

Station and Data Provenance -- KMEM (2021–2025)

Surface station

Station KMEM MEMPHIS INTERNATIONAL AIRPORT, TN
ICAO / WBAN / USAF KMEM / 13893 / 723340
GHCNh station ID USW00013893
Latitude, longitude 35.0560 N, 89.9860 W
Elevation 76.6 m MSL
Wind reference height 10.0 m Temperature reference height: 2.0 m

Upper air station

Station USM00072340 LITTLE ROCK/ADAMS FLD; AR.
Latitude, longitude 34.8350 N, 92.2594 W Elevation: 173.2 m MSL
Separation 209 km W of KMEM

Processing

Software AERMET 26135 | AERMINUTE 26135 | AERSURFACE 26135 (NLCD 2021)
Surface observations NCEI GHCNh hourly (replaces the discontinued ISHD)
Winds NCEI ASOS 1–minute and 5–minute, hourly–averaged by AERMINUTE
Upper air NCEI IGRA v2 radiosonde soundings
GHCNh quality control 68369 observations screened; 404 suspect/erroneous and 0 METAR–mismatch rejected
Report generated 2026–07–26

Files in this dataset

KMEM<yyyy>.sfc / .pfl AERMOD surface and profile files, processed WITHOUT ADJ_U*
KMEM<yyyy>US.sfc / .pfl the same period processed with METHOD STABLEBL ADJ_U*

The .sfc file carries the hourly boundary–layer parameters and the .pfl carries the wind and temperature profile at the measurement heights; AERMOD requires both. Use the regular set or the ADJ_U* set consistently -- do not mix them within a single AERMOD run. ADJ_U* is the EPA–approved treatment for low–wind stable hours and generally lowers modelled concentrations; its use should be stated and justified in the modelling protocol.

Each yearly .sfc ends with the 24 hours of 1 January of the FOLLOWING year. That is how AERMET writes the file for XDATES y/01/01 TO y+1/01/01 and is expected by AERMOD -- it is not duplicated data within the year.

AERMET Meteorological Data Report -- KMEM (2021–2025)

Generated 2026–07–26 | AERMET 26135 + AERMINUTE 26135 + AERSURFACE 26135 (NLCD 2021)

Surface data: NCEI GHCNh (replaces discontinued ISHD) | Upper air: IGRA soundings | Winds: 1–min ASOS (AERMINUTE)

Annual summary (regular, non–ADJ_U* files):

Year	Valid hrs	Calm %	Mean WS	Max WS	Prevail dir	Mean T	Precip (in)
2021	8760	0.8%	3.8 m/s	12.7 m/s	SSW	63.7 degF	52.0
2022	8760	0.2%	3.9 m/s	12.3 m/s	SSW	63.7 degF	54.6
2023	8759	1.3%	3.7 m/s	16.3 m/s	SSW	64.9 degF	54.3
2024	8784	1.8%	3.8 m/s	12.0 m/s	SSW	64.9 degF	59.9
2025	8681	1.6%	3.8 m/s	14.7 m/s	SSW	63.9 degF	38.9

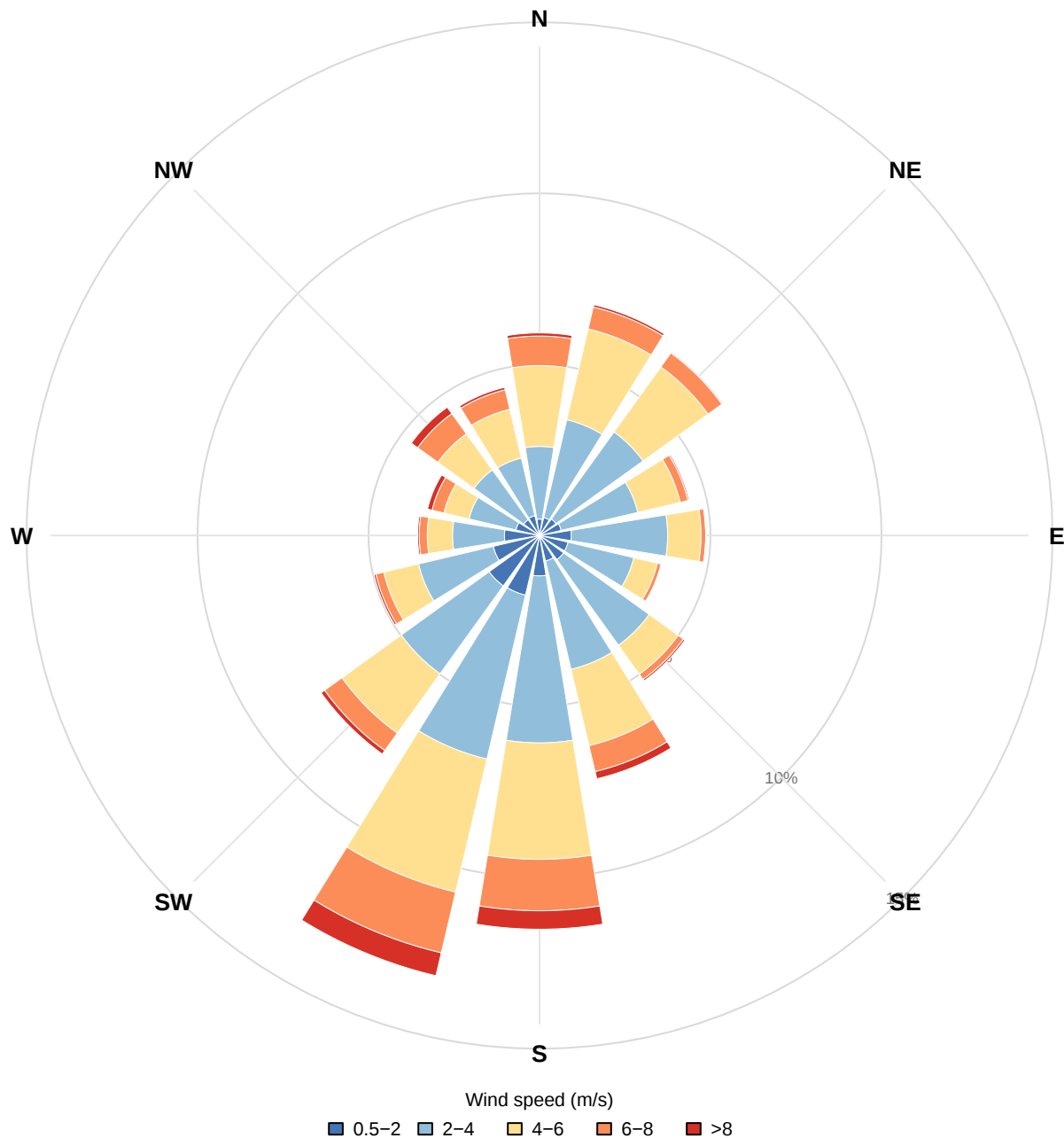
Quarterly data completeness vs EPA 90% criterion:

Year	Q1	Q2	Q3	Q4	Annual
2021	99.6%	99.5%	99.9%	99.8%	99.7%
2022	99.9%	100.0%	99.8%	100.0%	99.9%
2023	99.8%	98.7%	99.6%	100.0%	99.5%
2024	99.9%	100.0%	99.9%	99.6%	99.8%
2025	99.7%	99.6%	95.7%	99.4%	98.6%

Notes for PSD applications:

- Prevailing wind SSW; network–wide calms 1.1% of valid hours; ADJ_U* companion files (US) included in this dataset.
- ADJ_U* raises stable–hour friction velocity by 35% on average (median regular 0.195 → ADJ_U* 0.226 m/s).
- Surface characteristics: AERSURFACE 26135, NLCD 2021, 1000.0 m radius, 2 sector(s); z0 0.032–0.101 m. Full table follows.
- Wind roses use direction FROM which the wind blows; petals are % of all valid hours.
- AERMOD excludes calm and missing hours from the averaging period: 503 calm and 104 missing hours over 2021–2025 (1.4% of the record). AERMOD reports both counts in its own output; no substitution is made here.

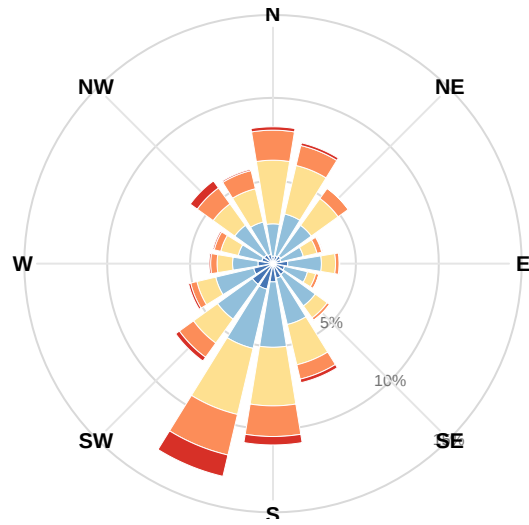
Wind Rose -- KMEM, 2021-2025 (all hours)



Calm (<0.5 m/s): 1.1%

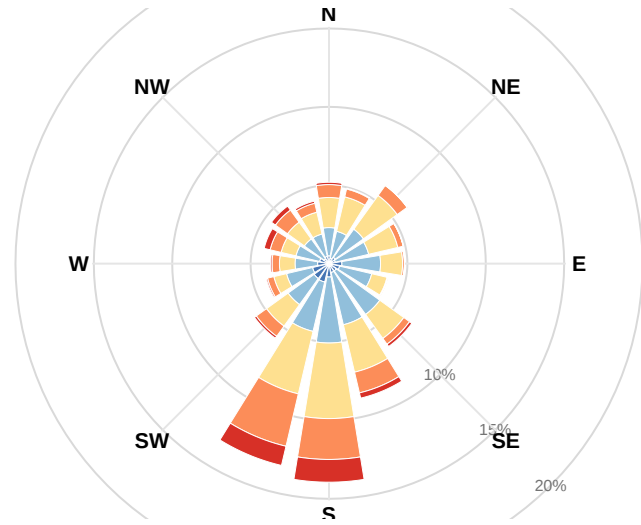
Seasonal Wind Roses -- KMEM, 2021–2025

Winter



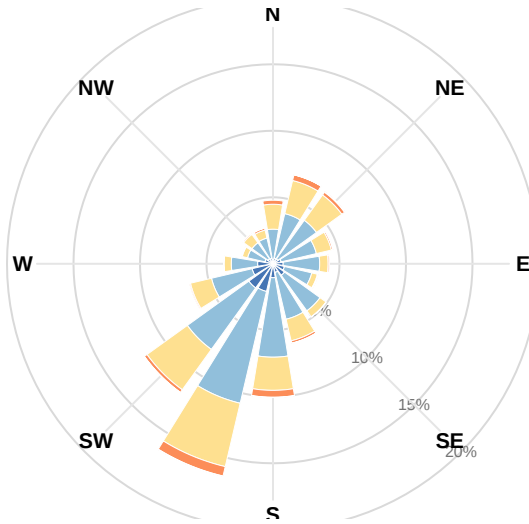
Calm (<0.5 m/s): 0.8%

Spring



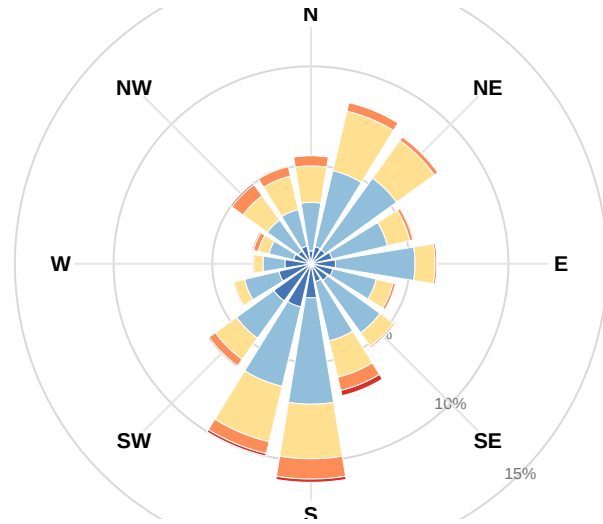
Calm (<0.5 m/s): 0.9%

Summer



Calm (<0.5 m/s): 1.2%

Fall



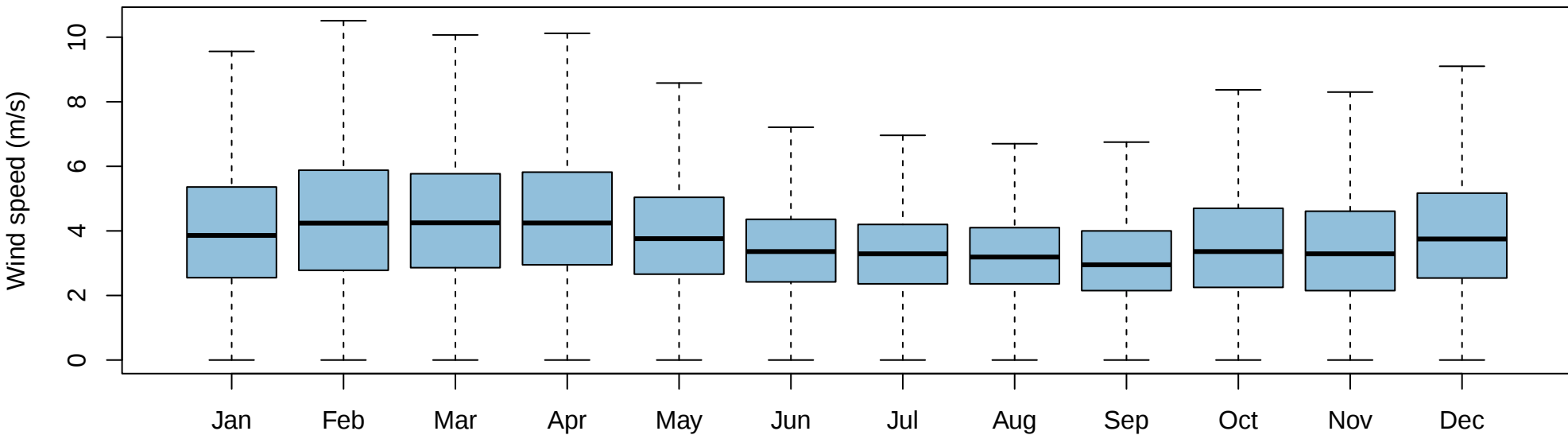
Calm (<0.5 m/s): 1.8%

Wind speed (m/s)

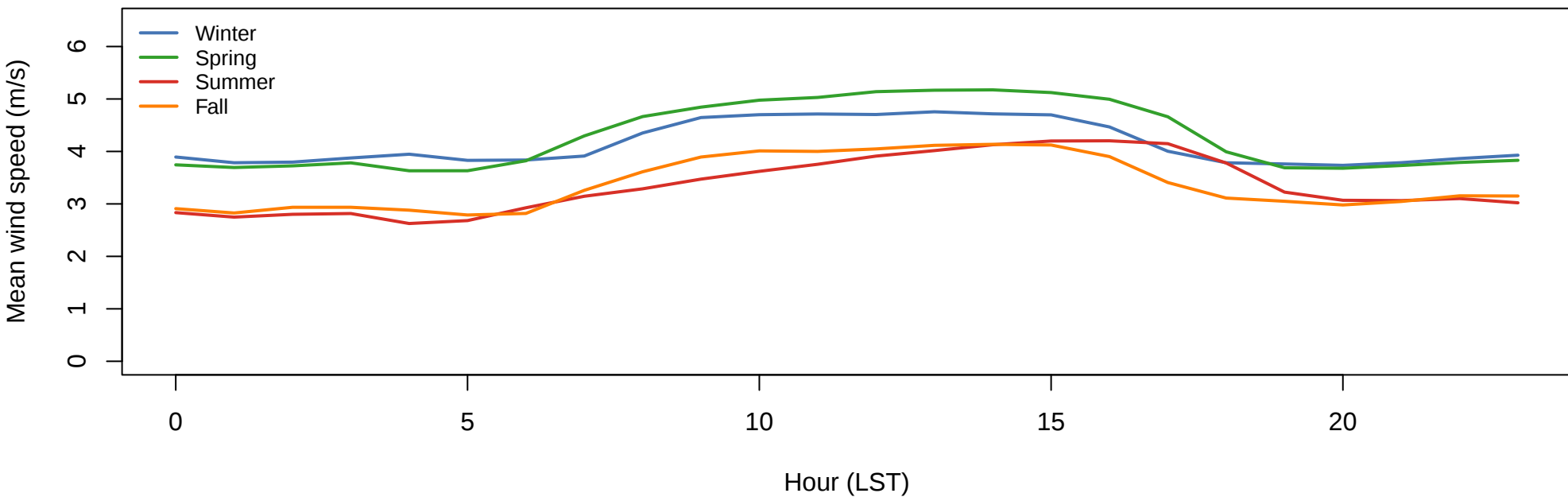
0.5–2 2–4 4–6 6–8 >8

Wind Speed -- KMEM, 2021–2025

Monthly wind speed distribution

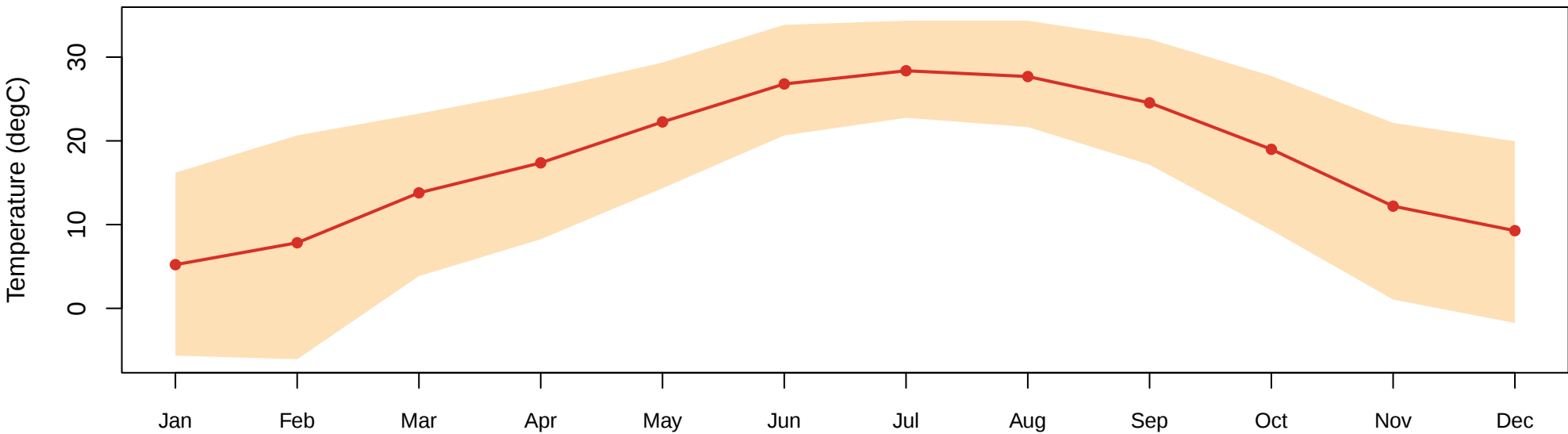


Diurnal wind speed by season

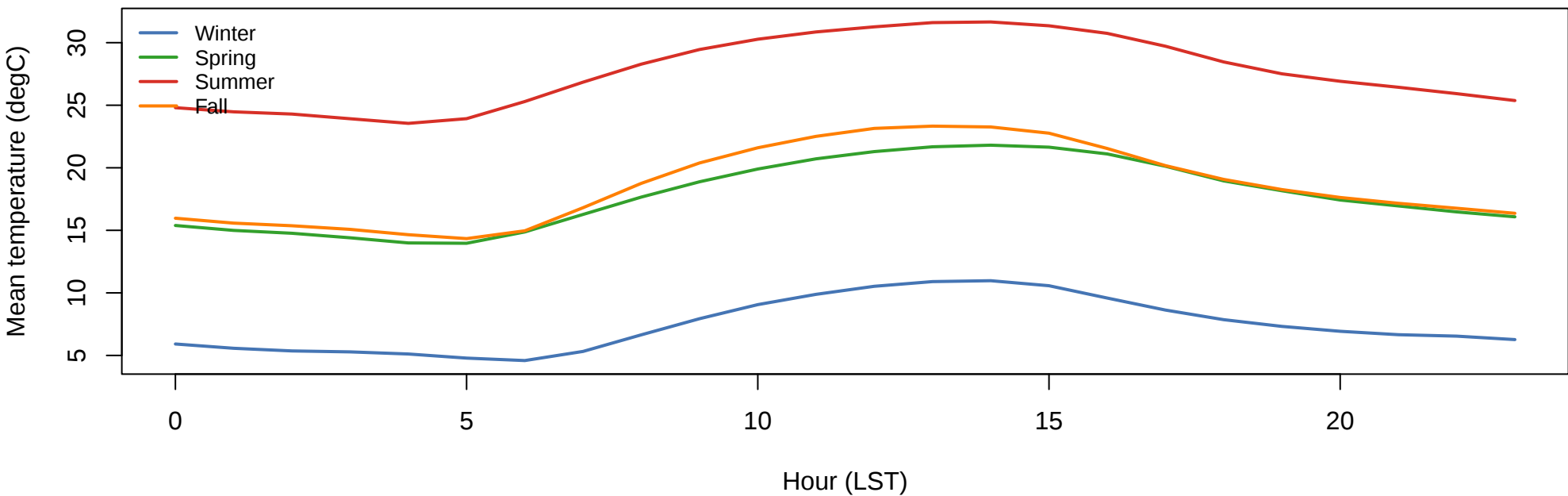


Temperature -- KMEM, 2021-2025

Monthly temperature: mean and 5th-95th percentile

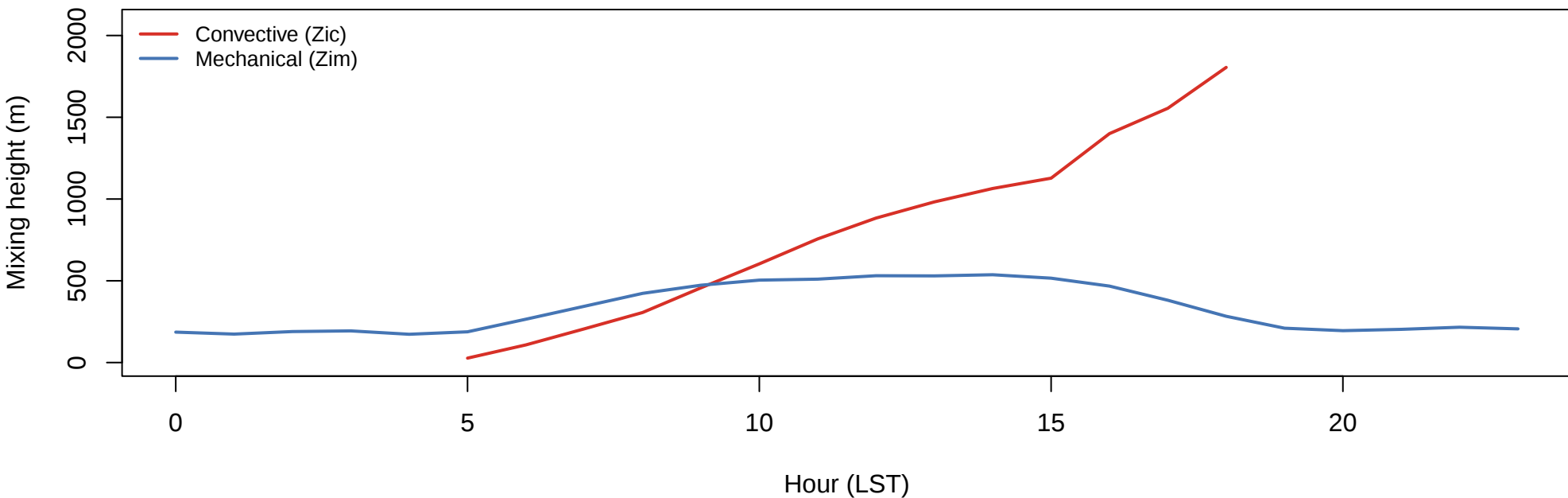


Diurnal temperature by season

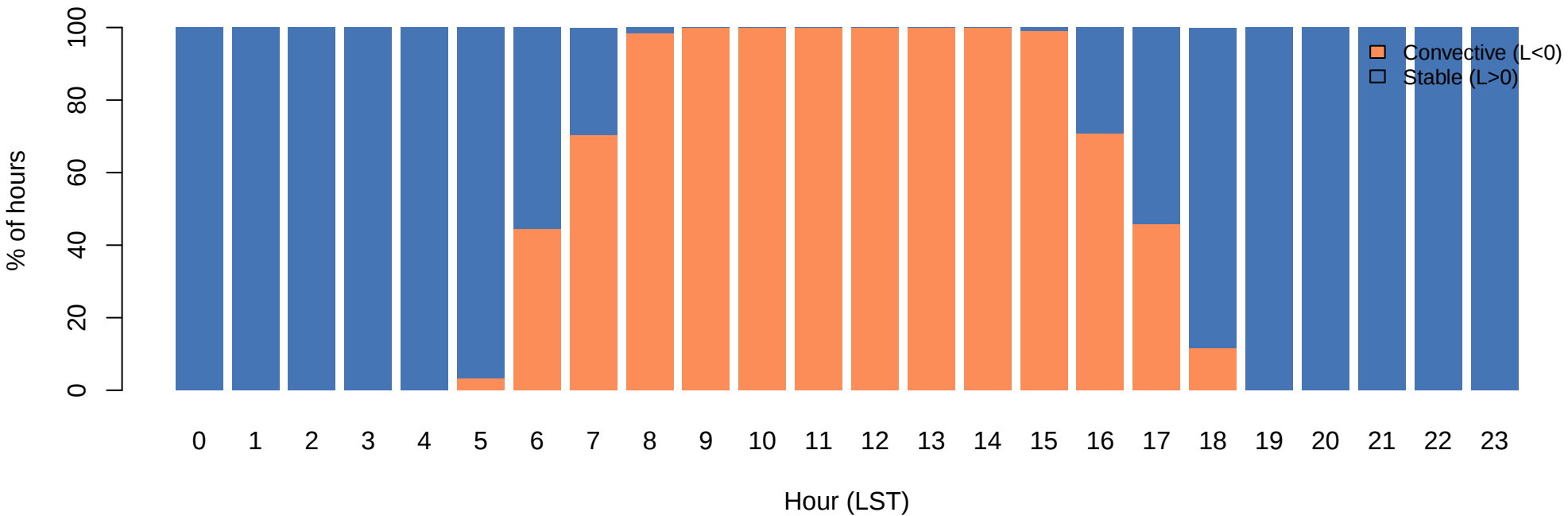


Mixing Heights & Stability -- KMEM, 2021–2025

Diurnal median mixing heights (AERMOD dispersion drivers)

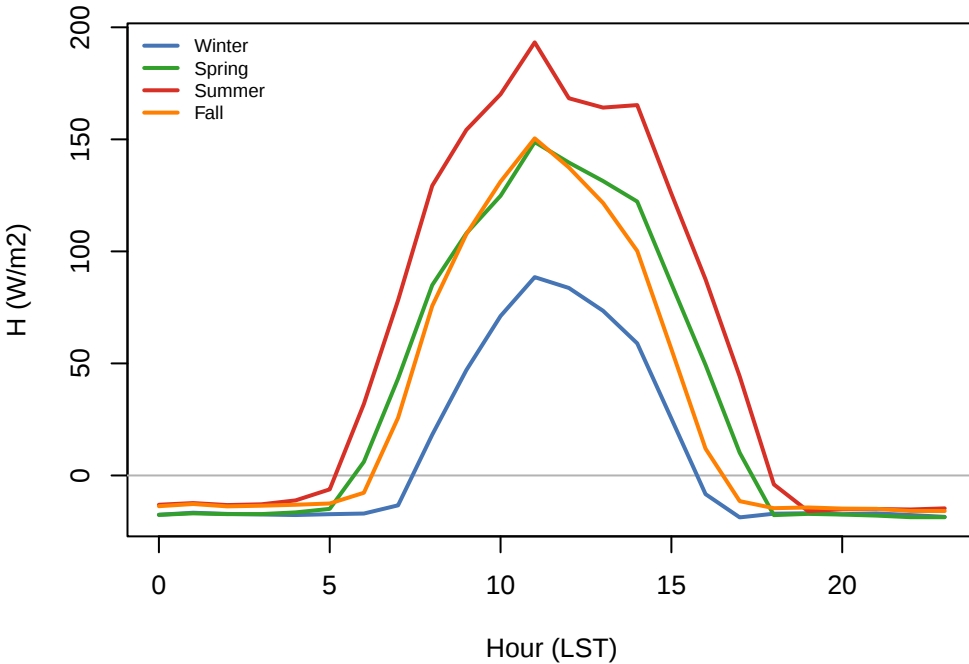


Boundary-layer state by hour (from Monin–Obukhov L)

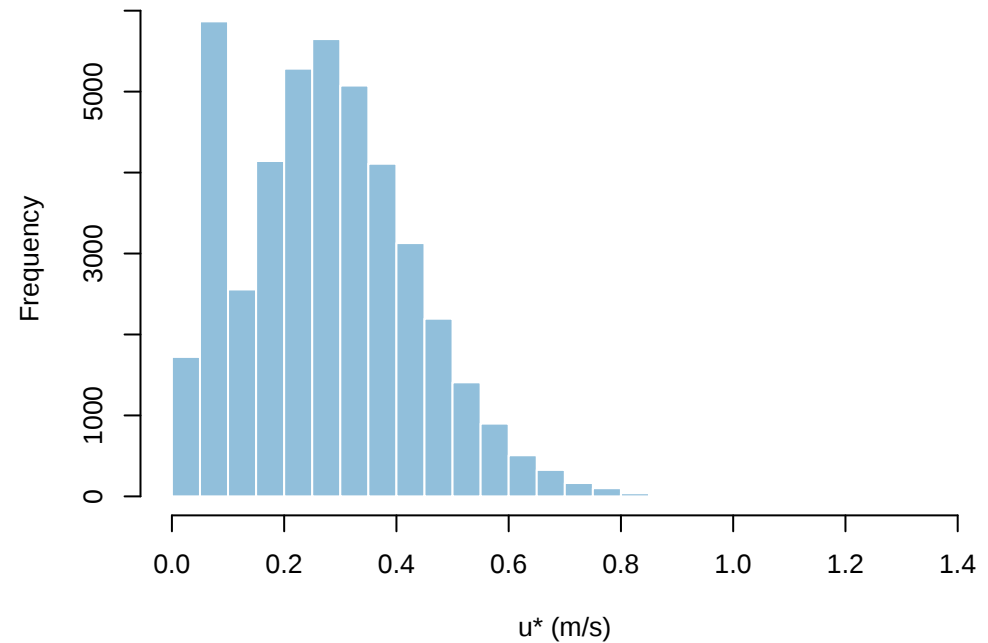


Surface Energetics & ADJ_U* -- KMEM, 2021–2025

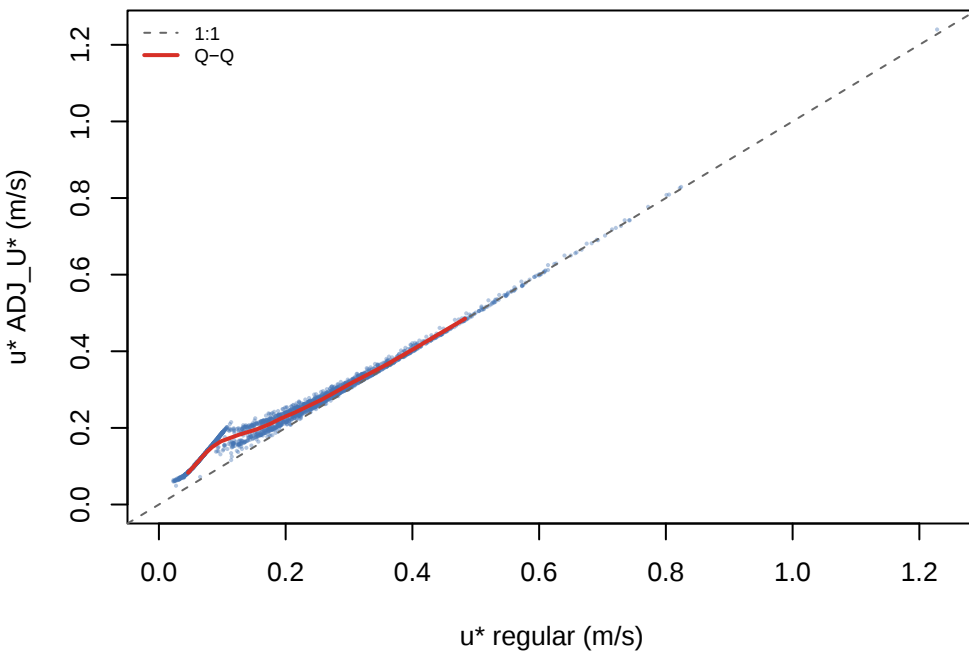
Sensible heat flux by season



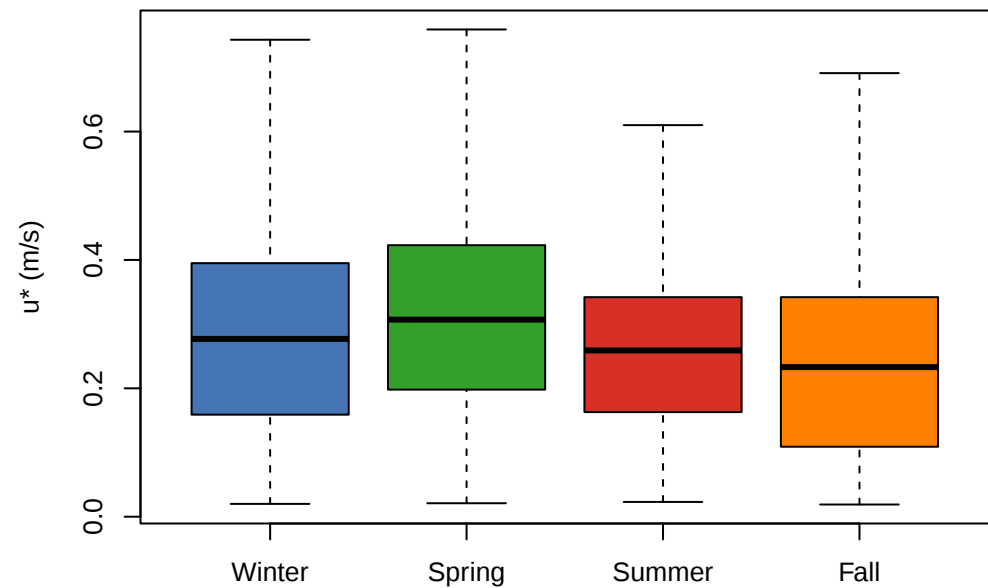
Friction velocity distribution



Stable-hour u^* : regular vs ADJ_U*



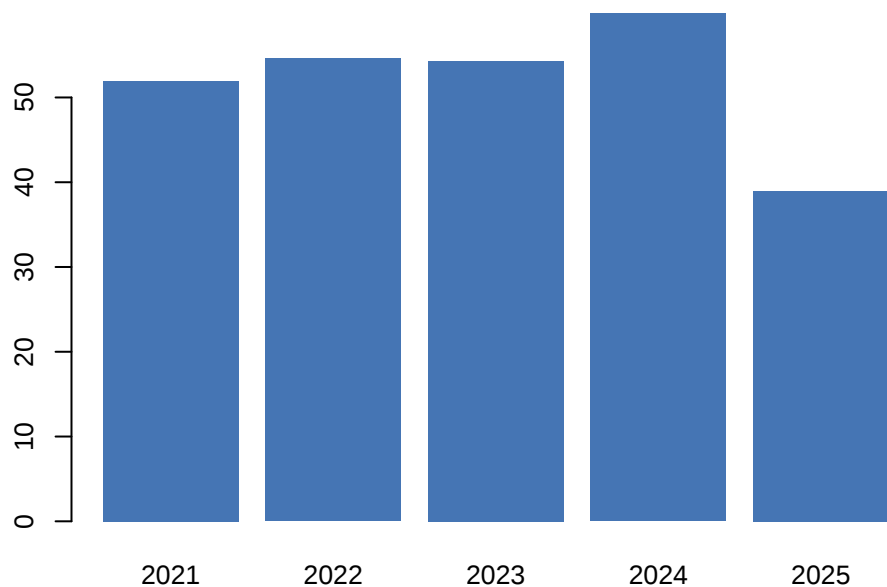
u^* by season



Moisture & Cloud Cover -- KMEM, 2021-2025

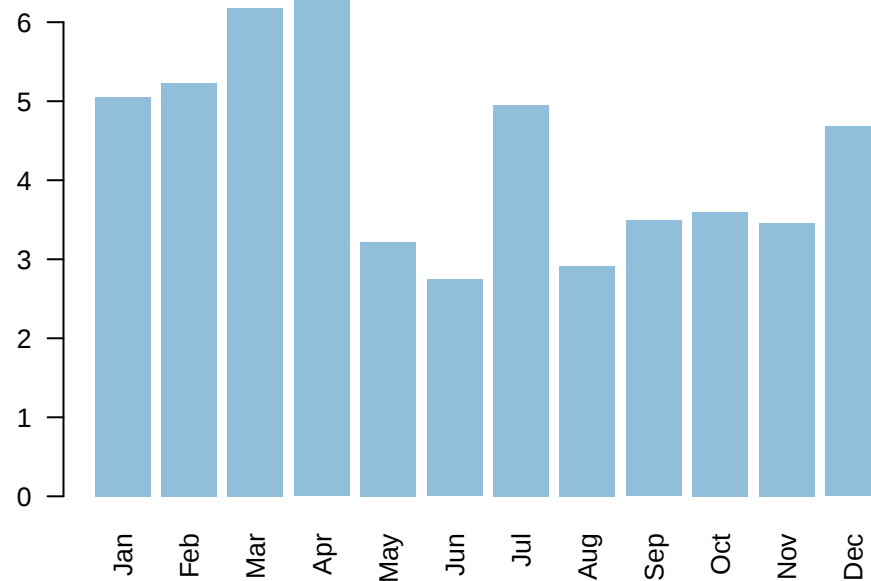
Annual precipitation

Precipitation (in)



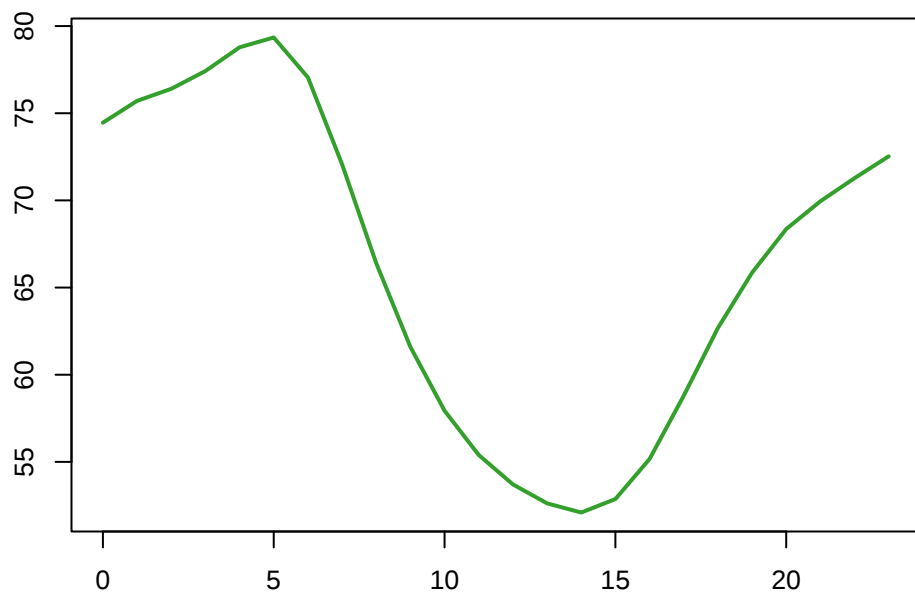
Mean monthly precipitation

Precipitation (in)



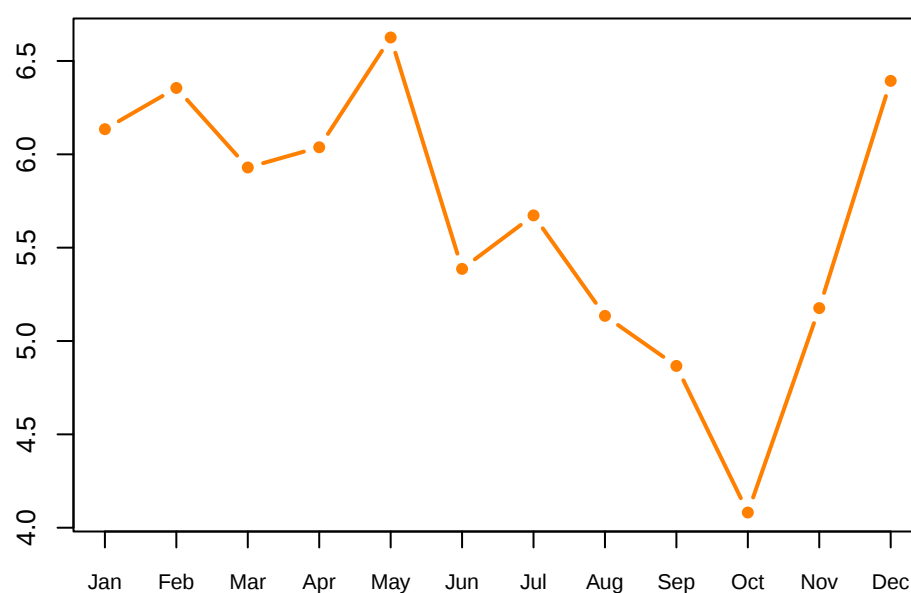
Diurnal relative humidity

RH (%)



Monthly mean cloud cover

Cloud cover (tenths)



Surface Characteristics -- KMEM (AERSURFACE 26135)

Run settings

Land cover NLCD 2021 land cover, with impervious and canopy
Roughness method ZORAD, 1000.0 m radius, monthly resolution
Site centre 35.056389, -89.986389 (NAD83)
Surface moisture Average; Arid: N
Continuous snow cover N
Non-airport sectors 1
Sectors 2
sector 1: 220.0 to 350.0 degrees
sector 2: 350.0 to 220.0 degrees

Monthly values applied by AERMET

Month	S1 alb	S1 Bo	S1 z0	S2 alb	S2 Bo	S2 z0
Jan	0.18	1.03	0.068	0.18	1.03	0.032
Feb	0.18	1.03	0.068	0.18	1.03	0.032
Mar	0.17	0.77	0.086	0.17	0.77	0.038
Apr	0.17	0.77	0.086	0.17	0.77	0.038
May	0.17	0.84	0.101	0.17	0.84	0.042
Jun	0.17	0.84	0.101	0.17	0.84	0.042
Jul	0.17	0.84	0.101	0.17	0.84	0.042
Aug	0.17	0.84	0.101	0.17	0.84	0.042
Sep	0.17	0.84	0.101	0.17	0.84	0.042
Oct	0.17	1.03	0.086	0.17	1.03	0.038
Nov	0.17	1.03	0.086	0.17	1.03	0.038
Dec	0.18	1.03	0.068	0.18	1.03	0.032

alb = albedo, Bo = Bowen ratio, z0 = surface roughness length (m). These are the values
AERMET applied; they are reproduced from the AERSURFACE output supplied with this dataset.

Data Quality Screening -- KMEM (2021–2025)

Surface data quality control applied before processing

NCEI flags every observation with a quality code that AERMET does not act on, so the GHCNh file is screened first. Rejected values are blanked and treated as missing; no record is dropped and no value is altered or substituted. A second screen compares the decoded wind speed against the verbatim METAR text NCEI carries alongside it, which catches decoding errors the quality flags miss.

Observations screened 68369
Rejected: NCEI suspect or erroneous 404
Rejected: decoded wind vs METAR text 0
Itemised log KMEM_GHCNh_2021_2025_qc_log.txt

Physical plausibility of the delivered files

Screening of the .sfc files as delivered. A non-zero count is not by itself an error, but each occurrence should be explainable before the data are used.

Year	Max wind	Min temp	Max temp	Hrs ws>25 m/s	Hrs T out of range
2021	12.7 m/s	−17.2 C	35.7 C	0	0
2022	12.3 m/s	−17.2 C	38.9 C	0	0
2023	16.3 m/s	−3.9 C	38.2 C	0	0
2024	12.0 m/s	−16.1 C	37.2 C	0	0
2025	14.7 m/s	−11.8 C	37.8 C	0	0

Bounds used: wind speed above 25 m/s, temperature outside −25 to +45 C.

Monthly data completeness (% of hours with valid wind and temperature)

