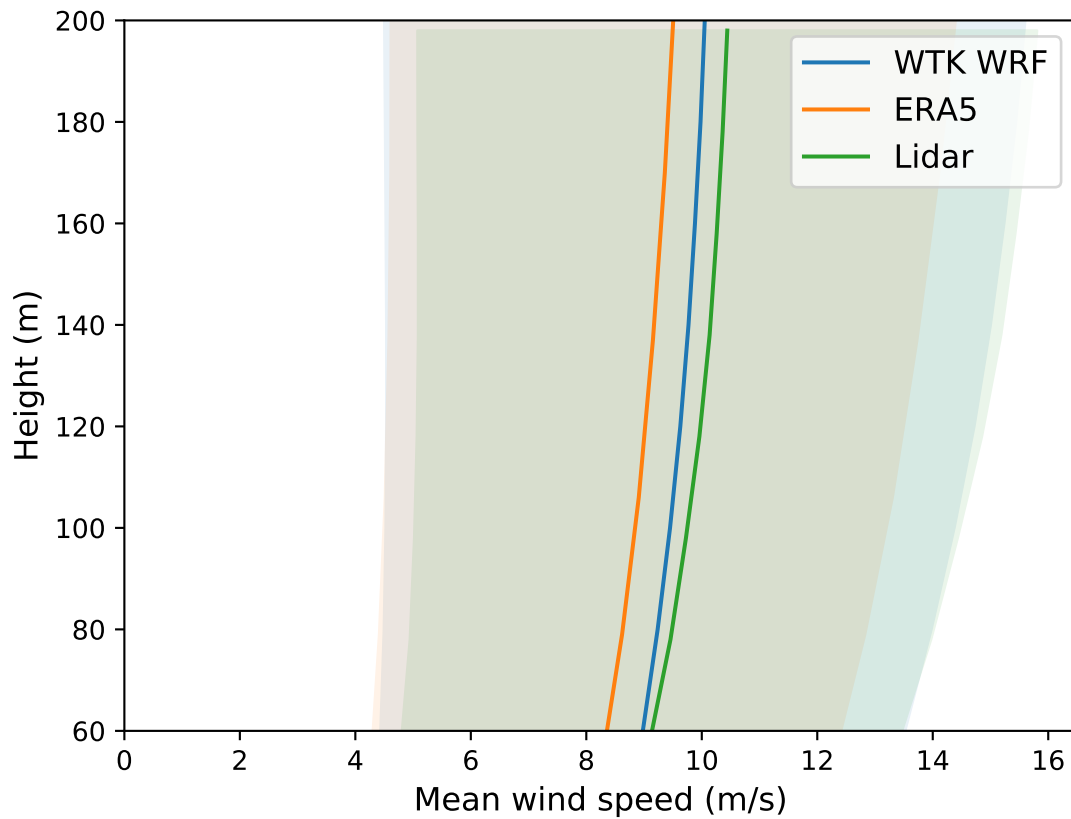
Figure S2. Mean vertical wind speed profiles for all three data sources at the location of the E06 lidar. The shaded bands represent ± the standard deviation of the data.
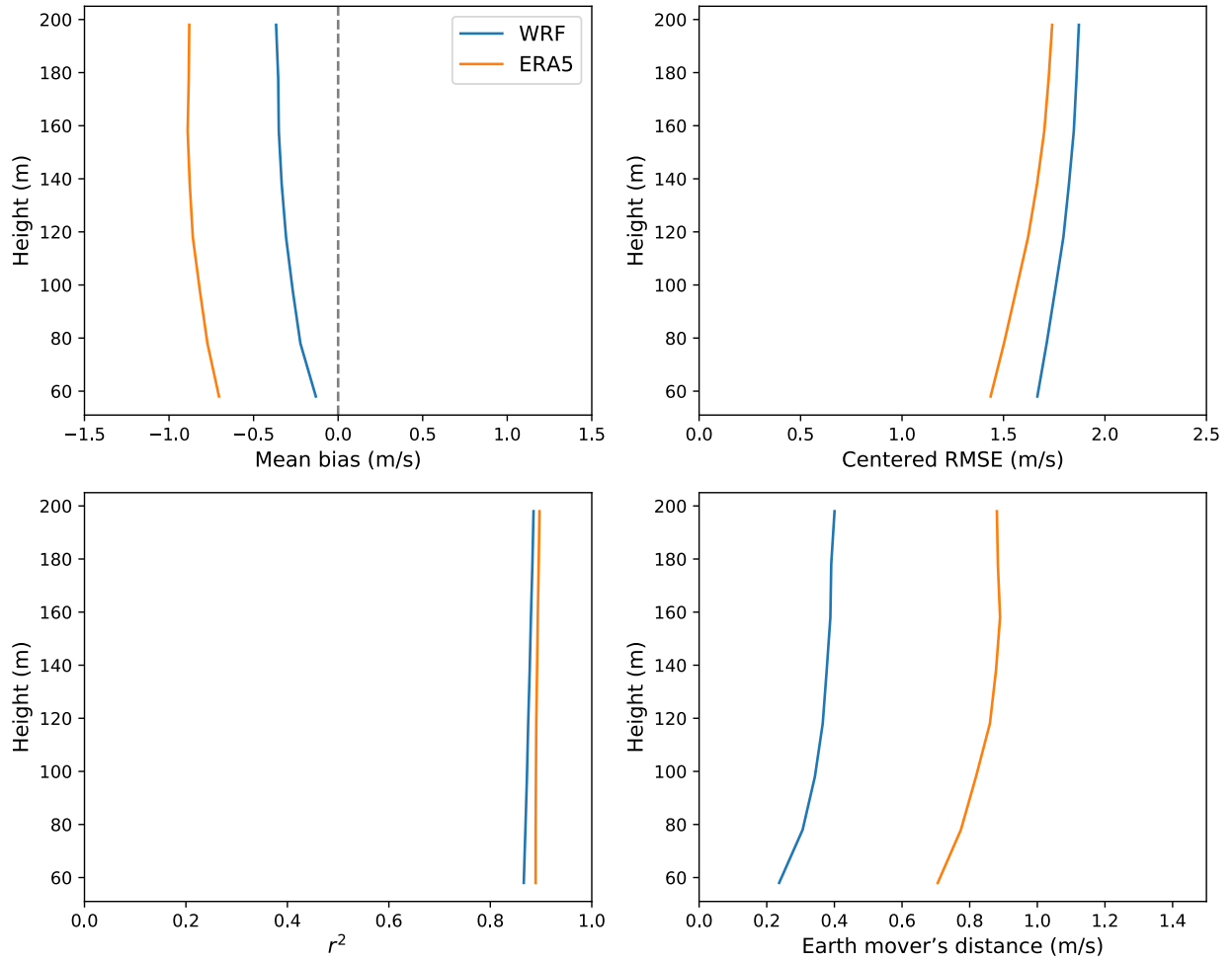
Figure S3. Vertical profiles of mean bias, cRMSE, r^2, and EMD for the offshore test case using the E06 lidar.
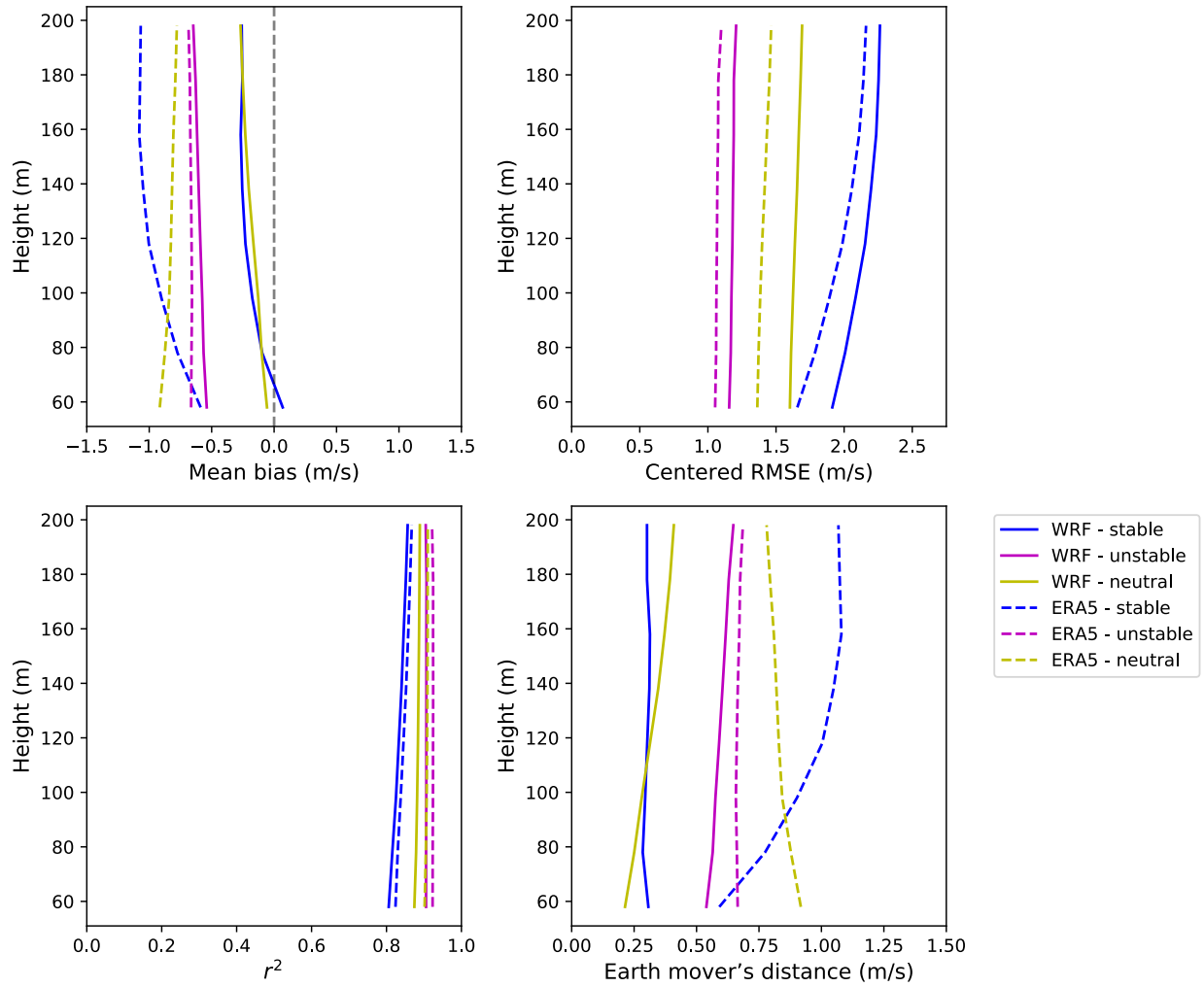
Figure S4. Vertical profiles of performance metrics segregated by stability for the offshore test case using the E06 lidar.
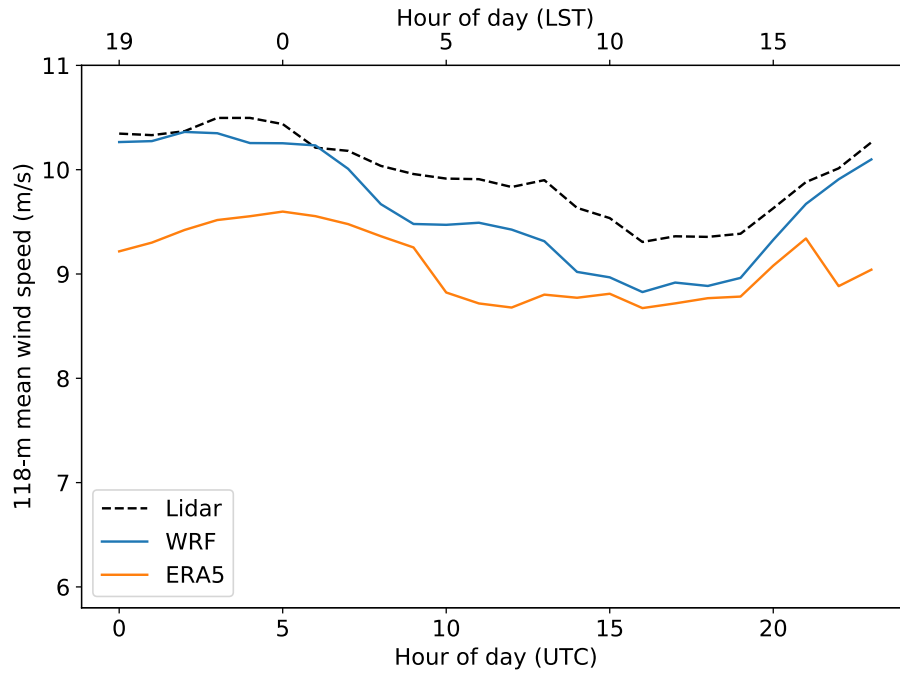
Figure S5. Average diurnal cycle of the ~120-meter wind speed from lidar, WRF, and ERA-5 at the location of the E06 lidar.
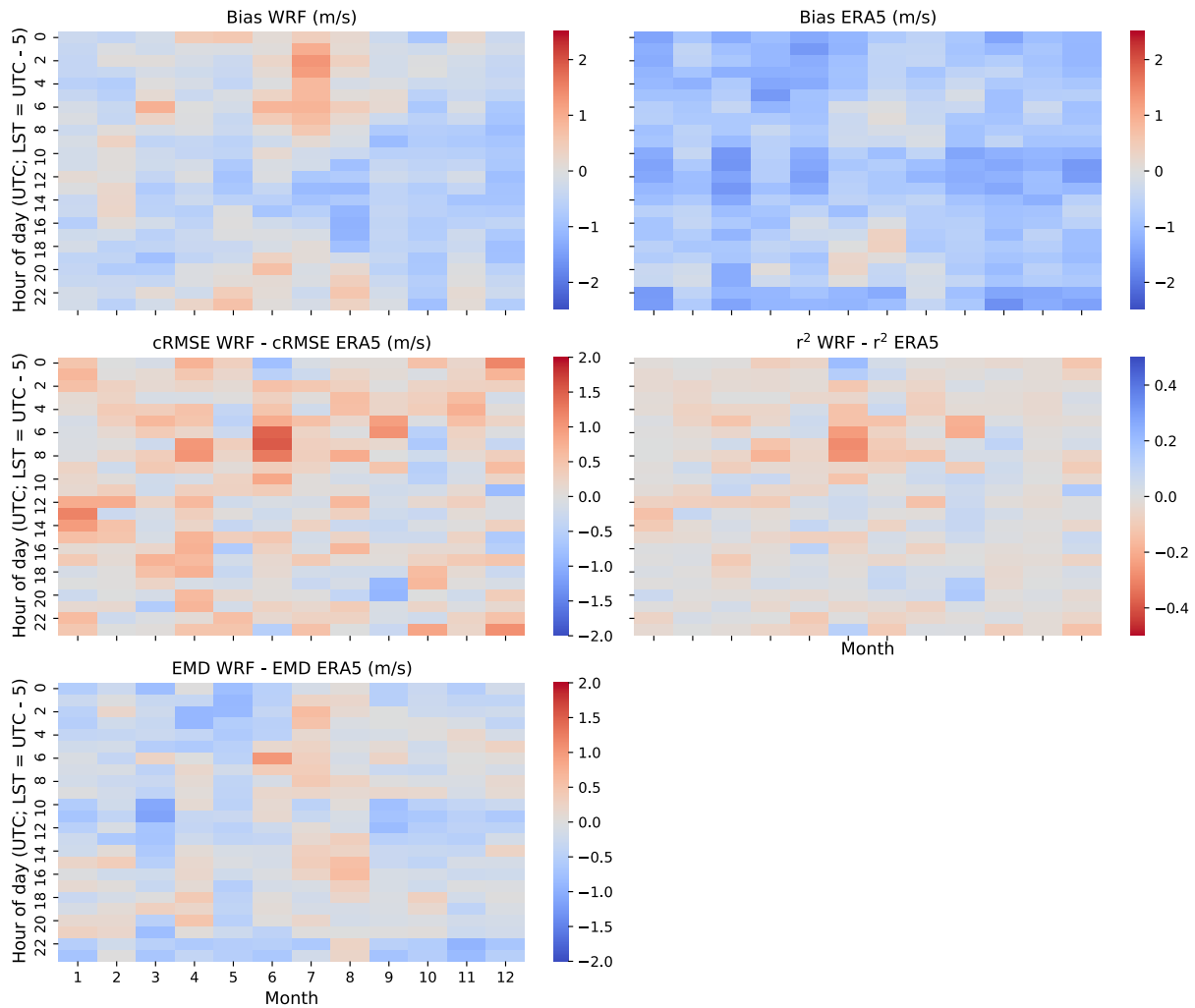
Figure S6. 24x12 heat maps at the location of the E06 lidar showing the diurnal and seasonal variability in the performance metrics for the 98-meter wind speed.