



Supplement of

Understanding day-night differences in dust aerosols over the dust belt of North Africa, the Middle East, and Asia

Jacob Z. Tindan et al.

Correspondence to: Jacob Z. Tindan (jztindan@psu.edu) and Bing Pu (bpu@ku.edu)

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Figure S1: A map of AERONET sites used for the evaluation of LMD IASI DOD and the examination of day-night differences in CAOD. AERONET solar sites and their ID numbers corresponding to Tables 2 are shown in red dots for North Africa, blue dots for the Middle East, and green dots for Asia. Lunar sites (as listed in Table 3) are shown in cyan-stars for North Africa, magenta stars for the Middle East. None of the lunar sites in Asia met the data filtering criteria.



Figure S2: Annual mean (Ann) and seasonal mean climatology (2008–2019) of CALIOP DOD at (a–e) daytime (~1:30 p.m. local solar equator-crossing time (ECT), (f–j) nighttime (~1:30 a.m. local solar ECT), and (k–o) day-night differences. Areas where day-night differences in DOD do not pass the 95% confidence level (t-test) in (i–l) are masked out in grey.



Figure S3: Same as Fig. S2. but for dust plume height (km) from CALIOP.



Figure S4: Annual (Ann) and seasonal mean surface winds climatology (2008–2020) three hours prior to IASI overpass time at (a–e) daytime (6:30 a.m. local solar ECT), (f–j) nighttime (6:30 p.m. local solar ECT), and (k–o) day-night difference from ERA5 (unit: m s⁻¹). Shading shows wind speed, and vectors denote wind directions. Areas where day-night differences in wind speed do not pass the 95% confidence level (t-test) in (i–l) are masked out in grey.



Figure S5: Annual (Ann) and seasonal mean surface winds climatology (2008–2020) six hours prior to IASI overpass time at (a–e) daytime (3:30 a.m. local solar ECT), (f–j) nighttime 3:30 p.m. local solar ECT), and (k–o) day-night difference from ERA5 (unit: m s⁻¹). Shading shows wind speed, and vectors denote wind directions. Areas where day-night differences in wind speed do not pass the 95% confidence level (t-test) in (i–l) are masked out in grey.



Figure S6: Annual (Ann) and seasonal mean climatology (2008–2020) of (a–e) daytime (9:30 a.m. local solar EC3D), nighttime (f–j) (9:30 p.m. local solar ECT), and (l–o) day-night difference in dust uplift potential (DUP) calculated based on a constant wind velocity threshold of 7 m s⁻¹ following Bergametti et al. (2017) and using wind speeds from ERA5. Areas where day-night differences in DUP do not pass the 95% confidence level (t-test) in (l–o) are masked out in grey.



Figure S7: Annual (Ann) and seasonal mean climatology (2008–2020) of precipitation rate from IMERG three hours prior to IASI overpass time at (a–e) daytime (6:30 a.m. local solar ECT), (f–j) nighttime (6:30 p.m. local solar ECT) and (l–o) daynight difference. Areas where day-night differences in precipitation rate do not pass the 95% confidence level (t-test) in (l-o) are masked out in grey.

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Figure S8: Annual (Ann) and seasonal mean climatology (2008–2020) of precipitation rate from IMERG six hours prior to IASI overpass time at (a–e) daytime (3:30 a.m. local solar ECT), (f–j) nighttime (3:30 p.m. local solar ECT), and (l–o) daynight difference. Areas where day-night differences in precipitation rate do not pass the 95% confidence level (t-test) in (l-o) are masked out in grey.



Figure S9: Annual (Ann) and seasonal mean climatology (2008–2020) of planetary boundary layer height (PBLH) at (a–e) daytime (9:30 a.m. local solar ECT), (f–j) nighttime (9:30 p.m. local solar ECT), and (k–o) day-night differences from MERRA-2. Areas where day-night differences in PBLH do not pass the 95% confidence level (t-test) in (k–o) are masked out in grey.



Figure S10: Annual (Ann) and seasonal mean climatology (2008–2020) of 850 hPa vertical velocity at (a–e) daytime (9:30 a.m. local solar ECT), (f–j) nighttime (9:30 p.m. local solar ECT), and (k)–(o) day-night differences from the ERA5 (unit: Pa s⁻¹). Areas where day-night differences in vertical velocity do not pass the 95% confidence level (t-test) in (k–o) are masked out in grey.

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