# Supporting Information for "Space - scale resolved surface-atmospheric fluxes across a heterogeneous mid-latitude forested landscape"

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**Table S1.** IOP averaged scale-resolved heat fluxes. RMS error values scaled by $\sqrt{N_{samples}}$

| IOP | Total LE | Total H | Turb. LE | Meso. LE | Turb. H | Meso. H |
|---|---|---|---|---|---|---|
| July | 179.98 ± 4.78 | 88.31 ± 0.94 | 123.07 ± 2.40 | 56.92 ± 4.14 | 71.25 ± 0.74 | 17.05 ± 0.58 |
| Aug. | 256.44 ±2.92 | 88.04 ± 1.02 | 210.28 ± 2.38 | 46.16 ± 1.69 | 68.02 ± 0.78 | 20.01 ± 0.66 |
| Sep. | 69.01 ± 2.86 | 89.13 ± 1.13 | 49.36 ± 1.87 | 19.65 ± 2.17 | 76.36 ± 0.78 | 12.77 ± 0.81 |

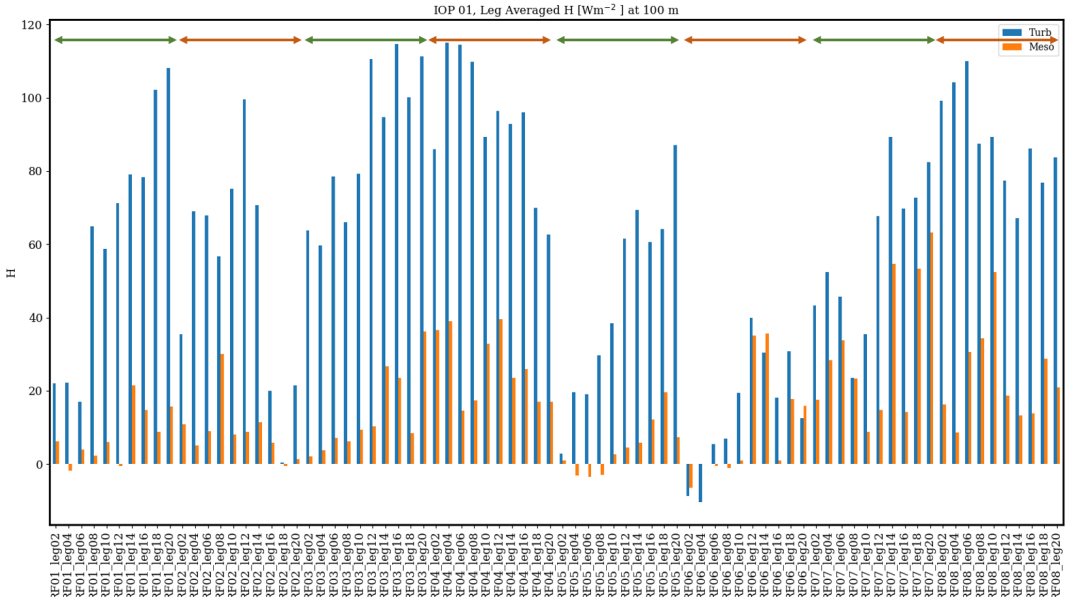


**Figure S1.** Flight leg averaged, scale-resolved sensible heat fluxes at 100m for the July IOP. x axis shows flight leg names. Arrows at the top of the figure span the length of one research flight. Green arrows cover morning flights and orange arrows cover afternoon flights.

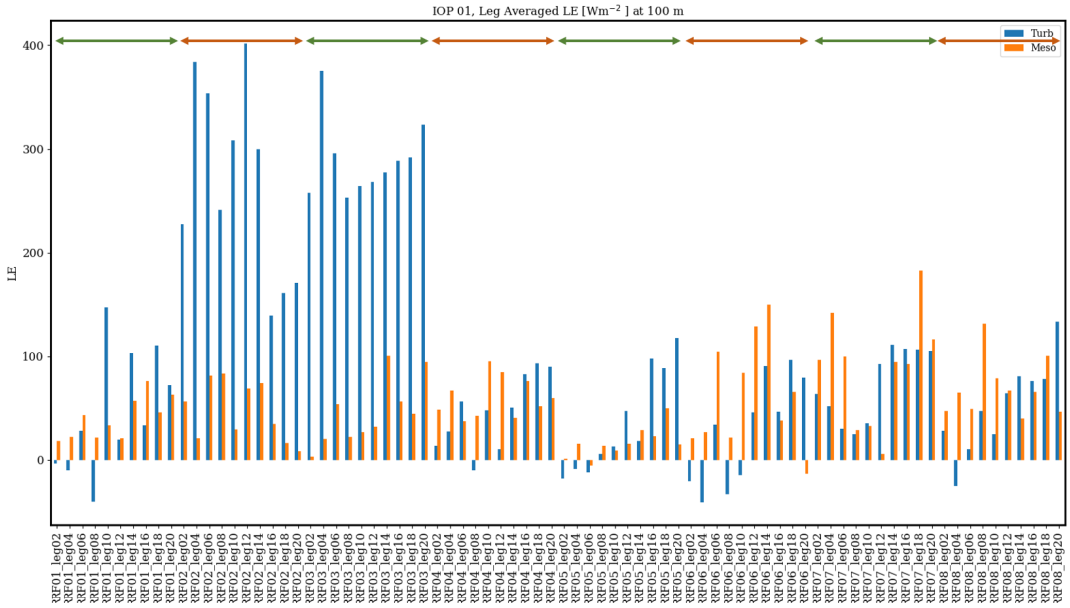


**Figure S2.** Flight leg averaged, scale-resolved latent heat fluxes at 100m for the July IOP. x axis shows flight leg names. Arrows at the top of the figure span the length of one research flight. Green arrows cover morning flights and orange arrows cover afternoon flights.

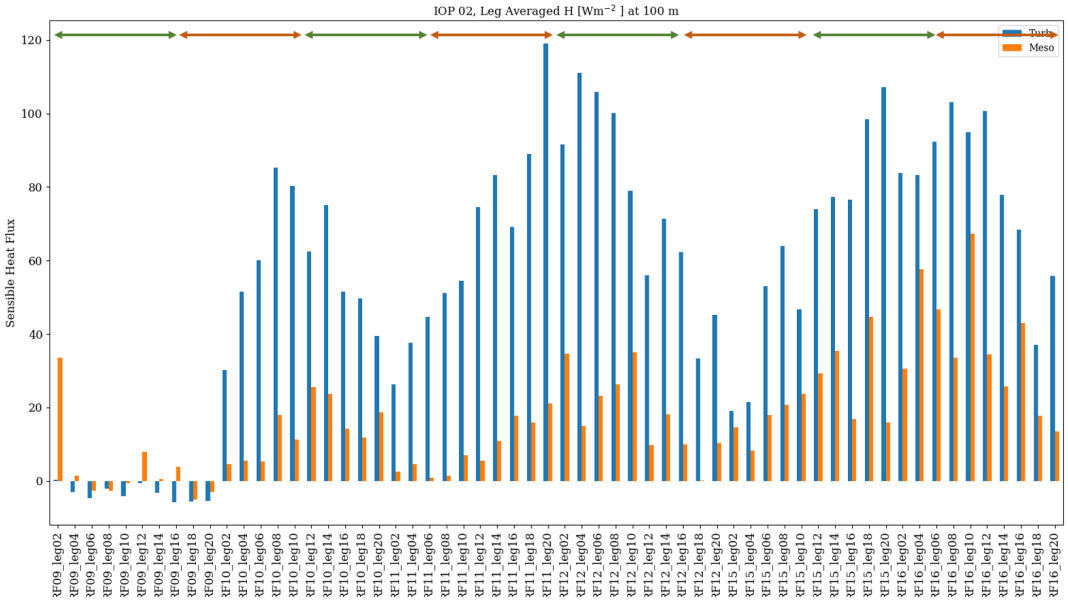


**Figure S3.** Flight leg averaged, scale-resolved sensible heat fluxes at 100m for the August IOP. x axis shows flight leg names. Arrows at the top of the figure span the length of one research flight. Green arrows cover morning flights and orange arrows cover afternoon flights.

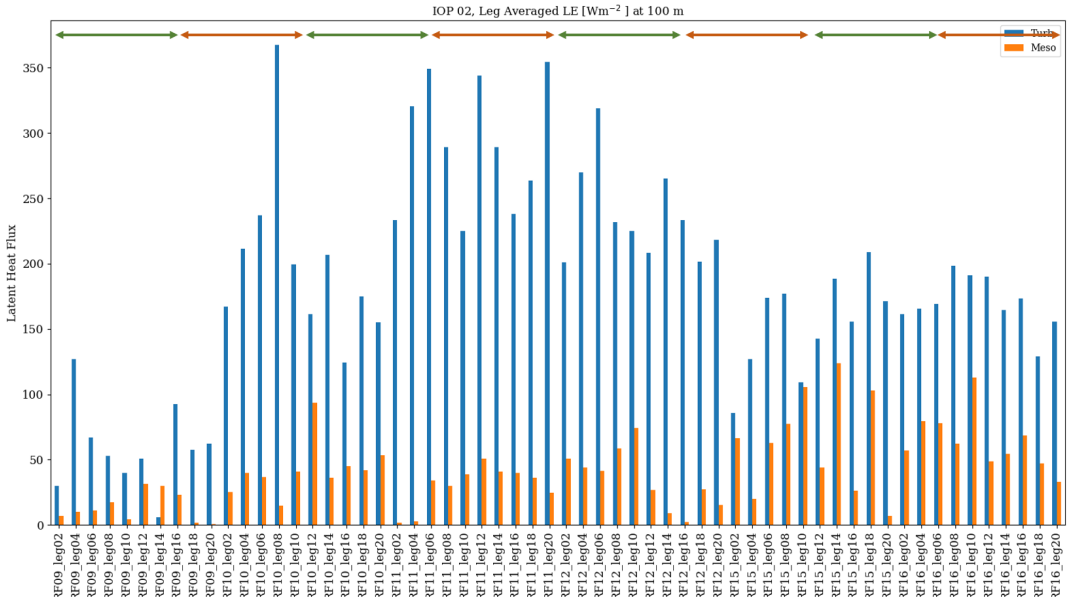


**Figure S4.** Flight leg averaged, scale-resolved latent heat fluxes at 100m for the August IOP. x axis shows flight leg names. Arrows at the top of the figure span the length of one research flight. Green arrows cover morning flights and orange arrows cover afternoon flights.

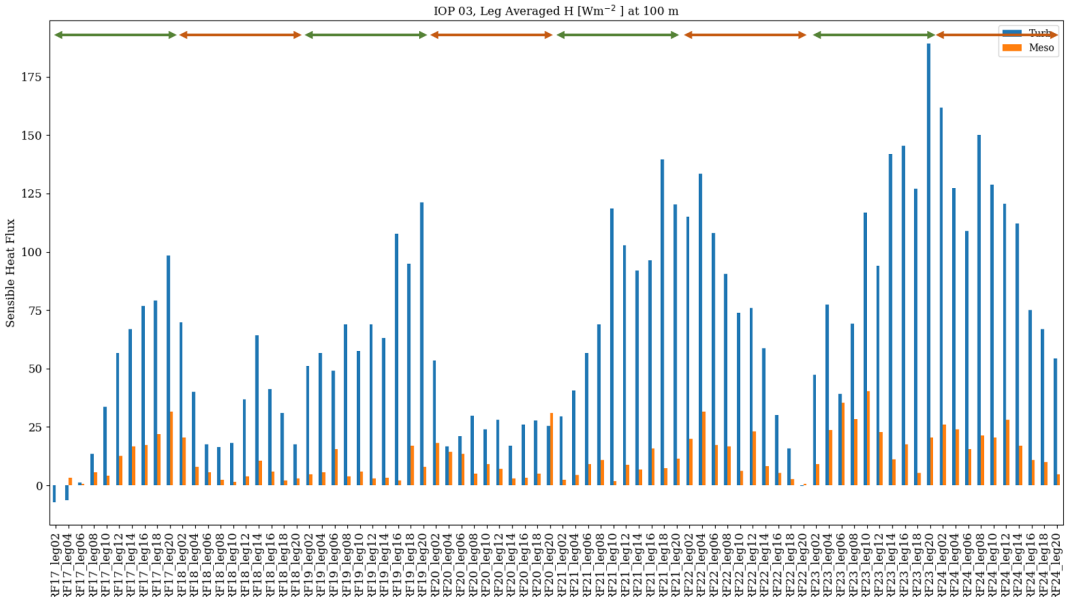


**Figure S5.** Flight leg averaged, scale-resolved sensible heat fluxes at 100m for the September IOP. x axis shows flight leg names. Arrows at the top of the figure span the length of one research flight. Green arrows cover morning flights and orange arrows cover afternoon flights.

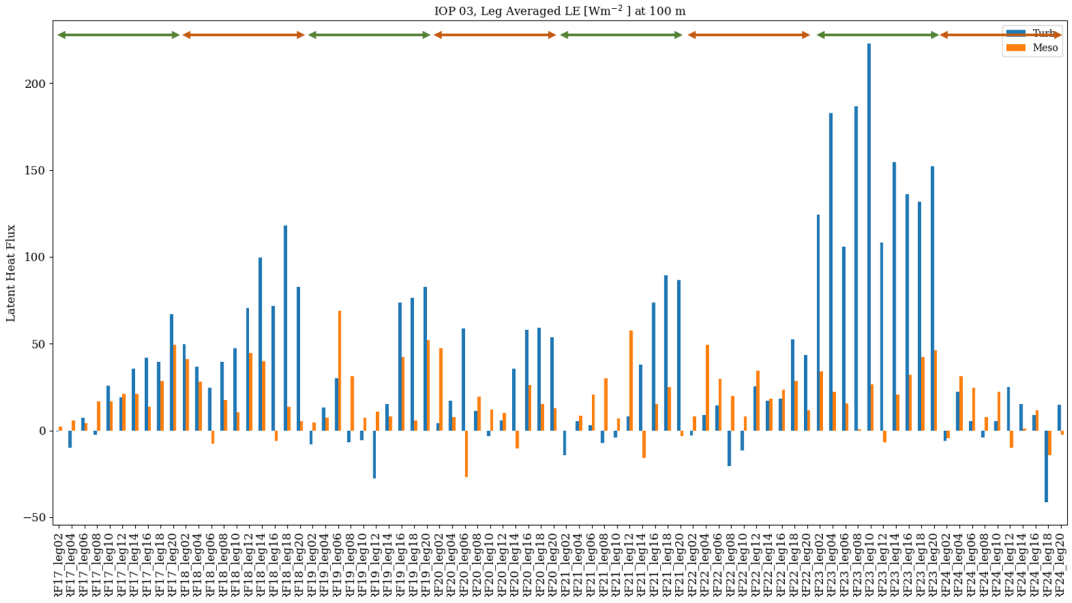


**Figure S6.** Flight leg averaged, scale-resolved latent heat fluxes at 100m for the September IOP. x axis shows flight leg names. Arrows at the top of the figure span the length of one research flight. Green arrows cover morning flights and orange arrows cover afternoon flights.

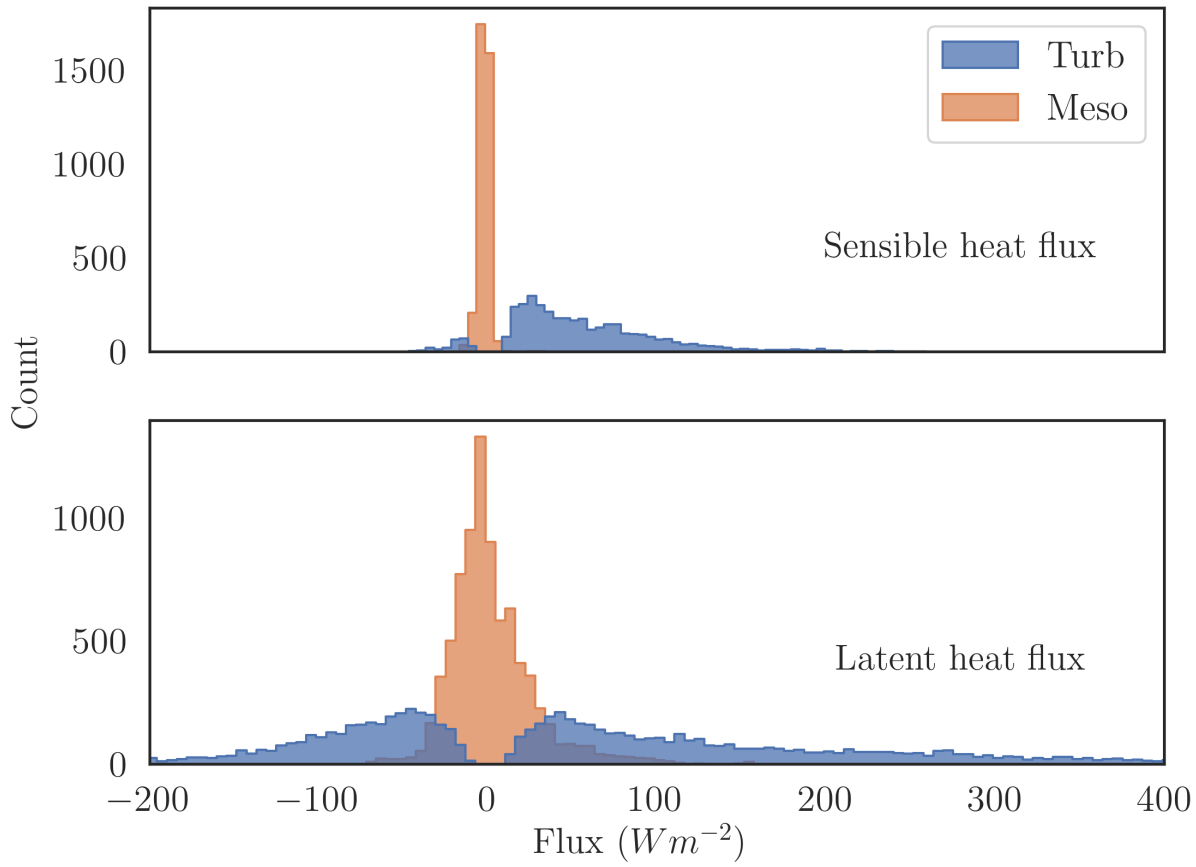


**Figure S7.** Histograms of turbulent and mesoscale fluxes for cases when the measured mesoscale fractions are lesser than 0

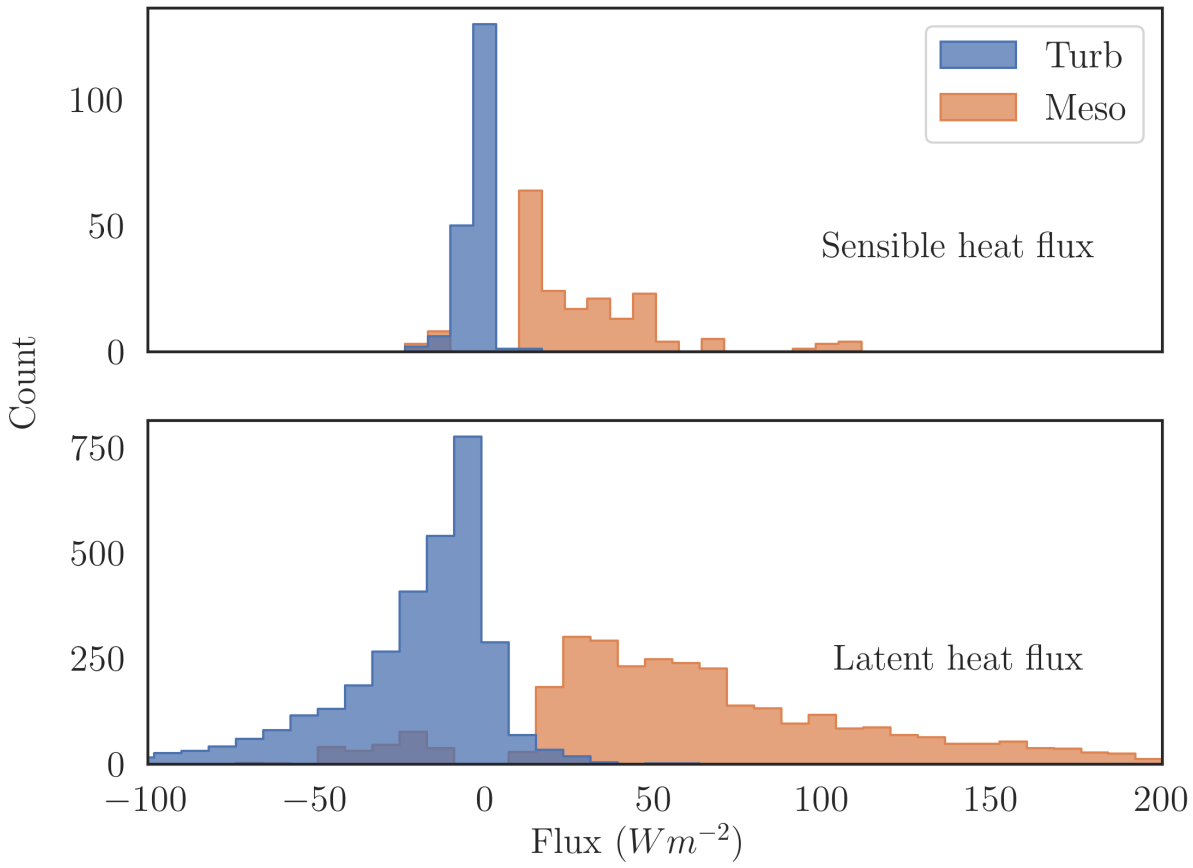


**Figure S8.** Histograms of turbulent and mesoscale fluxes for cases when the measured mesoscale fractions are greater than 1

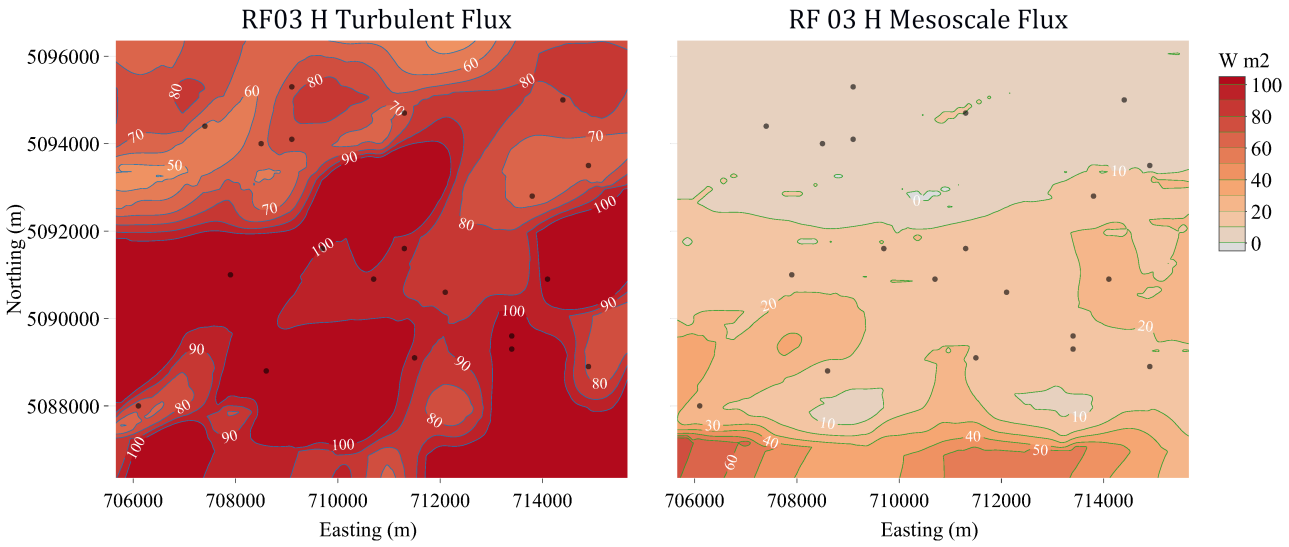


**Figure S9.** Turbulent (left) and mesoscale ( right) sensible heat flux topographies for Research Flight 03 in the July IOP, 11 Jul. 09:20 to 11:20 CDT, over the 10x10 km CHEESEHEAD core domain. The brown dots are the NCAR-ISFS tower locations.

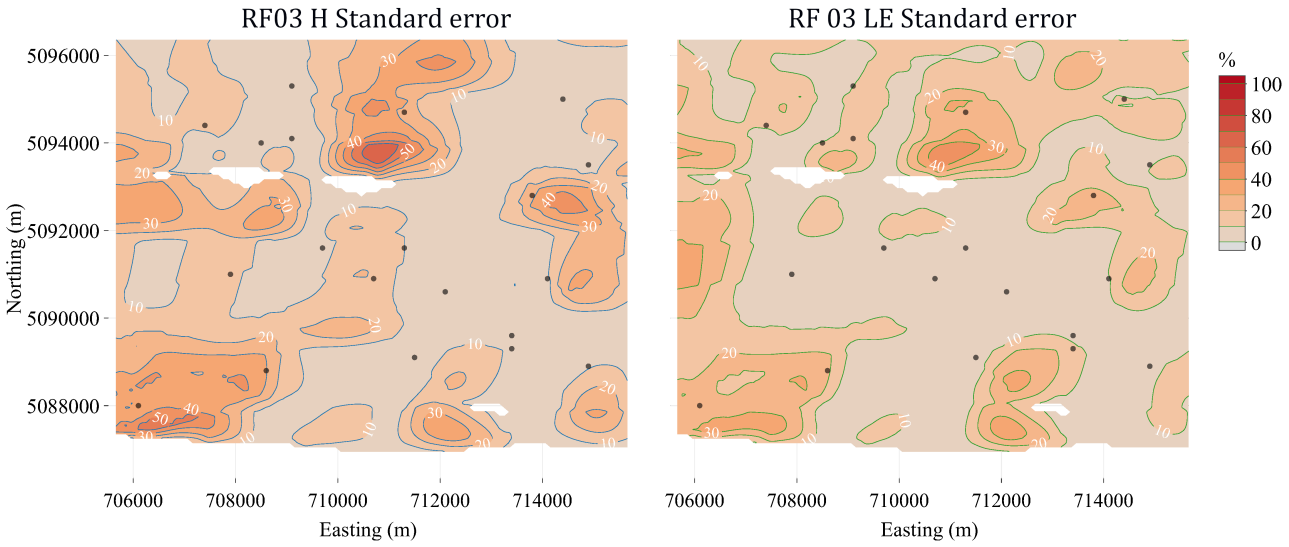


**Figure S10.** Standard error topographies for sensible (left) and latent ( right) heat fluxes for Research Flight 03 in the July IOP, 11 Jul. 09:20 to 11:20 CDT, over the 10x10 km CHEESEHEAD core domain. The brown dots are the NCAR-ISFS tower locations.

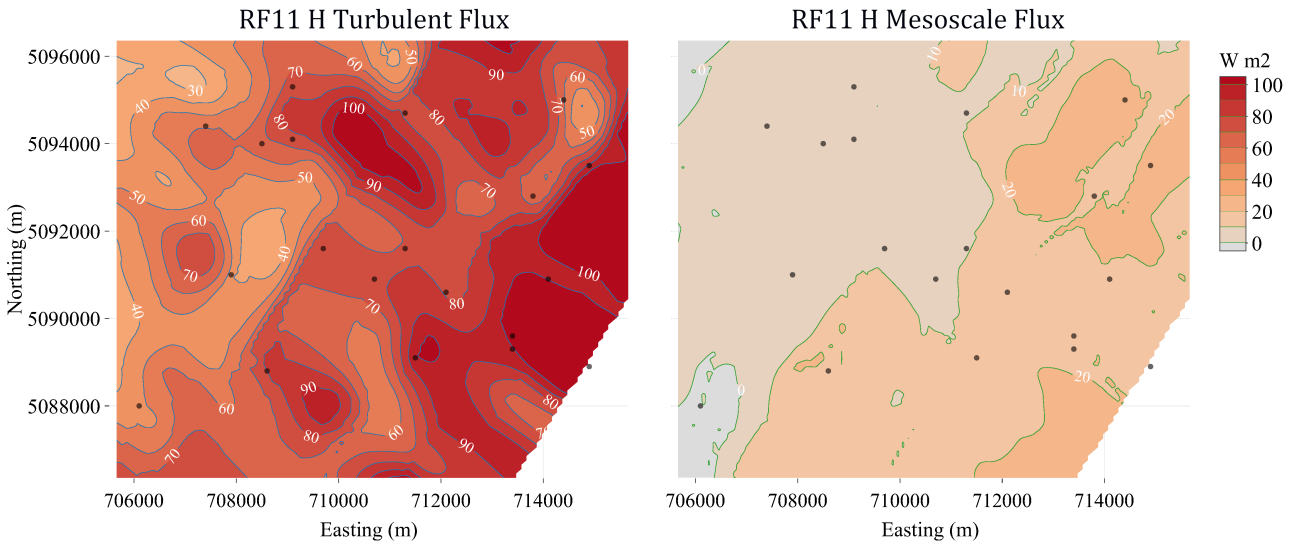


**Figure S11.** Turbulent (left) and mesoscale ( right) sensible heat flux topographies for Research Flight 11 in the August IOP, 21 Aug. 09:00 to 11:30 CDT, over the 10x10 km CHEESEHEAD core domain. The brown dots are the NCAR-ISFS tower locations.

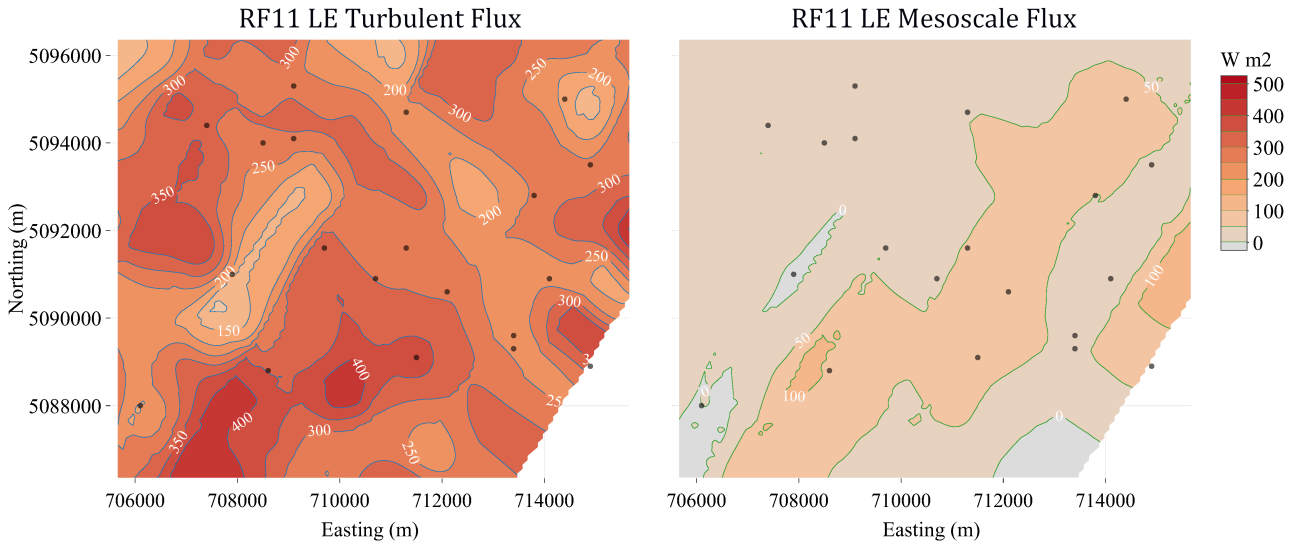


**Figure S12.** Turbulent (left) and mesoscale ( right) latent heat flux topographies for Research Flight 11 in the August IOP, 21 Aug. 09:00 to 11:30 CDT, over the 10x10 km CHEESEHEAD core domain. The brown dots are the NCAR-ISFS tower locations.

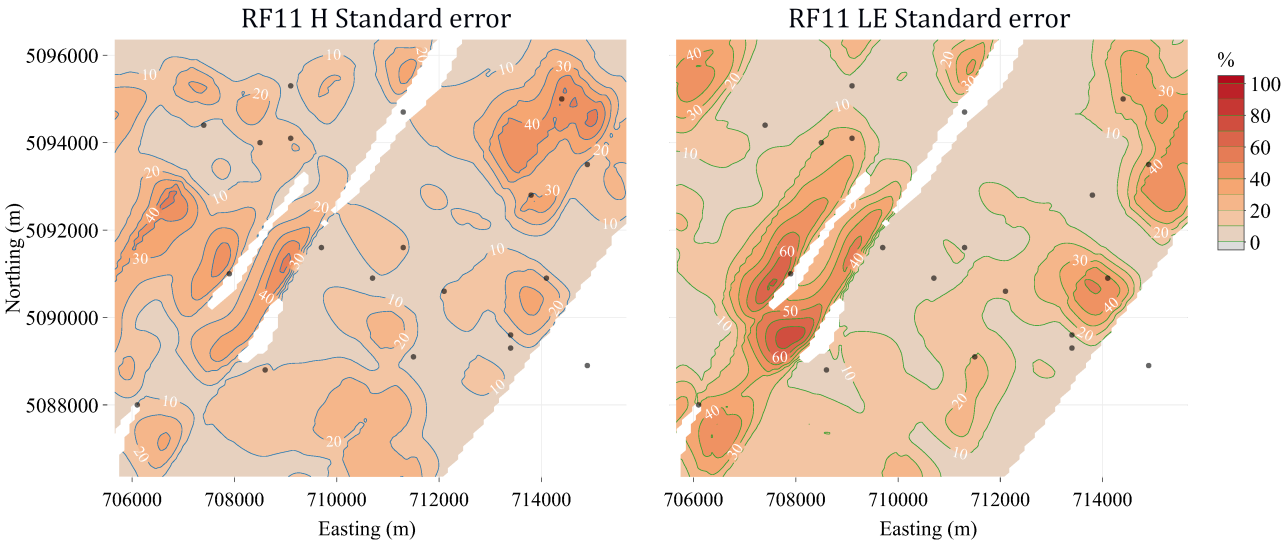


**Figure S13.** Standard error topographies for sensible (left) and latent ( right) heat fluxes for Research Flight 11 in the August IOP, 21 Aug. 09:00 to 11:30 CDT, over the 10x10 km CHEESEHEAD core domain. The brown dots are the NCAR-ISFS tower locations.

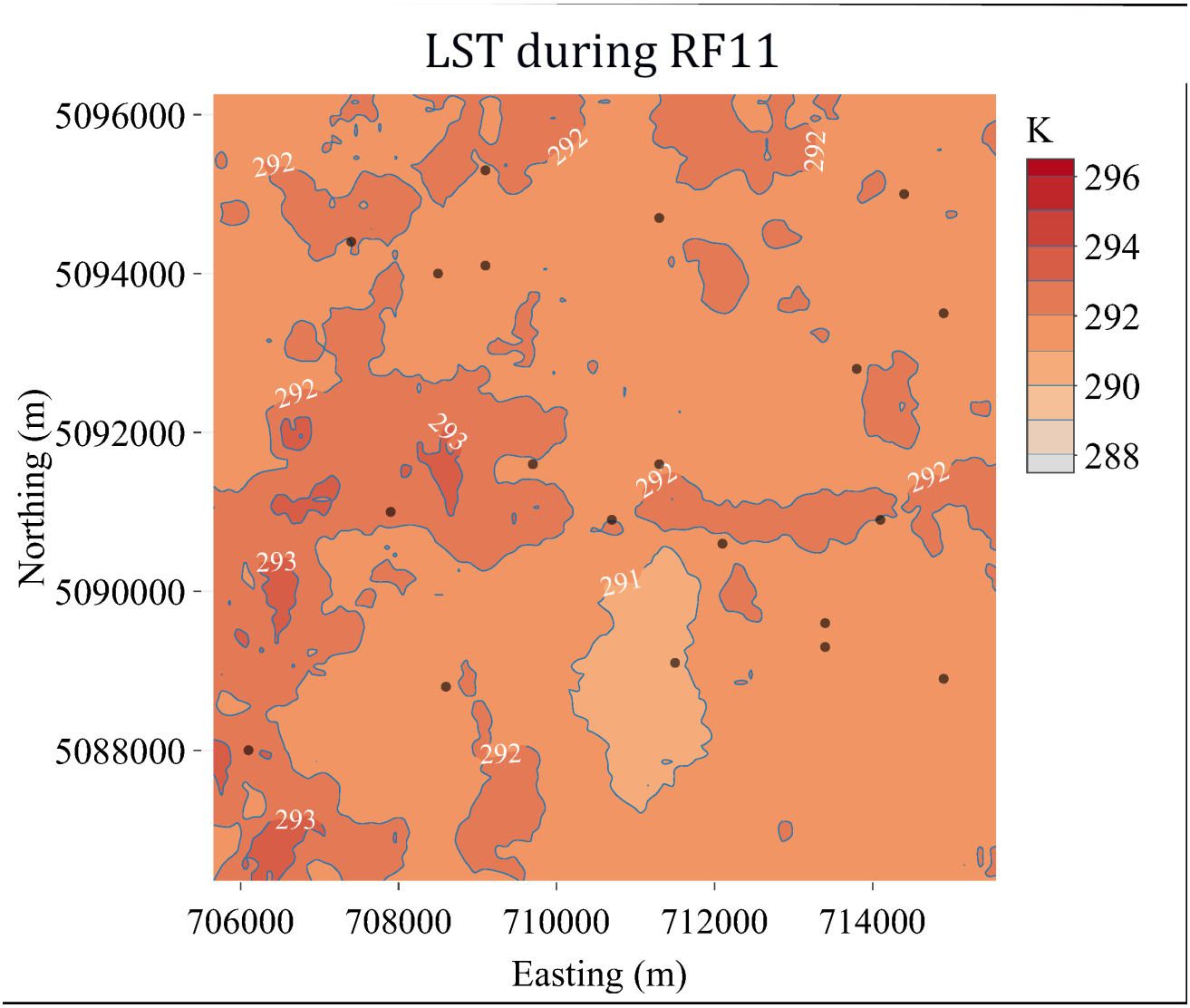


**Figure S14.** Fusion Land Surface Temperature data for the 10x10 km domain during Research Flight 11, 21 Aug. 2019 09:00 to 11:30 CDT , from Desai et al. (2021)

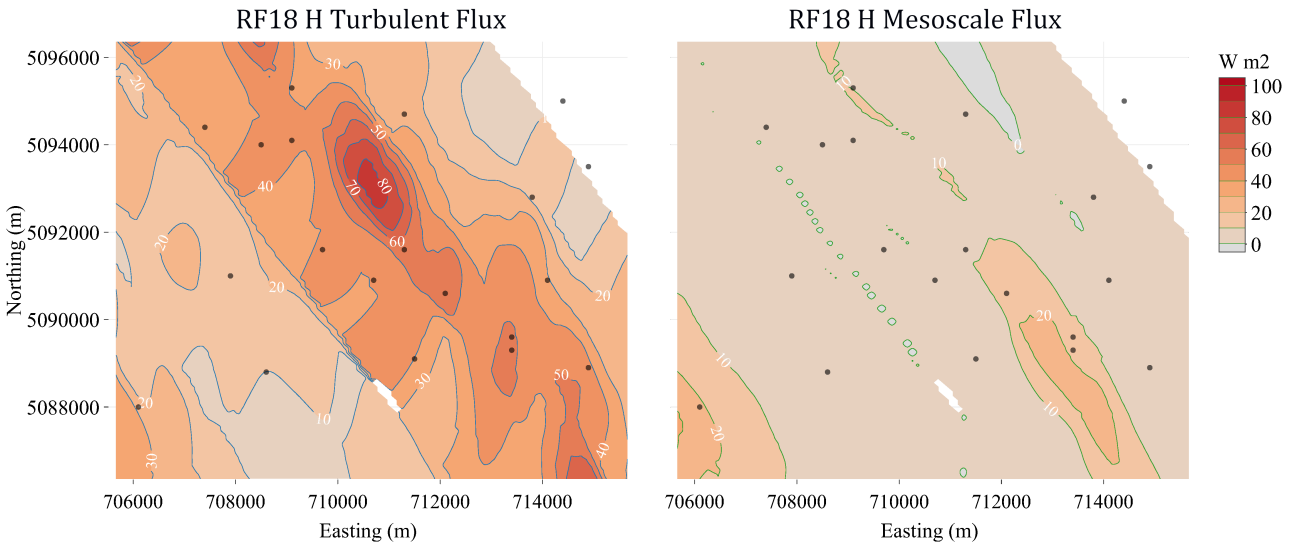


**Figure S15.** Turbulent (left) and mesoscale ( right) sensible heat flux topographies for Research Flight 18 in the September IOP, 24 Sep. 14:00 to 16:30 CDT, over the 10x10 km CHEESEHEAD core domain. The brown dots are the NCAR-ISFS tower locations.

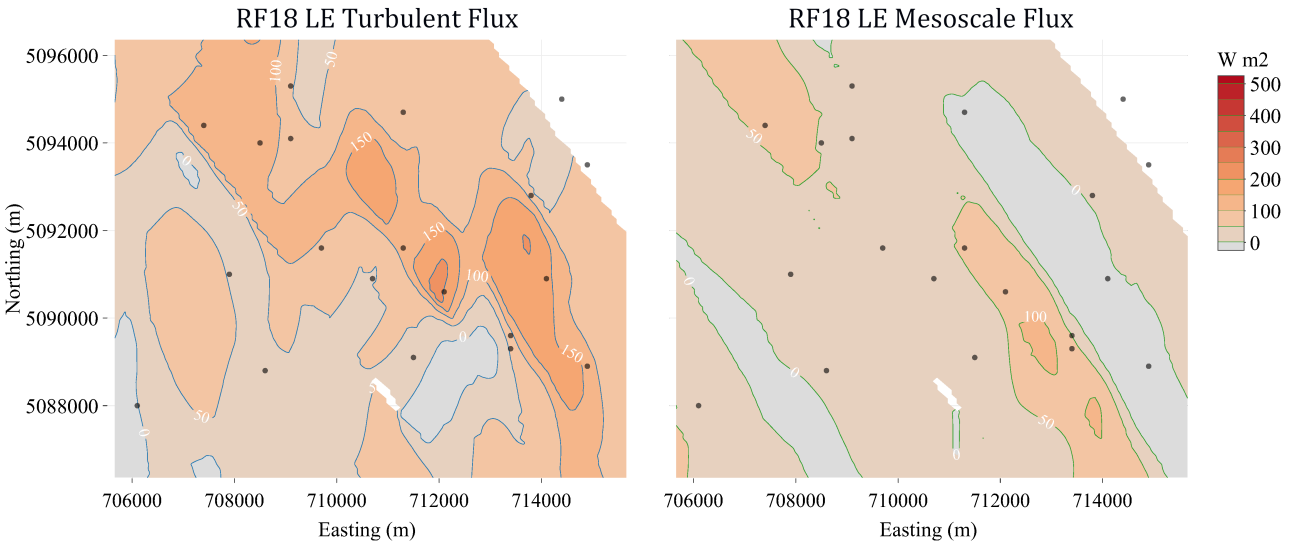


**Figure S16.** Turbulent (left) and mesoscale ( right) latent heat flux topographies for Research Flight 18 in the September IOP, 24 Sep. 14:00 to 16:30 CDT, over the 10x10 km CHEESEHEAD core domain. The brown dots are the NCAR-ISFS tower locations.

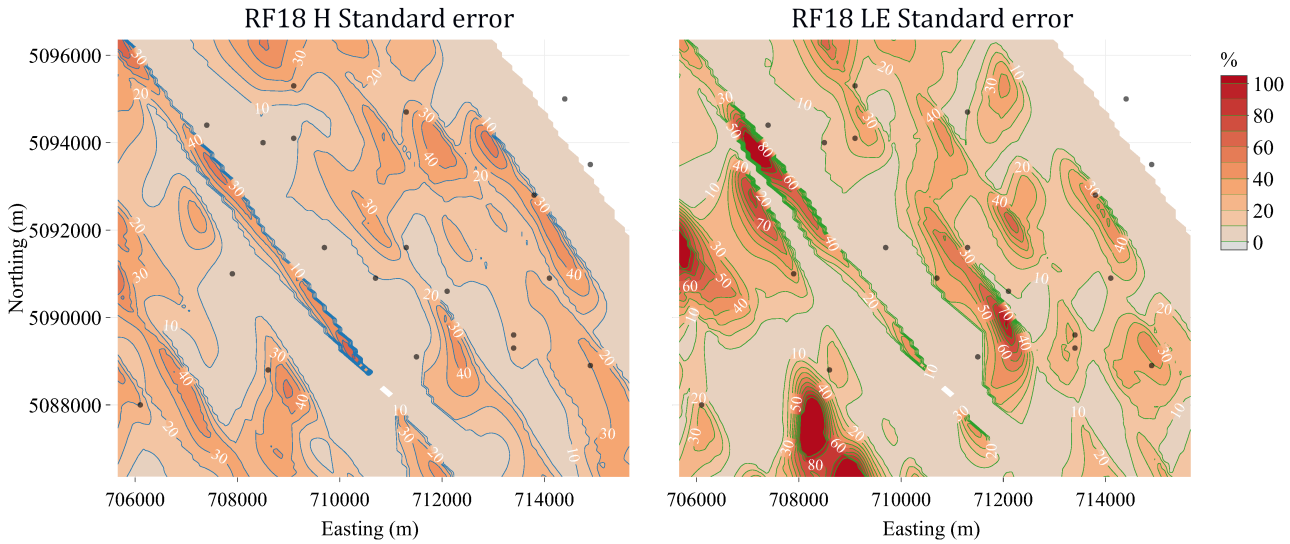


**Figure S17.** Standard error topographies for sensible (left) and latent ( right) heat fluxes for Research Flight 18 in the September IOP, 24 Sep. 14:00 to 16:30 CDT, over the 10x10 km CHEESEHEAD core domain. The brown dots are the NCAR-ISFS tower locations.

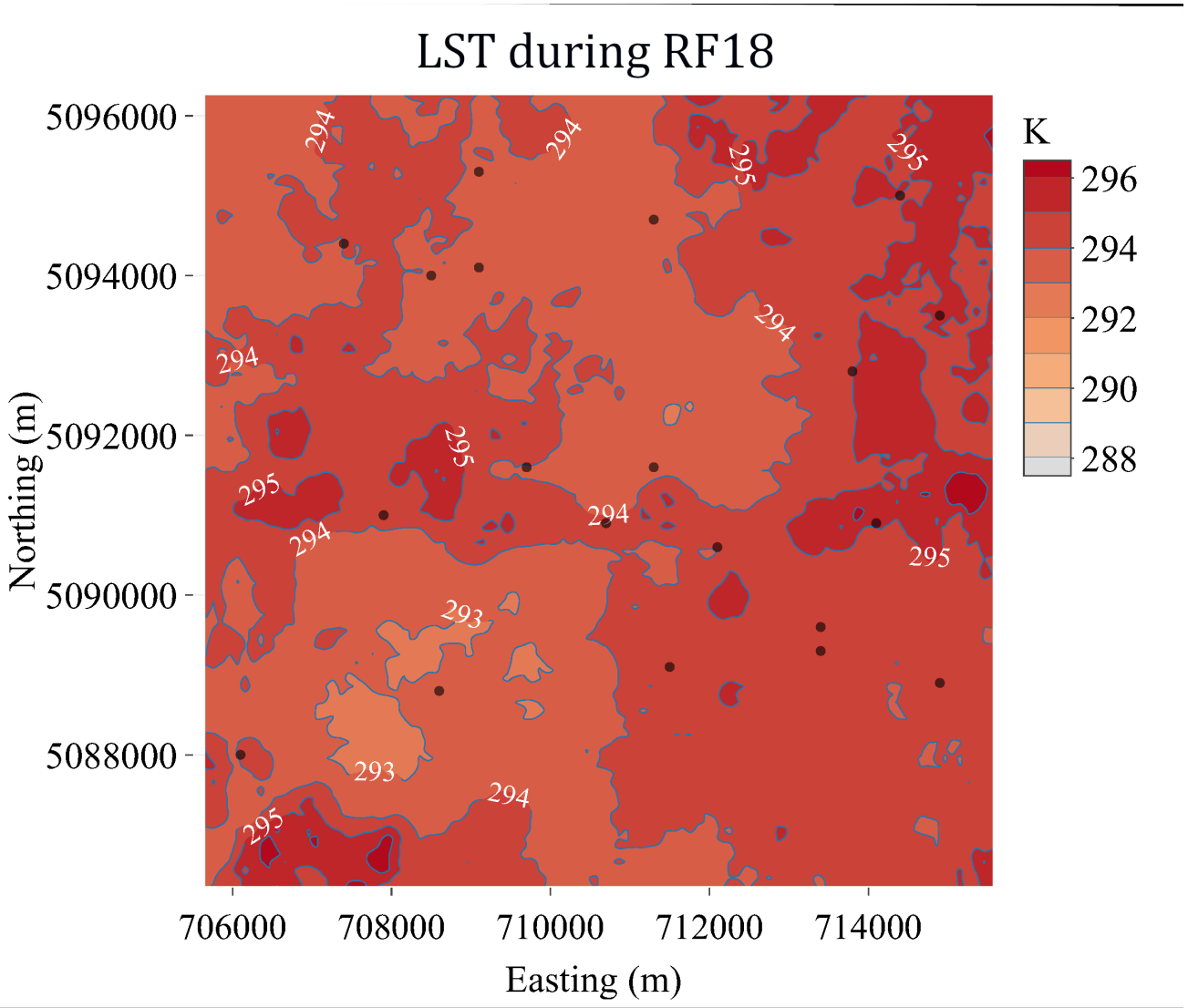


**Figure S18.** Fusion Land Surface Temperature data for the 10x10 km domain during Research Flight 18 in the September IOP, 24 Sep. 14:00 to 16:30 CDT, from Desai et al. (2021)