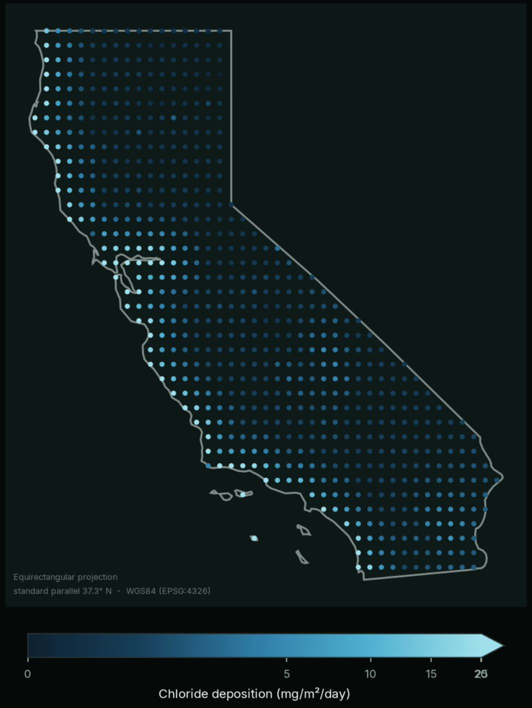
■ CLIMETRY

REGIONAL CLIMATE ENVELOPE

Regional Environmental Exposure Envelope

California

Spatial distribution of environmental and material-ageing exposure across the complete analysis grid.



673
locations
Analyzed regional grid · 0.25°

Dataset	Period	Analysis snapshot	Report generated	Revision
CEY10 2015-2024	2015-2024	2026-09-08	2026-09-08	Regional Envelope v1.3

00

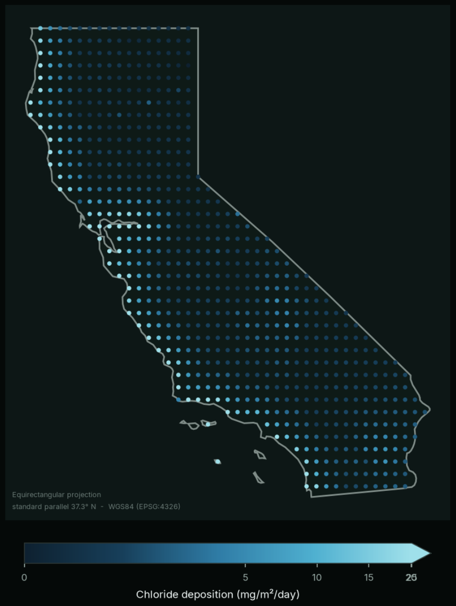
Table of Contents

Regional report logic from coverage to engineering action

Executive Overview

Coverage, headline exposure spread and the engineering takeaway

673	20.1	22.0
locations	mg/m2/day	um/year
Regional coverage	P95 Chloride deposition	P95 Steel corrosion rate
0.25° grid	P50 0.88 mg/m2/day	P50 5.8 um/year



ENGINEERING IMPLICATION

Across 673 analyzed locations, chloride deposition shows the widest relative spread (P05 0.19 mg/m2/day to P95 20.1 mg/m2/day) - the metric most worth checking against your specific site within this region before assuming the regional mean applies.

LIMITATION

Regional percentiles describe spatial spread across the analyzed locations. They are not failure probability, certified site classification or product lifetime. Confirm the chosen site with a Point Analysis before fixing material protection.

Regional Coverage

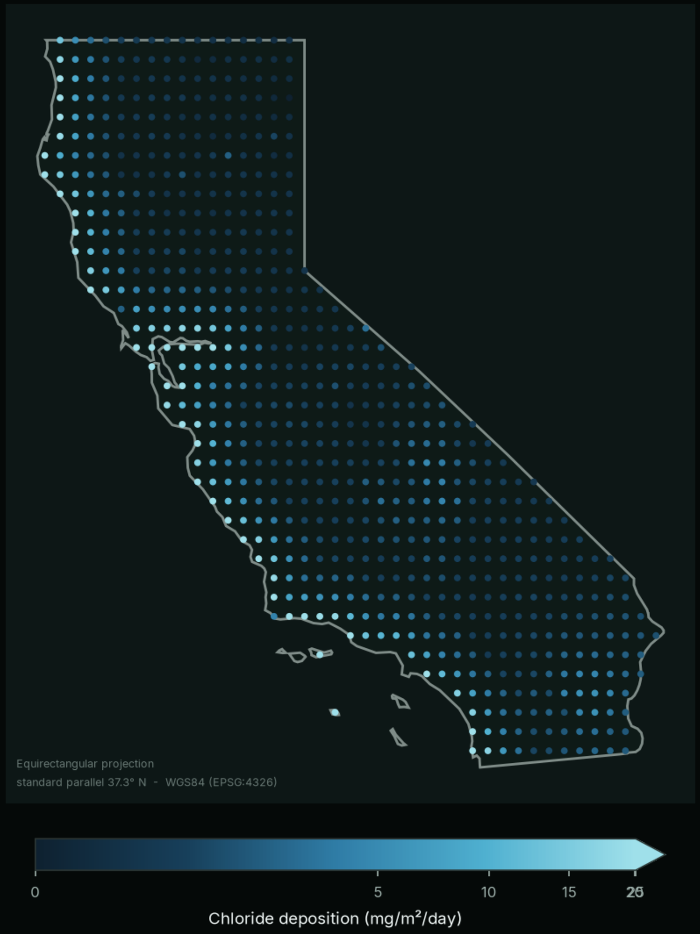
Every analyzed gridpoint and how exposure varies spatially

What the regional envelope contains

Every one of the 673 analyzed gridpoints in California contributes to the distributions and percentile bands in this report. The map shows those real coordinates rather than a sampled or illustrative point cloud.

Reading this chart - The highest-chloride deposition 10% of analyzed locations sit toward the western part of the region on average (mean longitude -121.58 vs -119.42 for the rest) - the kind of spatial clustering a histogram alone cannot show: locations at similar latitude can see materially different exposure.

> **LIMITATION**
>
> Regional percentiles describe spatial spread across the analyzed locations. They are not failure probability, certified site classification or product lifetime. Confirm the chosen site with a Point Analysis before fixing material protection.



02.1 Building the Envelope from Gridpoints

What a gridpoint is and what the regional percentiles mean

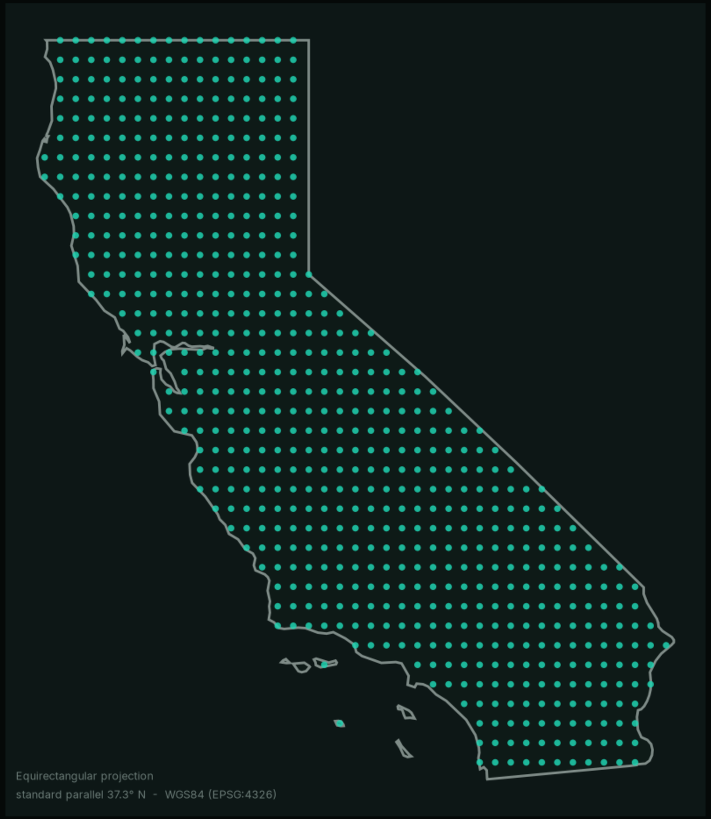
What is a gridpoint?

Climetry's CEY climate dataset is organized on a regular 0.25° latitude/longitude grid. Each location is a real grid-cell center intersected with the region boundary.

How the envelope is computed

For each metric, all 673 regional locations are pooled into one spatial distribution. P05-P95 therefore describes geographic spread across the region, not uncertainty or temporal variability at one site.

> LIMITATION
>
> Regional P95 is a spatial percentile. It is not failure probability, a certified site classification, or a substitute for a Point Analysis at a known deployment coordinate.



03

The Engineering Chain

Climate to stressor to mechanism to material response to engineering action

This report follows one chain: regional climate -> atmospheric stressors -> physical degradation mechanism -> material response -> engineering action. Parts I and II quantify the drivers; Part III quantifies the material response; Section 09 turns it into screening actions and verification.

Environmental driver(s)	Physical degradation mechanism	Material response (where in this report)
Relative humidity + near-condensation hours + chloride / sulfate deposition	Persistent surface electrolyte (long time-of-wetness); ions raise its conductivity	Metal corrosion - carbon steel, zinc, copper, aluminium (Part III)
UV surface dose + air temperature	Photo-oxidation: UV initiates radical chain scission, temperature accelerates it (Arrhenius)	Polymer and coating embrittlement, chalking, loss of elongation (Part III polymers)
Surface ozone (with mechanical strain, a design assumption)	Ozone attacks C=C bonds at strained surfaces	Cracking of ozone-sensitive elastomers - NR, SBR, NBR (ozone / elastomer score)
Moisture (RH, condensation) + air temperature	Hydrolysis: water cleaves ester / amide / carbonate bonds, faster when warm	Chain cleavage in hydrolysis-sensitive polymers, adhesives, coatings (hydrolysis / moisture score)
Heat hours + daily temperature cycling	Thermal oxidation and thermo-mechanical fatigue	Property drift, outgassing, softening; fatigue at bonded / constrained interfaces (thermal oxidation score)

HOW TO READ THE REST OF THIS REPORT

Every histogram + map page answers 'how big is this driver and where'. The monthly pages answer 'when in the year'. The decision matrix (09.1) answers 'so what should I do and test'. None of it is a lifetime prediction - it is screening to size design margin and qualification tests.

PART I

THERMODYNAMICS

Temperature, humidity, moisture and freeze/heat hours - how the base climate varies across the region.

How the Climate Basis Is Built and Checked

The representative year, its data basis, and the independent-station validation

The Climetry Environmental Year (CEY)

A representative 8,760-hour environmental year for durability screening. CEY is inspired by the ISO 15927-4 reference-year principle but extends the selection variables toward environmental durability: air temperature, relative humidity, dew point, RH80 hours, time of wetness and condensation potential. The goal is to preserve the long-term hourly distribution of each variable, not just monthly means.

Data basis

CEY is built from ten years (2015-2024) of hourly ERA5-Land reanalysis. For each calendar month the most representative real month is selected so that the assembled year reproduces the ten-year hourly distribution of the durability variables above. The regional envelope in this report pools the CEY of every analyzed gridpoint in the region.

> WHAT CEY IS NOT
>
> CEY is a screening climatology, not a weather forecast and not an extreme-value dataset. Use the P95 of the regional envelope as a conservative screening value, then confirm the chosen site with a Point Analysis.

Validation against independent stations

Climetry's ERA5-Land and CEY10 climate basis is checked against 7,053 independent NOAA / Meteostat weather stations. Near-zero mean bias; most of the residual temperature scatter is grid-cell-versus-point elevation, not model error.

Independent weather stations	7,053
Station-month comparisons	338,544
Period	2015-2024, every populated continent
Temperature	RMSE 1.57 °C · bias -0.33 °C
Dew point	RMSE 1.42 °C · Spearman 0.99
Relative humidity	RMSE 4.8 %-pt · ~unbiased
Absolute humidity	RMSE 0.80 g/m³ · Spearman 0.99
CEY10 monthly temperature profile	RMSE 1.28 °C · R^2 0.98
CEY10 absolute-humidity profile	RMSE 0.58 g/m³ · R^2 0.99

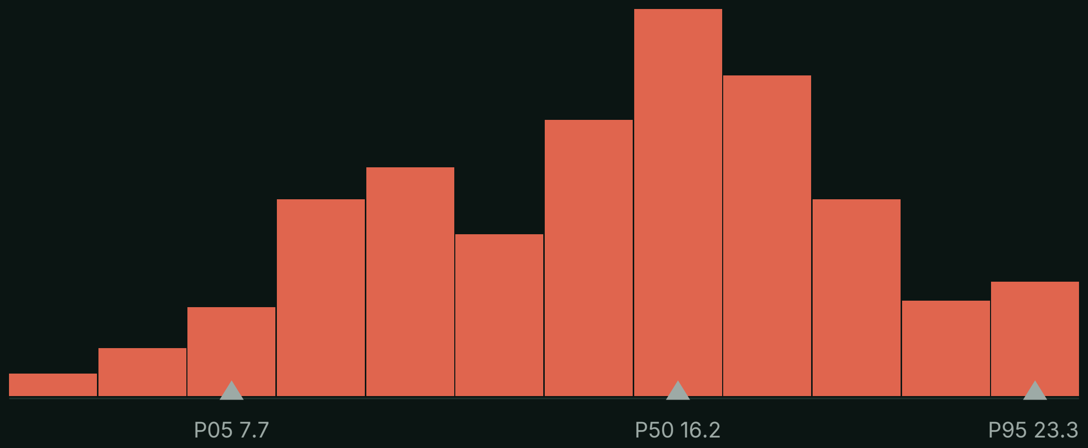
Full method, station inventory and per-variable subsets: getclimetry.com/scientific-validation

Mean temperature

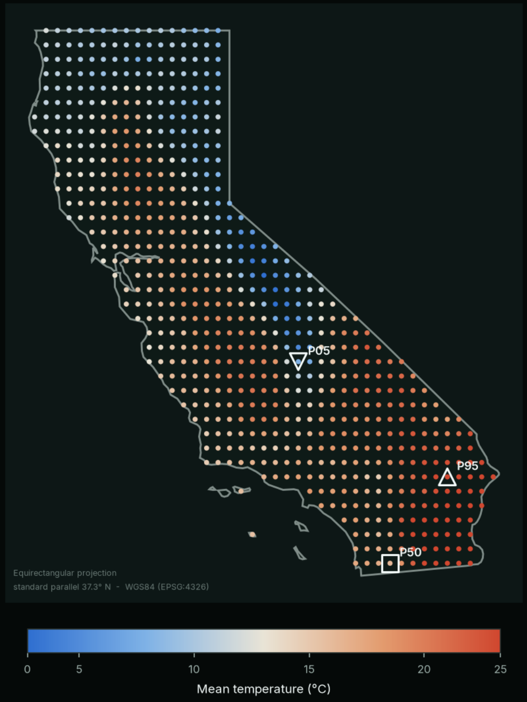
Annual distribution and spatial location across 673 analyzed gridpoints

Mean temperature

°C



Mean 15.5 °C · n = 673



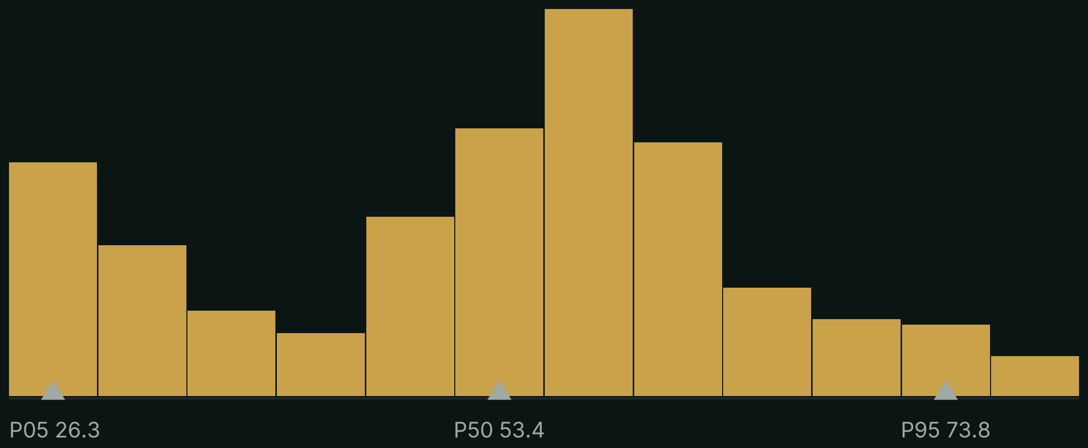
Mean temperature — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 7.7 °C @ 36.250, -118.500 · P50 16.2 °C @ 32.750, -116.500 · P95 23.3 °C @ 34.250, -115.250. Spatial variation across the region: Moderate (P95/P50 ≈ 1.44). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

Relative humidity

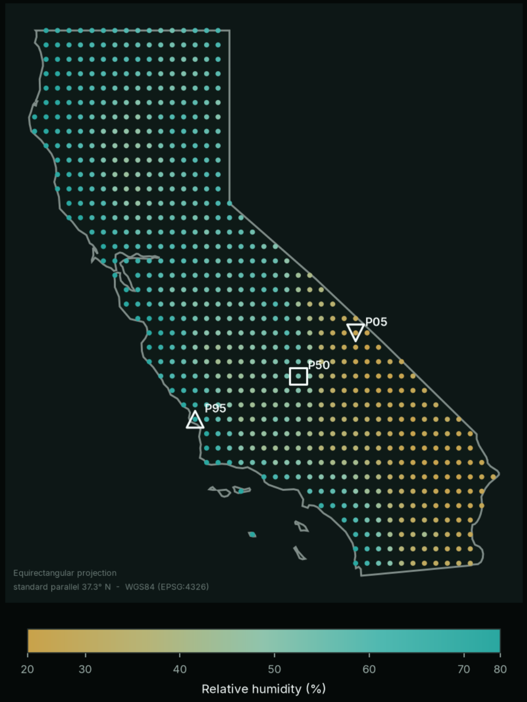
Annual distribution and spatial location across 673 analyzed gridpoints

Relative humidity

%



Mean 50.6 % · n = 673



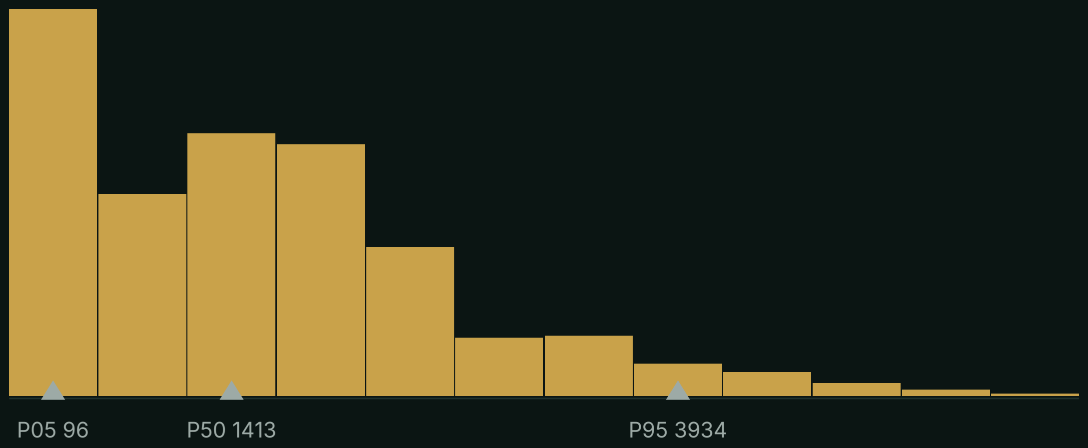
Relative humidity — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 26.3 % @ 36.750, -117.250 · P50 53.4 % @ 36.000, -118.500 · P95 73.8 % @ 35.250, -120.750. Spatial variation across the region: Moderate (P95/P50 ≈ 1.38). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

RH80 exposure

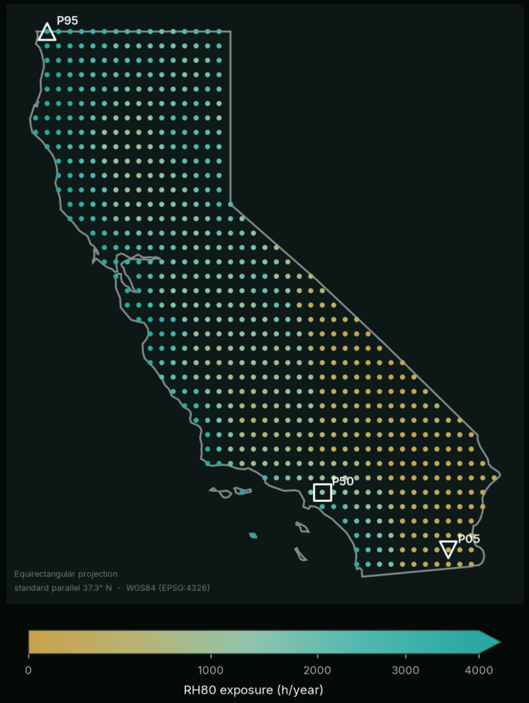
Annual distribution and spatial location across 673 analyzed gridpoints

RH80 exposure

h/year



Mean 1539 h/year · n = 673



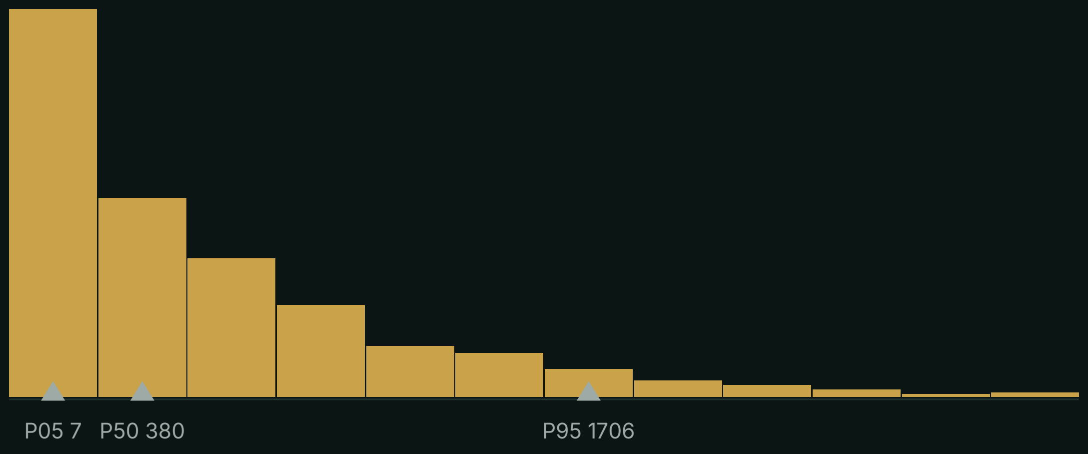
RH80 exposure — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 96 h/year @ 33.000, -115.250 · P50 1413 h/year @ 34.000, -118.000 · P95 3934 h/year @ 42.000, -124.000. Spatial variation across the region: High (P95/P50 ≈ 2.78). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

RH90 exposure

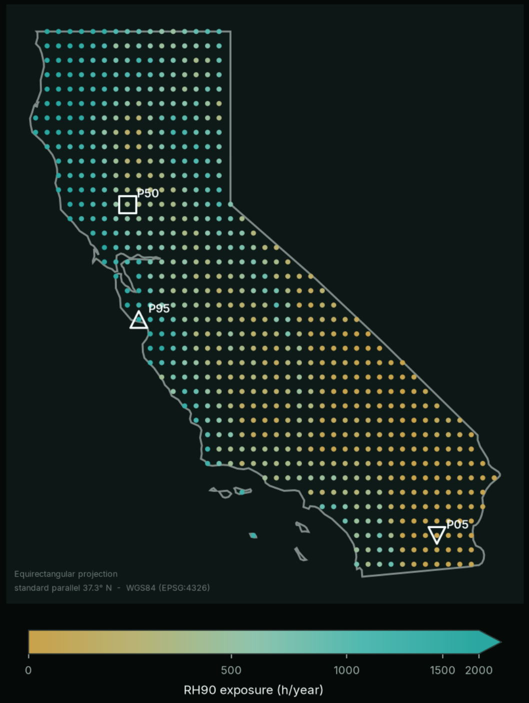
Annual distribution and spatial location across 673 analyzed gridpoints

RH90 exposure

h/year



Mean 547 h/year · n = 673



RH90 exposure — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 7 h/year @ 33.250, -115.500 · P50 380 h/year @ 39.000, -122.250 · P95 1706 h/year @ 37.000, -122.000. Spatial variation across the region: High (P95/P50 ≈ 4.49). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

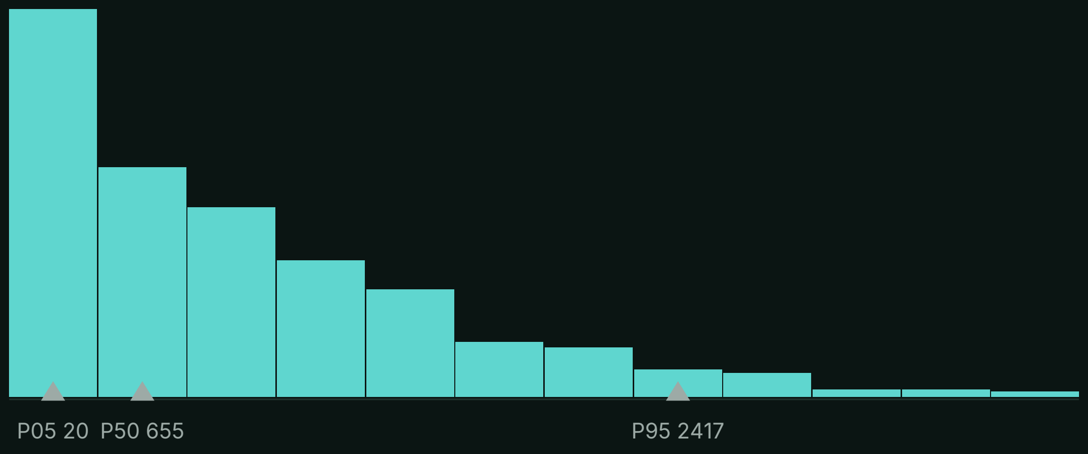
04.6

Near-condensation hours

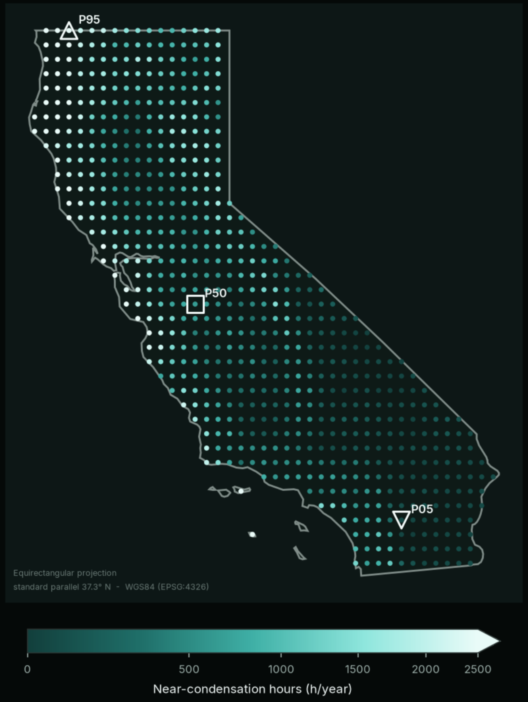
Annual distribution and spatial location across 673 analyzed gridpoints

Near-condensation hours

h/year



Mean 834 h/year · n = 673

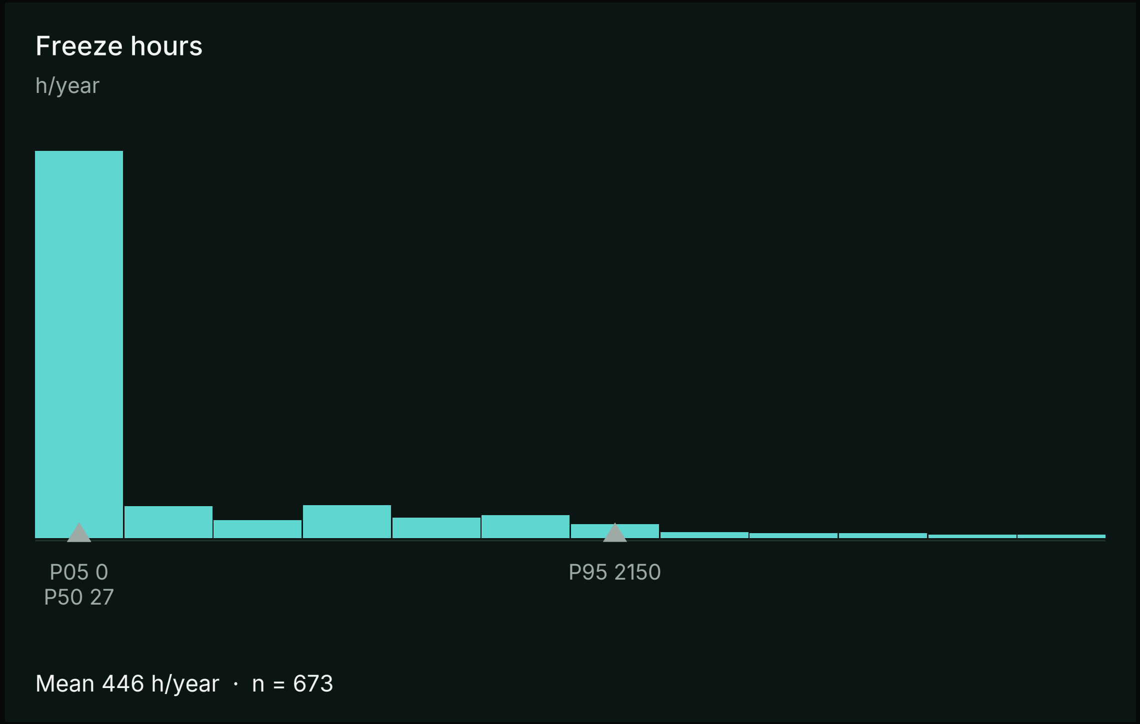


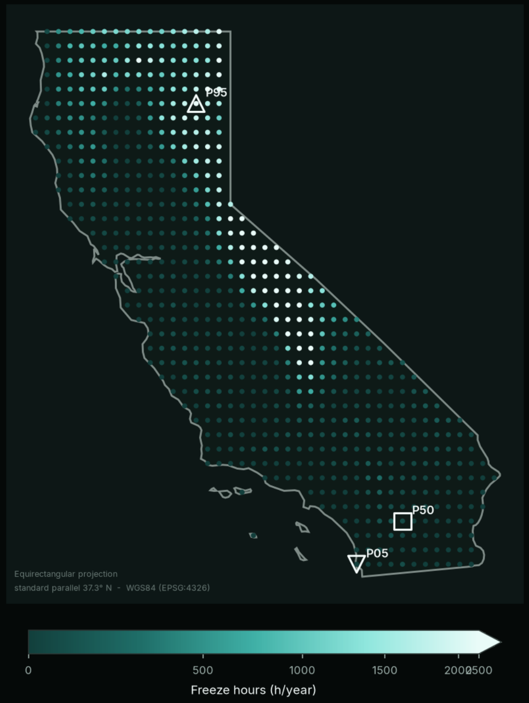
Near-condensation hours — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 20 h/year @ 33.500, -116.250 · P50 655 h/year @ 37.250, -120.750 · P95 2417 h/year @ 42.000, -123.500. Spatial variation across the region: High (P95/P50 ≈ 3.69). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

04.7

Freeze hours

Annual distribution and spatial location across 673 analyzed gridpoints





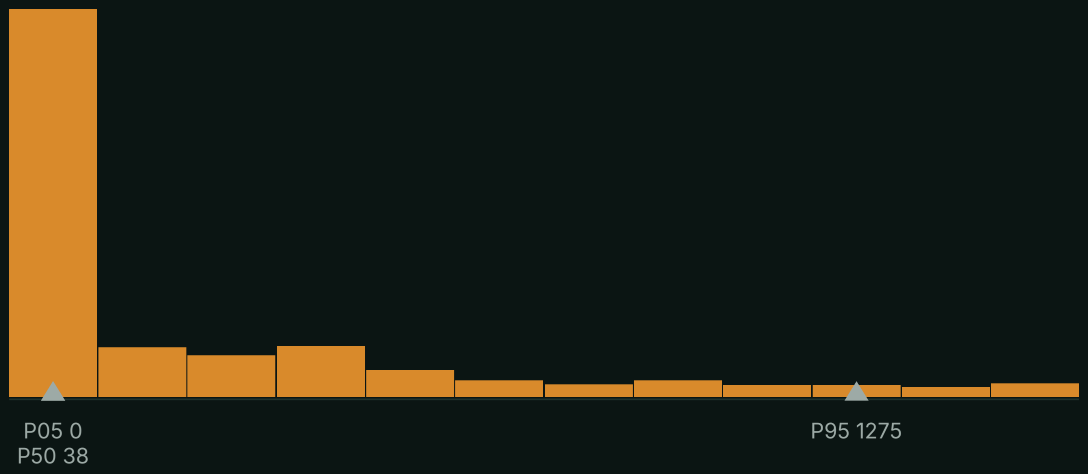
Freeze hours — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 0 h/year @ 32.750, -117.250 · P50 27 h/year @ 33.500, -116.250 · P95 2150 h/year @ 40.750, -120.750. Spatial variation across the region: High (P95/P50 ≈ 79.64). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

Heat hours

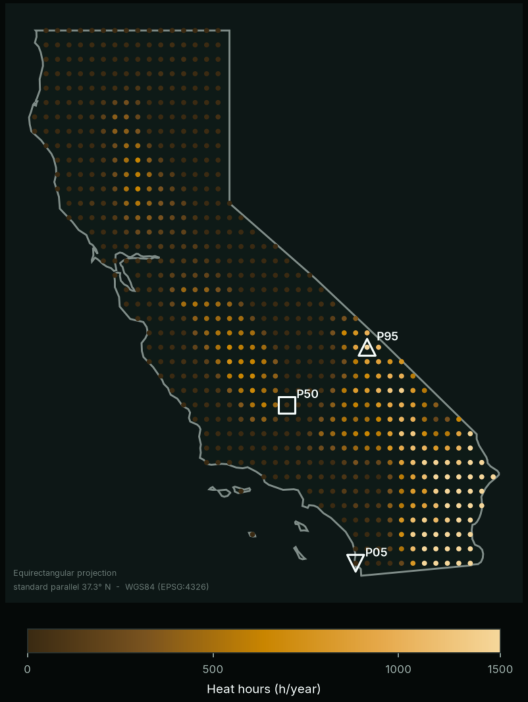
Annual distribution and spatial location across 673 analyzed gridpoints

Heat hours

h/year



Mean 274 h/year · n = 673



Heat hours — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 0 h/year @ 32.750, -117.250 · P50 38 h/year @ 35.500, -118.750 · P95 1275 h/year @ 36.500, -117.000. Spatial variation across the region: High (P95/P50 ≈ 33.55). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

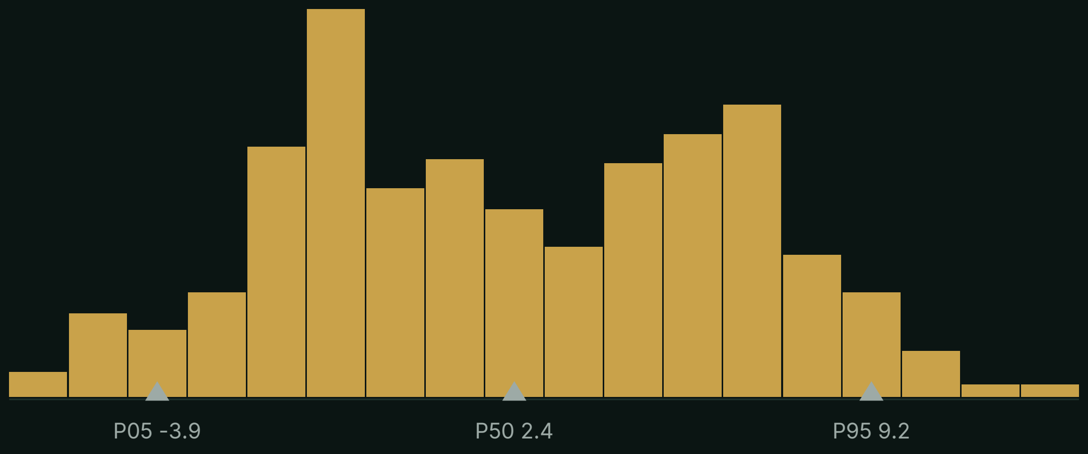
04.9

Dew point

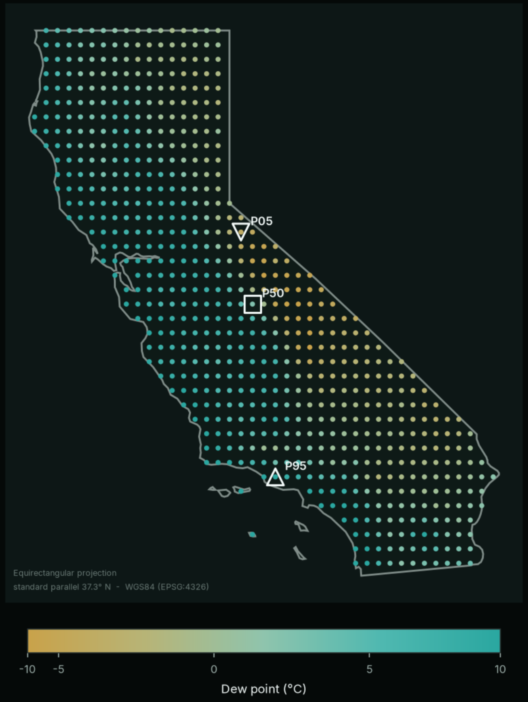
Annual distribution and spatial location across 673 analyzed gridpoints

Dew point

°C



Mean 2.7 °C · n = 673



Dew point — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 -3.9 °C @ 38.500, -119.750 · P50 2.4 °C @ 37.250, -119.500 · P95 9.2 °C @ 34.250, -119.000. The temperature at which the region's air would start to condense. Together with air temperature it fixes condensation risk and time of wetness. Evaluated from the region's hourly temperature / dew-point states and only then aggregated - never from a mean, which would bias this non-linear quantity. Monthly breakdown →

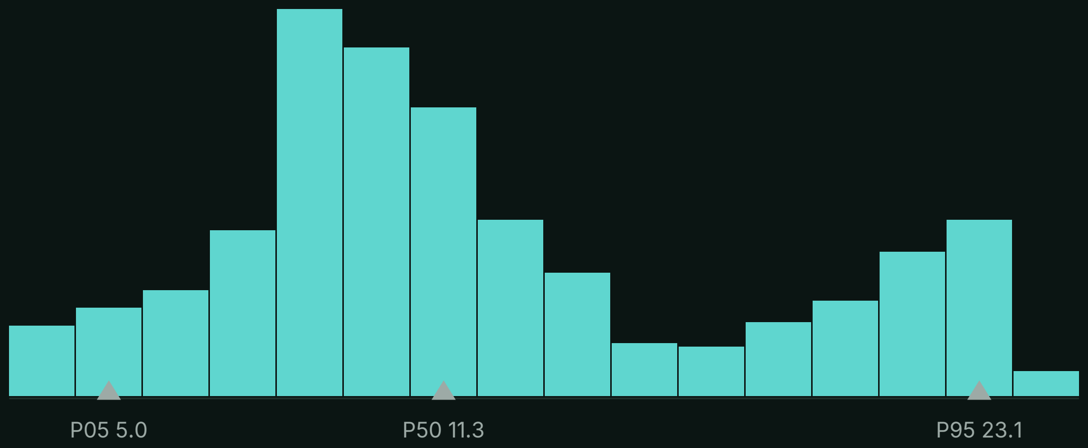
04.10

Dew-point depression

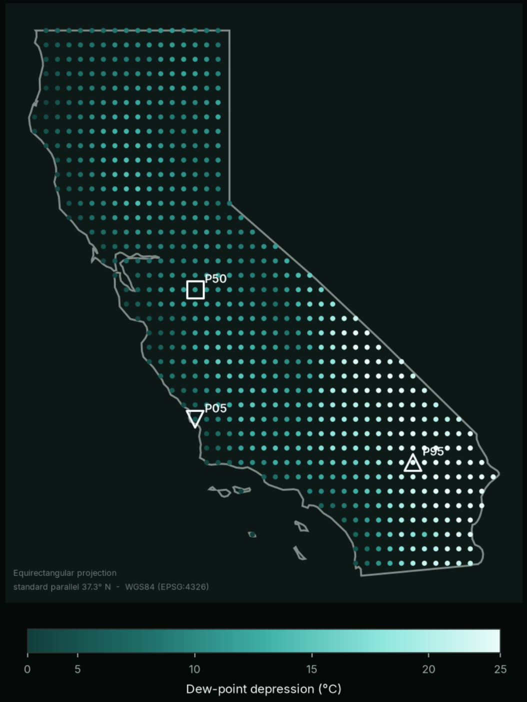
Annual distribution and spatial location across 673 analyzed gridpoints

Dew-point depression

°C



Mean 12.7 °C · n = 673



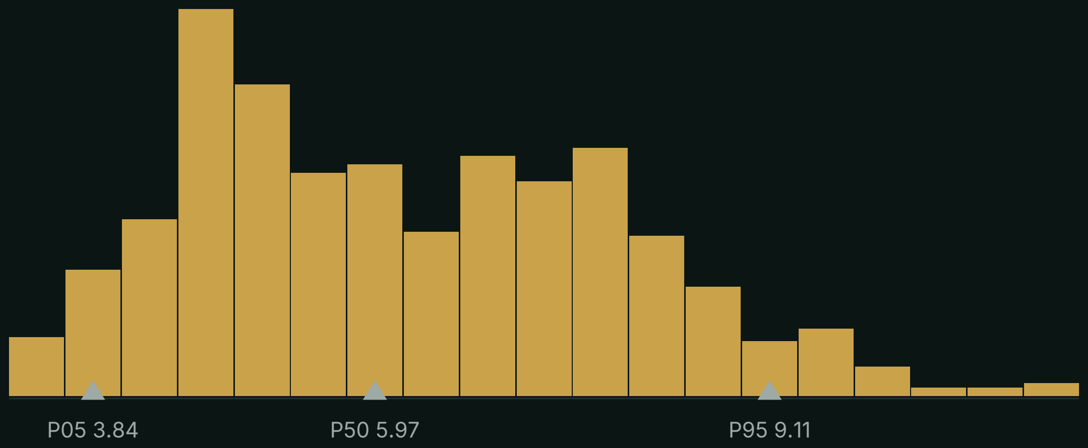
Dew-point depression — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 5.0 °C @ 35.250, -120.750 · P50 11.3 °C @ 37.500, -120.750 · P95 23.1 °C @ 34.500, -116.000. Air temperature minus dew point. A small depression means surfaces sit near the wetting point; a large one means strong drying potential - one of the most useful single indicators for condensation and corrosion screening. Evaluated from the region's hourly temperature / dew-point states and only then aggregated - never from a mean, which would bias this non-linear quantity. Monthly breakdown →

Absolute humidity

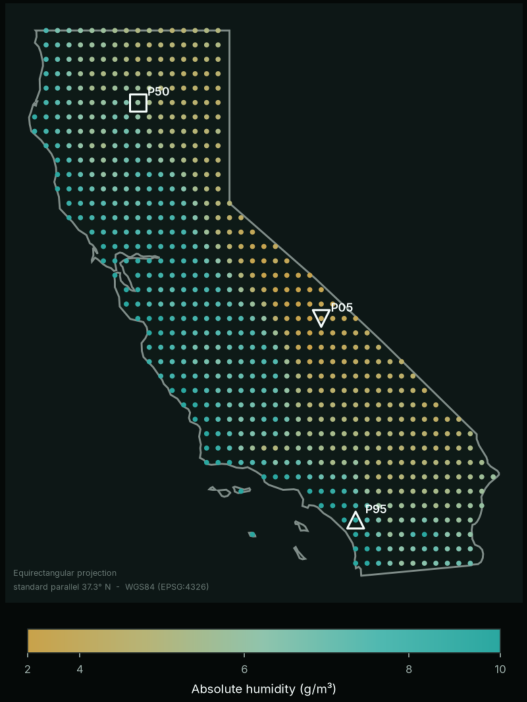
Annual distribution and spatial location across 673 analyzed gridpoints

Absolute humidity

g/m³



Mean 6.20 g/m³ · n = 673



Absolute humidity — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 3.84 g/m³ @ 37.000, -118.000 · P50 5.97 g/m³ @ 40.750, -122.000 · P95 9.11 g/m³ @ 33.500, -117.250. The mass of water vapour per cubic metre of air. Unlike relative humidity it does not depend on temperature, so it is the better measure of the moisture reservoir driving absorption, hydrolysis and coating blistering. Evaluated from the region's hourly temperature / dew-point states and only then aggregated - never from a mean, which would bias this non-linear quantity. Monthly breakdown →

PART II

II

ATMOSPHERE

Chloride deposition, sulfate deposition, UV surface dose and surface ozone - modifiers layered on top of the base climate.

05.1

How Atmospheric Exposure Is Modelled

Marine chloride transport, its drivers, and the station validation for this region

The marine chloride model

Airborne sea salt is produced at the ocean surface by breaking waves (whitecaps); its production rate rises steeply with wind speed. Climetry transports that salt inland with a finite-volume advection-deposition scheme on a high-resolution grid, so the plume follows real coastline shape and prevailing wind rather than a simple distance-to-coast curve.

Deposition along the path is modulated by terrain (headlands and ridgelines scavenge more salt; sheltered bays less) and by land cover (ESA WorldCover: forest and built-up surfaces capture more aerosol than open grassland). Monthly wind climatology drives the seasonal cycle. The output is a screening estimate of chloride deposition in mg/m²/day at every gridpoint.

SCREENING ESTIMATE

This is an engineering screening field, not a validated ISO 9225 wet-candle measurement. It is designed to rank exposure and size qualification tests, not to certify a site class.

Validation for this region

Model	North America v2.4 - MERRA-2 hybrid + receptor-grid chloride model
Grade	Engineering screening
Independent reference stations (n)	237
Coefficient of determination R^2	0.196
Spearman rank correlation ρ	0.808

What the validation means

Rank correlation is strong (ρ = 0.81), supporting comparative screening and spatial ranking of marine chloride exposure from sheltered inland sites to exposed open coast. Absolute deposition magnitude remains less tightly constrained (R^2 = 0.20), particularly across the highly heterogeneous coastal exposure range.

Sulfate deposition uses MERRA-2; UV and ozone use ERA5 / CAMS. Full chain: getclimetry.com/scientific-validation

05.2

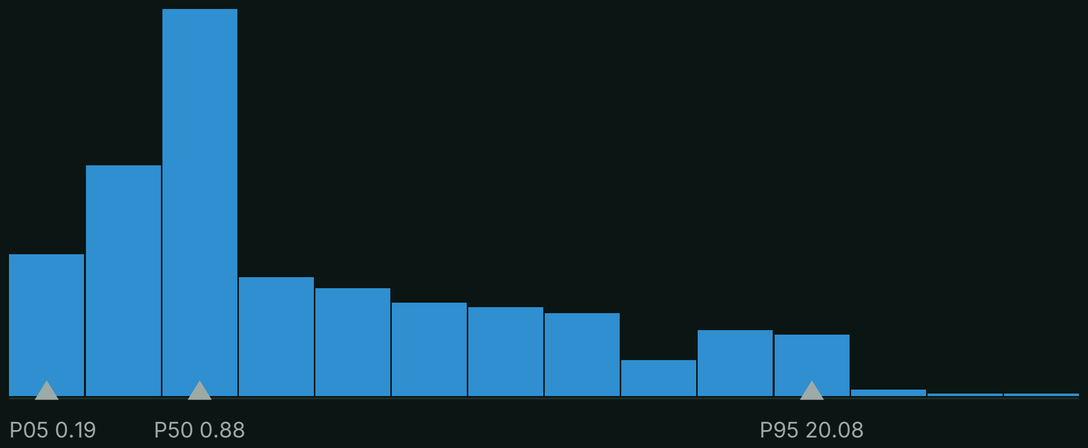
Chloride deposition

Annual distribution and spatial location across 673 analyzed gridpoints

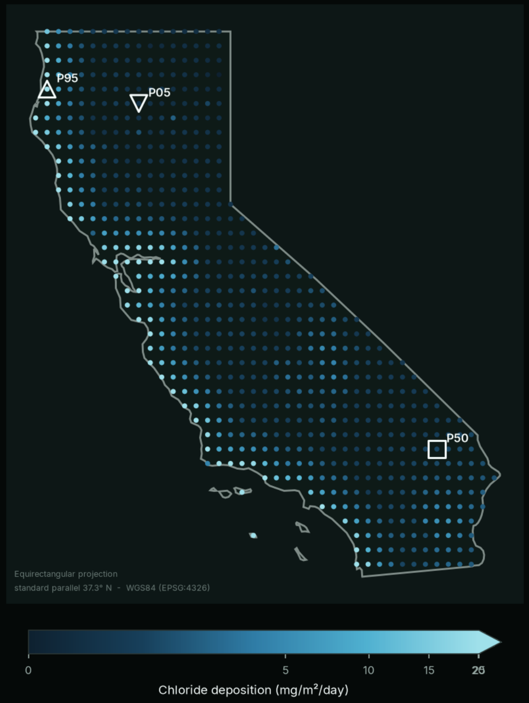
CLIMETRY

Chloride deposition

mg/m²/day



Mean 3.91 mg/m²/day · n = 673



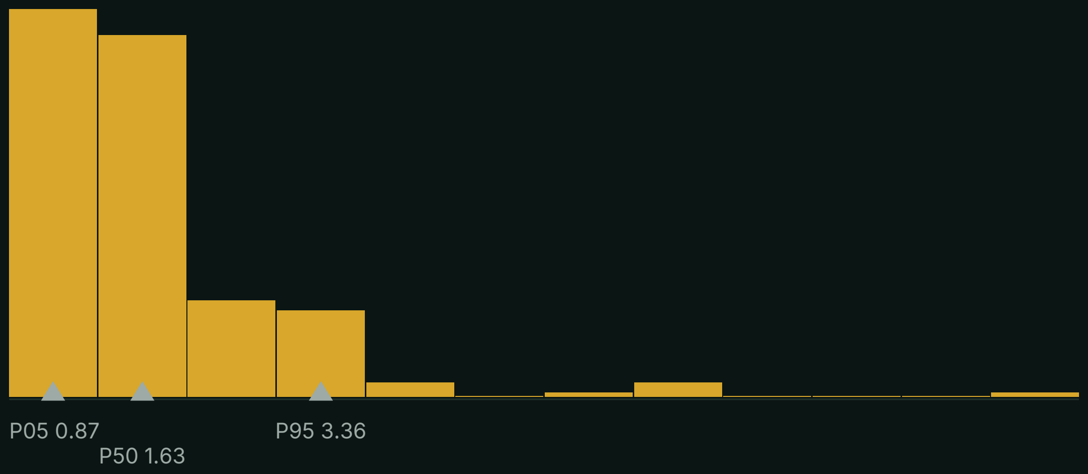
Chloride deposition — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 0.19 mg/m²/day @ 40.750, -122.000 · P50 0.88 mg/m²/day @ 34.750, -115.500 · P95 20.08 mg/m²/day @ 41.000, -124.000. Spatial variation across the region: High (P95/P50 ≈ 22.82). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

Sulfate deposition

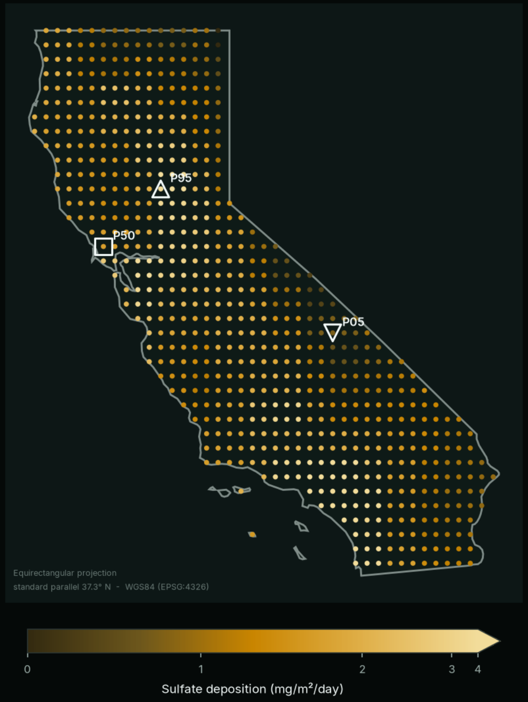
Annual distribution and spatial location across 673 analyzed gridpoints

Sulfate deposition

mg/m²/day



Mean 1.85 mg/m²/day · n = 673



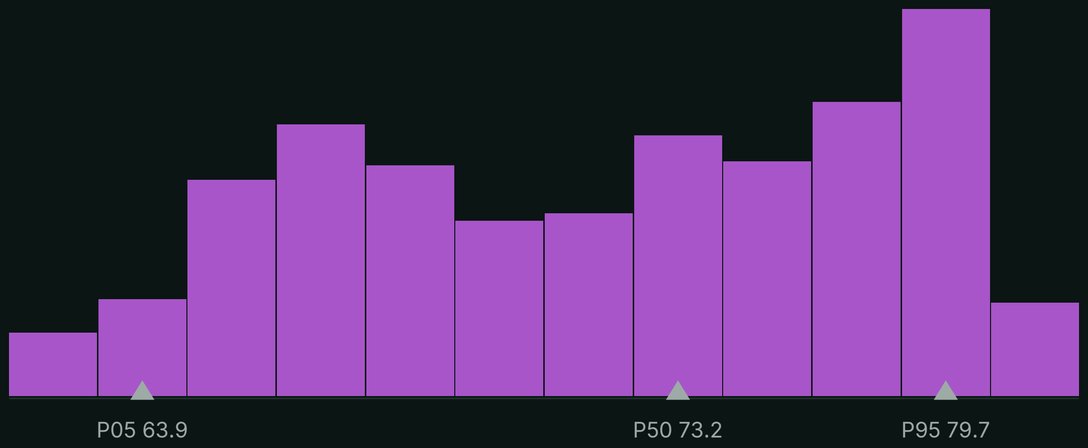
Sulfate deposition — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 0.87 mg/m²/day @ 36.750, -117.750 · P50 1.63 mg/m²/day @ 38.250, -122.750 · P95 3.36 mg/m²/day @ 39.250, -121.500. Spatial variation across the region: High (P95/P50 ≈ 2.06). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

UV surface dose

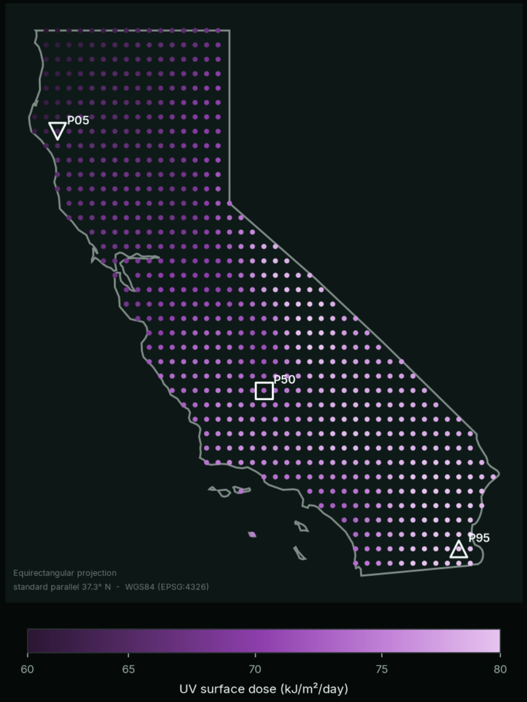
Annual distribution and spatial location across 673 analyzed gridpoints

UV surface dose

kJ/m²/day



Mean 72.4 kJ/m²/day · n = 673



UV surface dose — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 63.9 kJ/m²/day @ 40.250, -123.750 · P50 73.2 kJ/m²/day @ 35.750, -119.250 · P95 79.7 kJ/m²/day @ 33.000, -115.000. Spatial variation across the region: Low (P95/P50 ≈ 1.09). Location within the region provides little mitigation - polymer formulation, UV stabilisation and shielding dominate over siting. Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

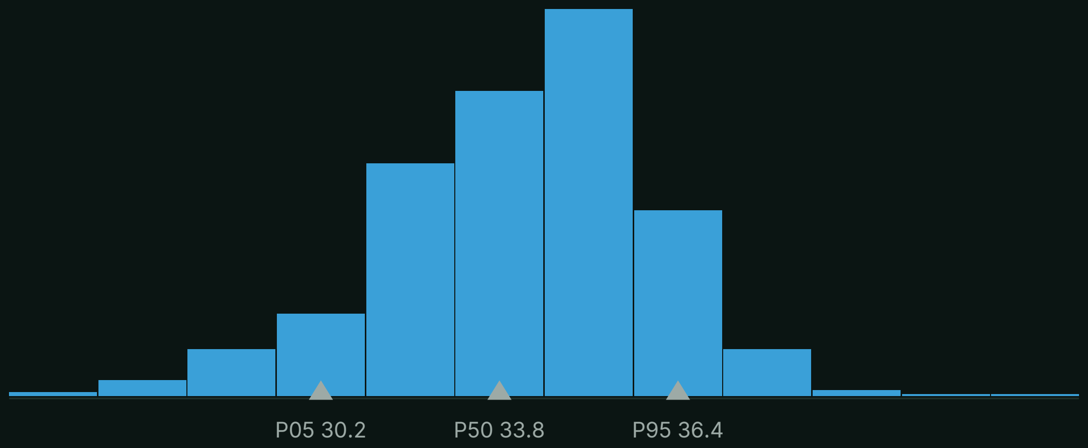
05.5

Surface ozone

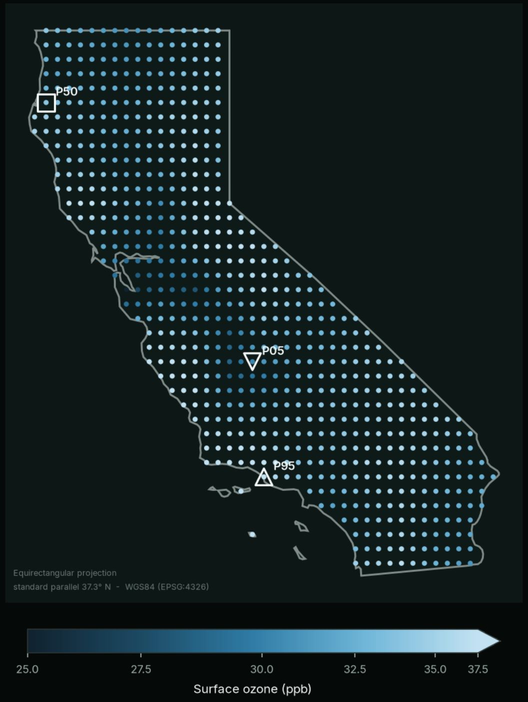
Annual distribution and spatial location across 673 analyzed gridpoints

Surface ozone

ppb



Mean 33.6 ppb · n = 673



Surface ozone — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 30.2 ppb @ 36.250, -119.500 · P50 33.8 ppb @ 40.750, -124.000 · P95 36.4 ppb @ 34.250, -119.250. Spatial variation across the region: Low (P95/P50 ≈ 1.08). Siting cannot be relied on to reduce ozone exposure - specify ozone-resistant elastomer chemistry and protective additives instead. Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

PART III

III

MATERIALS

Regional metal corrosion and polymer-ageing distributions and the engineering response.

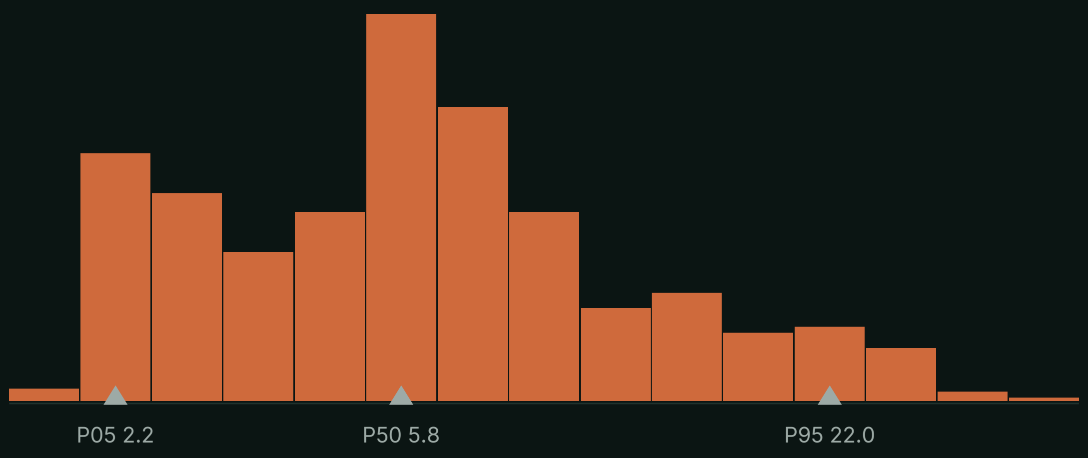
06.1

Carbon steel corrosion rate

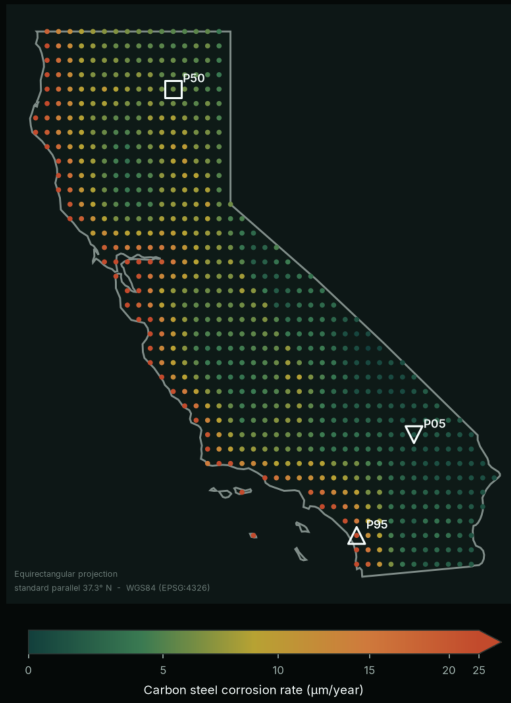
First-year corrosion rate - screening estimate - across 673 analyzed gridpoints

Carbon steel corrosion rate

µm/year



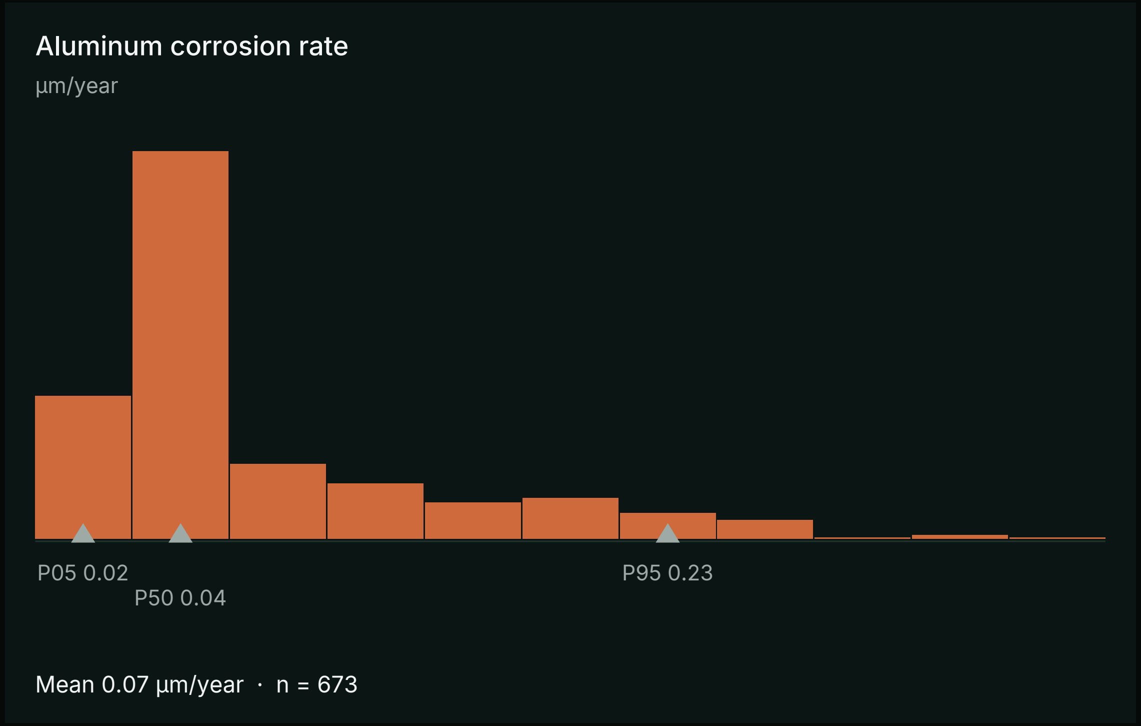
Mean 7.7 µm/year · n = 673

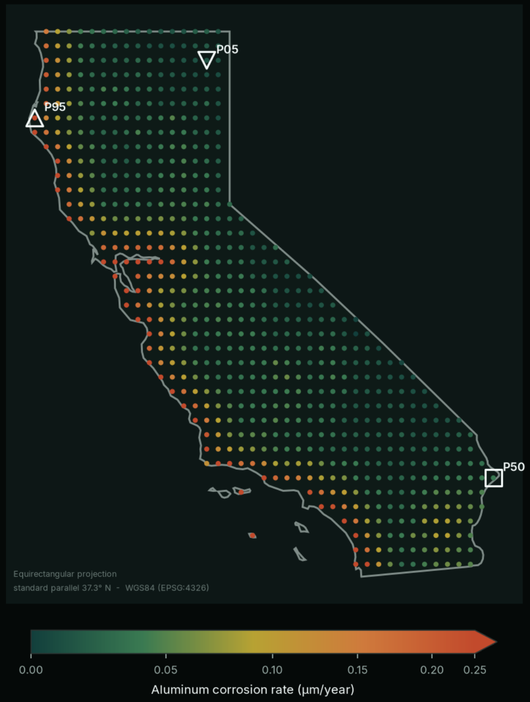


Carbon steel corrosion rate — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 2.2 µm/year @ 35.000, -116.000 · P50 5.8 µm/year @ 41.000, -121.250 · P95 22.0 µm/year @ 33.250, -117.250. These are first-year corrosion rates - a screening estimate. Do not extrapolate them linearly over service life: long-term corrosion loss is generally sub-linear and depends on patina formation, exposure continuity and the protection system. Spatial variation across the region: High (P95/P50 ≈ 3.81). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

Aluminum corrosion rate

First-year corrosion rate - screening estimate - across 673 analyzed gridpoints

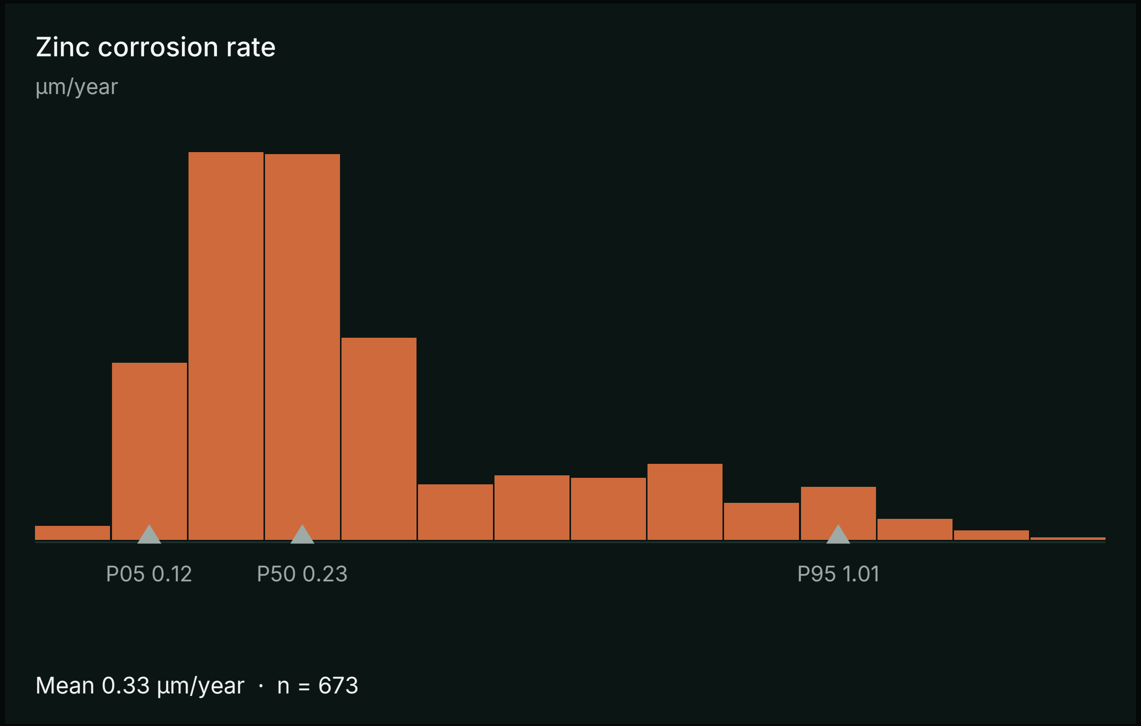


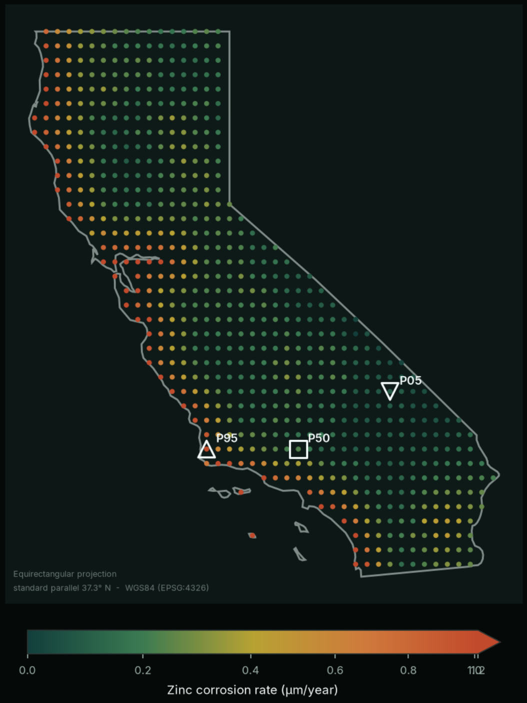


Aluminum corrosion rate — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 0.02 µm/year @ 41.500, -120.500 · P50 0.04 µm/year @ 34.250, -114.250 · P95 0.23 µm/year @ 40.500, -124.250. These are first-year corrosion rates - a screening estimate. Do not extrapolate them linearly over service life: long-term corrosion loss is generally sub-linear and depends on patina formation, exposure continuity and the protection system. Spatial variation across the region: High (P95/P50 ≈ 5.85). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

06.3 Zinc corrosion rate

First-year corrosion rate - screening estimate - across 673 analyzed gridpoints





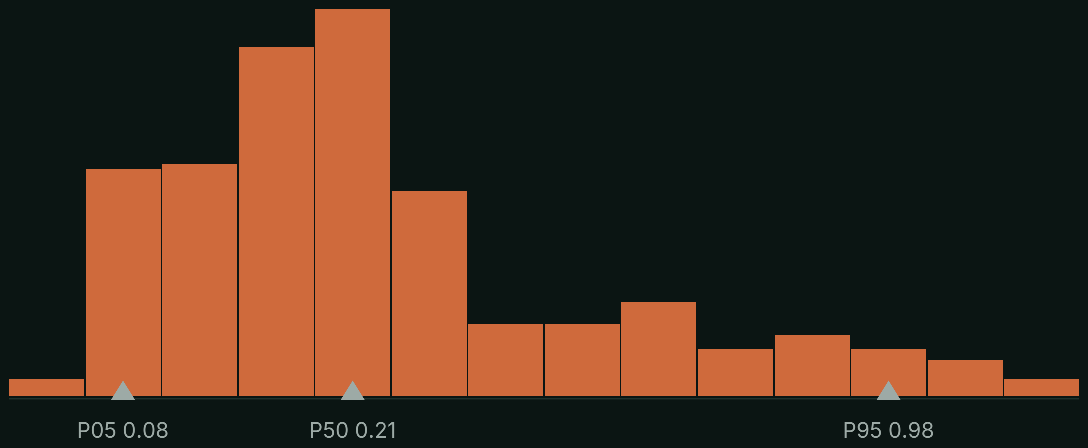
Zinc corrosion rate — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 0.12 µm/year @ 35.750, -116.500 · P50 0.23 µm/year @ 34.750, -118.500 · P95 1.01 µm/year @ 34.750, -120.500. These are first-year corrosion rates - a screening estimate. Do not extrapolate them linearly over service life: long-term corrosion loss is generally sub-linear and depends on patina formation, exposure continuity and the protection system. Spatial variation across the region: High (P95/P50 ≈ 4.44). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

Copper corrosion rate

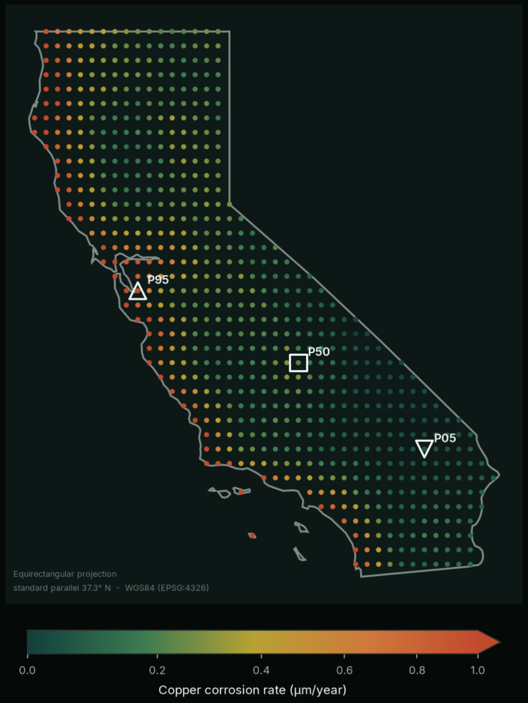
First-year corrosion rate - screening estimate - across 673 analyzed gridpoints

Copper corrosion rate

µm/year



Mean 0.32 µm/year · n = 673



Copper corrosion rate — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 0.08 µm/year @ 34.750, -115.750 · P50 0.21 µm/year @ 36.250, -118.500 · P95 0.98 µm/year @ 37.500, -122.000. These are first-year corrosion rates - a screening estimate. Do not extrapolate them linearly over service life: long-term corrosion loss is generally sub-linear and depends on patina formation, exposure continuity and the protection system. Spatial variation across the region: High (P95/P50 ≈ 4.58). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

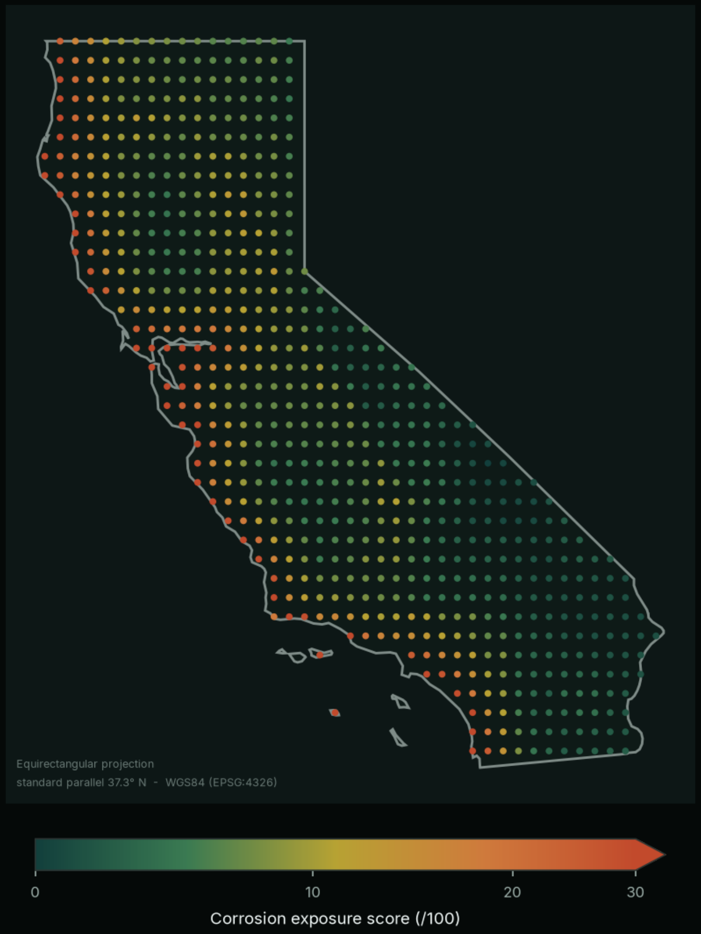
Corrosion Severity Map

Where combined exposure concentrates spatially

What the score combines

Corrosion exposure score combines chloride and sulfate deposition together with temperature and humidity into one 0–100 screening score at each real gridpoint.

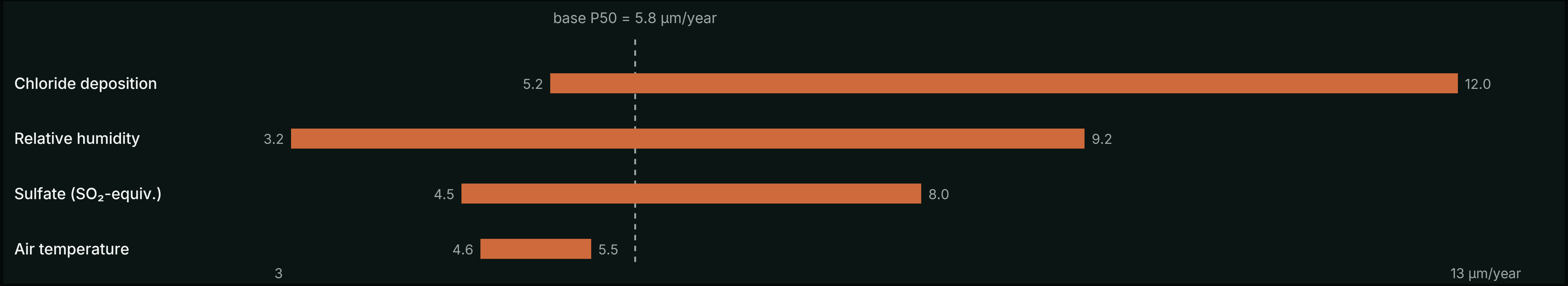
Reading this chart - The highest-corrosion exposure score 10% of analyzed locations sit toward the western part of the region on average (mean longitude -121.75 vs -119.41 for the rest) - the kind of spatial clustering a histogram alone cannot show: locations at similar latitude can see materially different exposure.



Corrosion Sensitivity & Engineering Uncertainty

Carbon steel first-year rate vs each ISO 9223 input, swept over the region's P05-P95

Each ISO 9223 input is swept over this region's own P05 to P95 (Chloride deposition 0.19-20.08 mg/m²/day; Relative humidity 26-74 %; Sulfate (SO_2-equiv.) 0.87-3.36 mg/m²/day; Air temperature 8-23 °C) while the others stay at their regional P50; the bar is the resulting first-year carbon-steel rate.



Screening scenario	How the inputs are set	First-year steel rate
Lower	each input at the P05/P95 end that reduces corrosion	1.6 µm/year
Base	every input at its regional P50	5.8 µm/year
Upper	each input at the P05/P95 end that increases corrosion	20.6 µm/year

THIS IS A SENSITIVITY ANALYSIS, NOT A CONFIDENCE INTERVAL

The Lower/Upper scenarios show how far the screening rate moves when the inputs sit at the edges of their regional spread - they carry no probability and are not statistical bounds; first-year rates are not to be extrapolated linearly over service life. The base case evaluates the model at the marginal P50 of each input, so it does not necessarily equal the P50 of the actual per-gridpoint rate distribution (non-linear response, correlated inputs) - the carbon-steel evidence page carries that per-gridpoint P50.

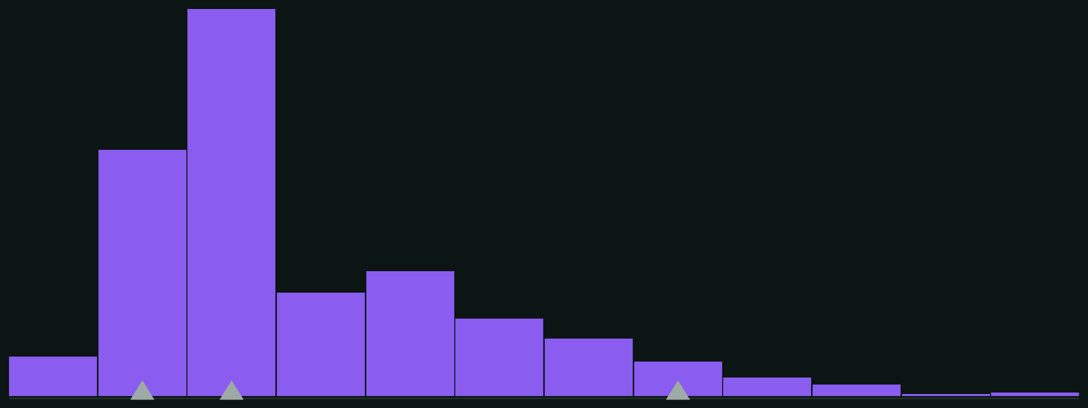
07.1

Climetry Polymer Exposure Screening Index

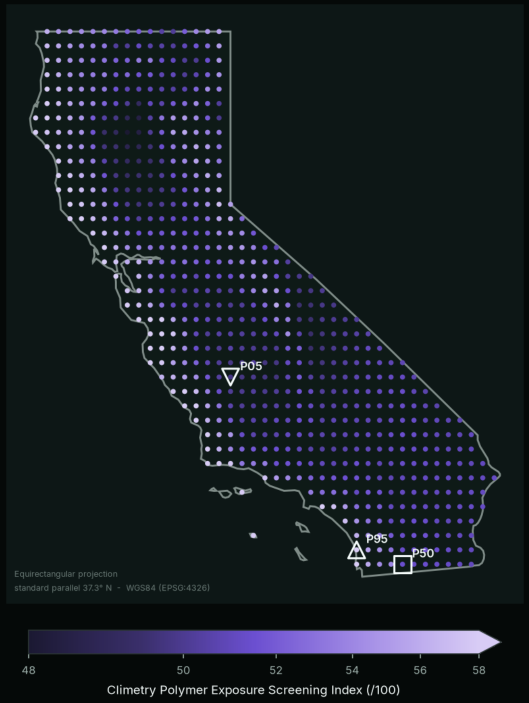
Annual distribution and spatial location across 673 analyzed gridpoints

Climetry Polymer Exposure Screening Index

0-100 index



Mean 52 · n = 673



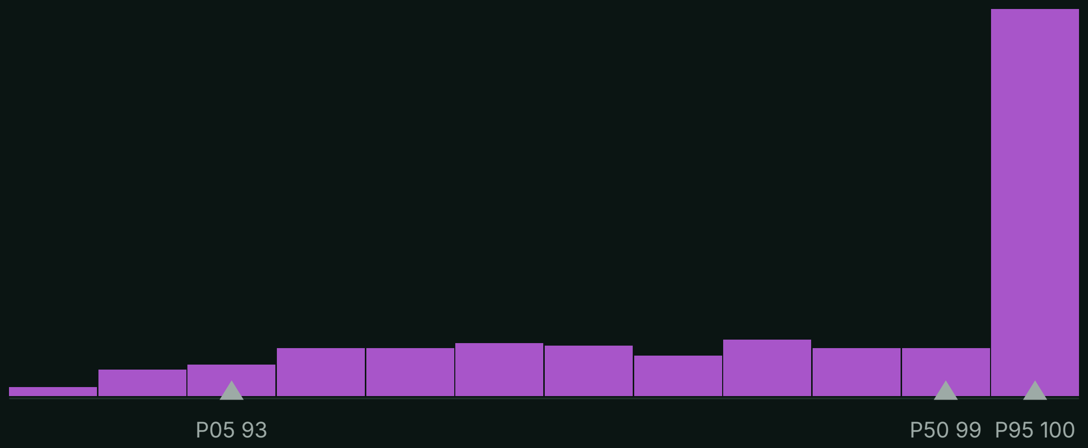
Climetry Polymer Exposure Screening Index — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 50 /100 @ 36.000, -120.000 · P50 51 /100 @ 32.750, -116.250 · P95 58 /100 @ 33.000, -117.250. Spatial variation across the region: Low (P95/P50 ≈ 1.13). The polymer-ageing environment is essentially uniform across the region - material selection and stabilisation, not location, are the effective controls. Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

UV / photo-oxidation score

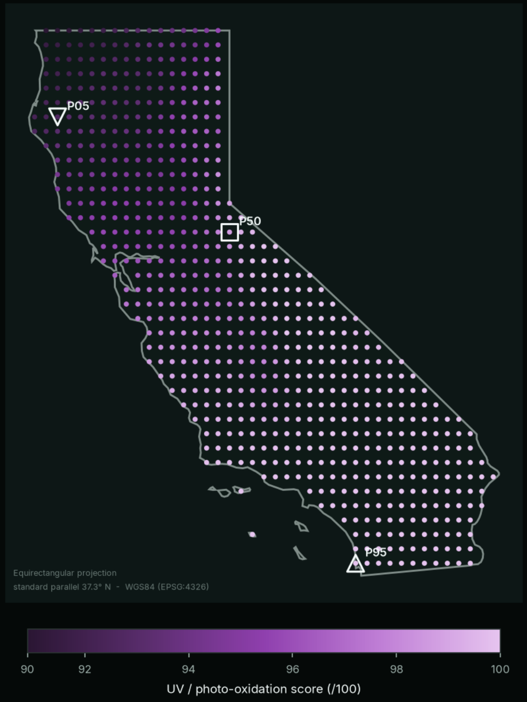
Annual distribution and spatial location across 673 analyzed gridpoints

UV / photo-oxidation score

0-100 index



Mean 98 · n = 673



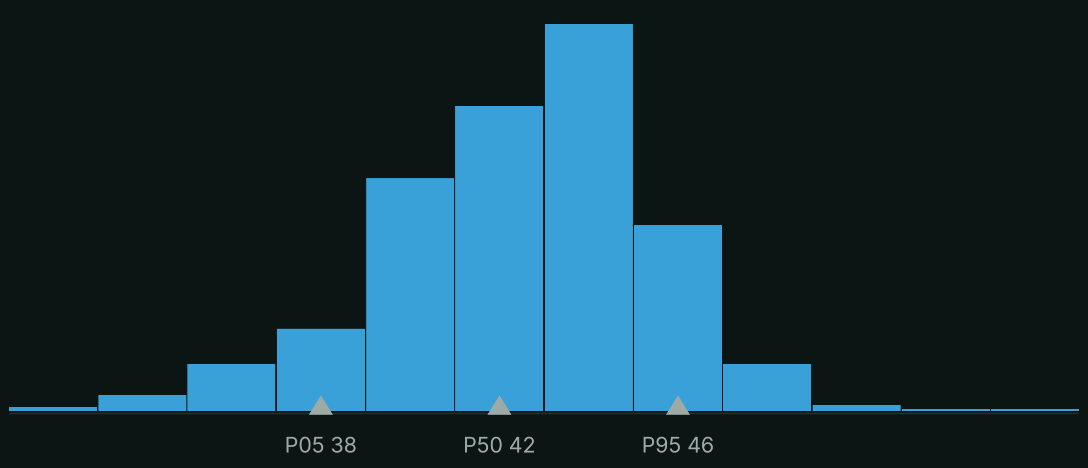
UV / photo-oxidation score — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 93 /100 @ 40.500, -123.750 · P50 99 /100 @ 38.500, -120.000 · P95 100 /100 @ 32.750, -117.250. Spatial variation across the region: Low (P95/P50 ≈ 1.01). Location within the region provides little mitigation - polymer formulation, UV stabilisation and shielding dominate over siting. Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

Ozone / elastomer score

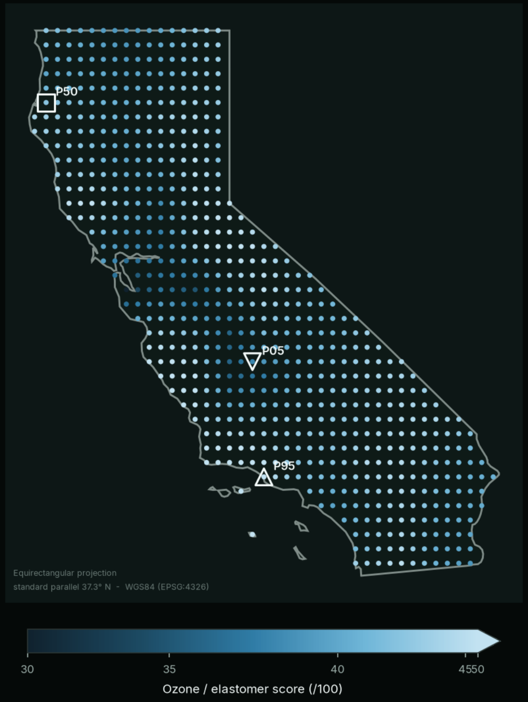
Annual distribution and spatial location across 673 analyzed gridpoints

Ozone / elastomer score

0-100 index



Mean 42 · n = 673



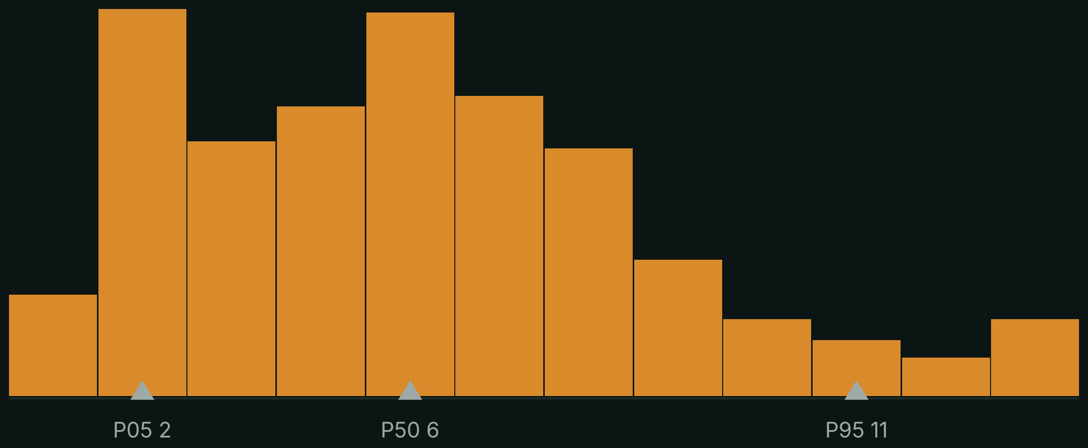
Ozone / elastomer score — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 38 /100 @ 36.250, -119.500 · P50 42 /100 @ 40.750, -124.000 · P95 46 /100 @ 34.250, -119.250. Spatial variation across the region: Low (P95/P50 ≈ 1.08). Siting cannot be relied on to reduce ozone exposure - specify ozone-resistant elastomer chemistry and protective additives instead. Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

Thermal oxidation score

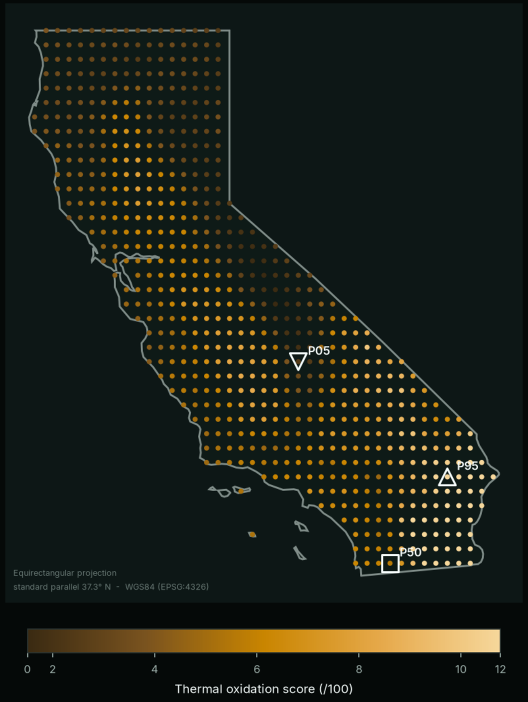
Annual distribution and spatial location across 673 analyzed gridpoints

Thermal oxidation score

0-100 index



Mean 6 · n = 673

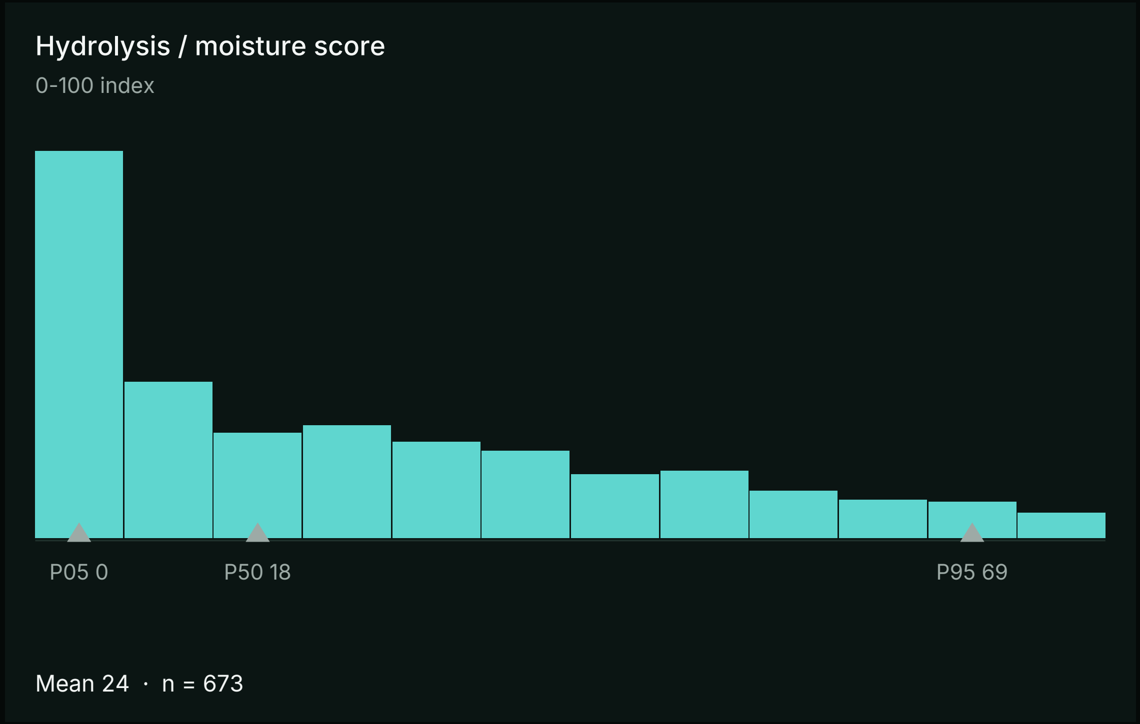


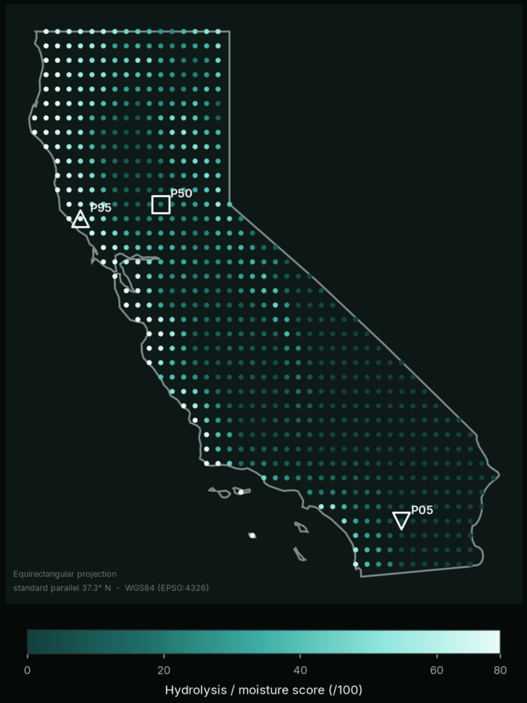
Thermal oxidation score — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 2 /100 @ 36.250, -118.500 · P50 6 /100 @ 32.750, -116.500 · P95 11 /100 @ 34.250, -115.250. Spatial variation across the region: High (P95/P50 ≈ 1.92). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

07.5

Hydrolysis / moisture score

Annual distribution and spatial location across 673 analyzed gridpoints





Hydrolysis / moisture score — where P05 / P50 / P95 occur (real analyzed gridpoints): P05 0 /100 @ 33.500, -116.250 · P50 18 /100 @ 39.000, -121.500 · P95 69 /100 @ 38.750, -123.250. Spatial variation across the region: High (P95/P50 ≈ 3.88). Full per-location engineering data are available in the Regional Engineering Data Package. Monthly breakdown →

Polymer Exposure Screening — Severity Map

Where combined exposure concentrates spatially

What the score combines

Climetry Polymer Exposure Screening Index combines UV / photo-oxidation, ozone / elastomer degradation, thermal oxidation and hydrolysis / moisture ageing into one 0–100 screening score at each real gridpoint.

Reading this chart - The highest-climetry polymer exposure screening index 10% of analyzed locations sit toward the western part of the region on average (mean longitude -121.94 vs -119.39 for the rest) - the kind of spatial clustering a histogram alone cannot show: locations at similar latitude can see materially different exposure.

PART 08

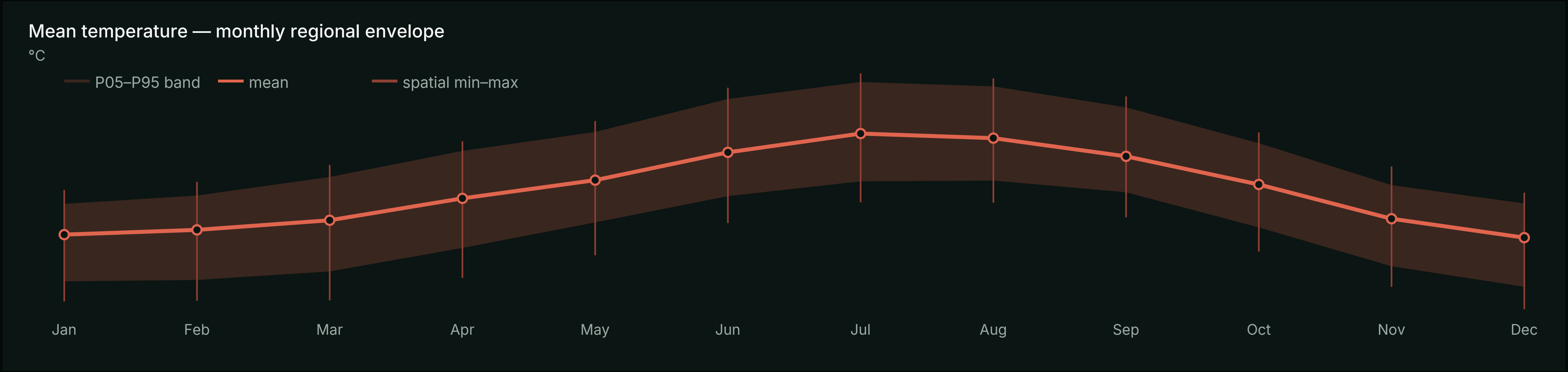
08 MONTHLY ENVELOPES

Seasonality of every thermodynamic, atmospheric and material quantity - the regional P05-P95 band and mean by calendar month, with the full Jan-December figures.

08.1

Monthly Thermodynamic Envelope

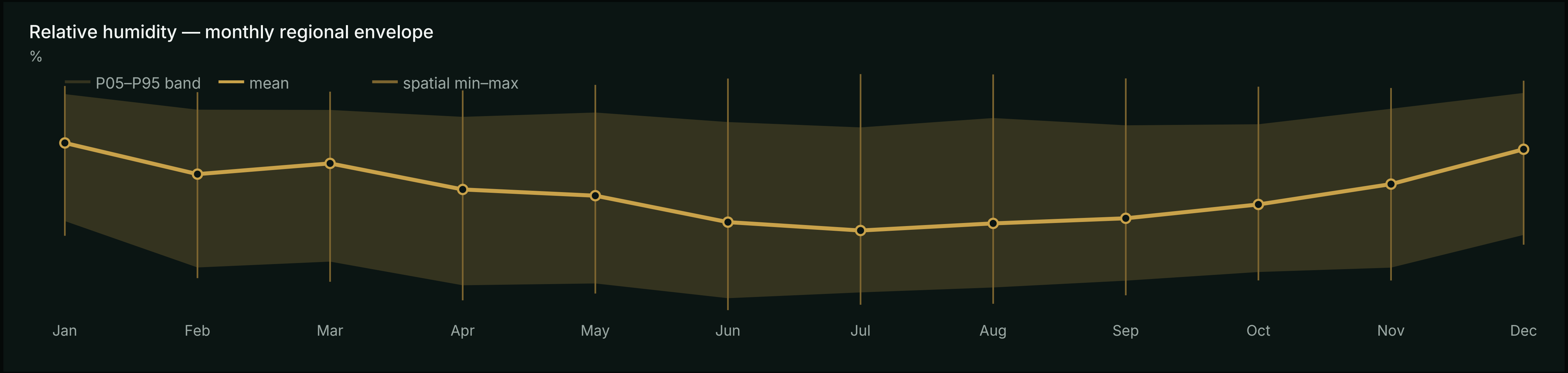
Mean temperature - regional P05-P95 spread with mean by month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (°C)	7.3	8.1	9.9	14.0	17.3	22.5	25.9	25.1	21.7	16.5	10.2	6.7
P05 (°C)	-1.4	-1.1	0.44	4.8	9.5	14.4	17.1	17.3	15.1	8.6	1.4	-2.4
P95 (°C)	12.9	14.5	17.9	22.7	26.2	32.3	35.5	34.7	30.8	24.2	16.4	13.0

Monthly Thermodynamic Envelope

Relative humidity - regional P05-P95 spread with mean by month

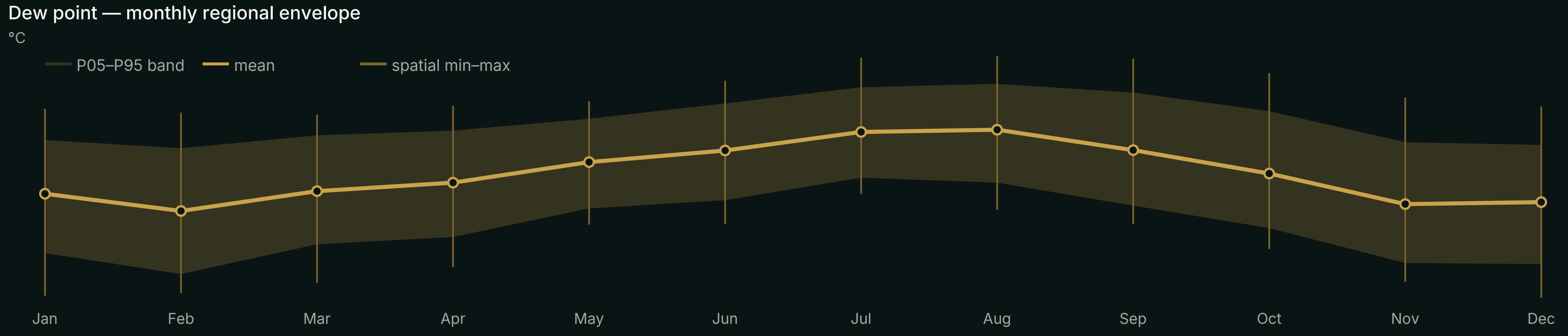


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (%)	66.1	56.1	59.5	51.2	49.3	40.8	38.1	40.4	42.0	46.5	52.9	64.1
P05 (%)	41.2	26.4	28.2	20.7	21.3	16.6	18.4	20.0	22.1	24.9	26.3	36.7
P95 (%)	81.6	76.7	76.6	74.4	75.8	72.7	71.0	74.0	71.7	72.0	77.0	82.0

08.3

Monthly Thermodynamic Envelope

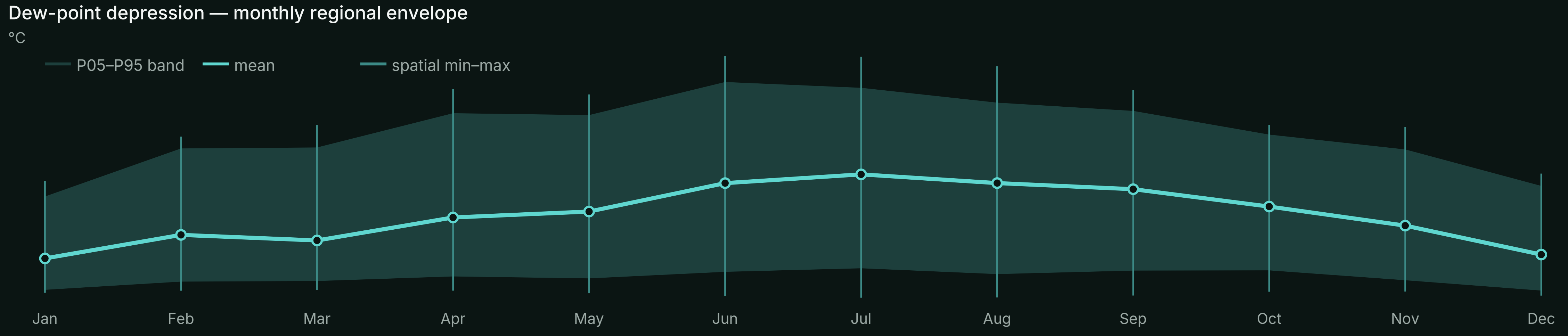
Dew point - regional P05-P95 spread with mean by month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (°C)	0.16	-2.0	0.49	1.6	4.2	5.6	8.0	8.2	5.7	2.7	-1.1	-0.90
P05 (°C)	-7.3	-10.0	-6.2	-5.3	-1.7	-0.65	2.2	1.6	-1.3	-4.2	-8.6	-8.7
P95 (°C)	6.9	5.9	7.5	8.1	9.6	11.6	13.6	14.0	12.9	10.6	6.7	6.3

Monthly Thermodynamic Envelope

Dew-point depression - regional P05-P95 spread with mean by month

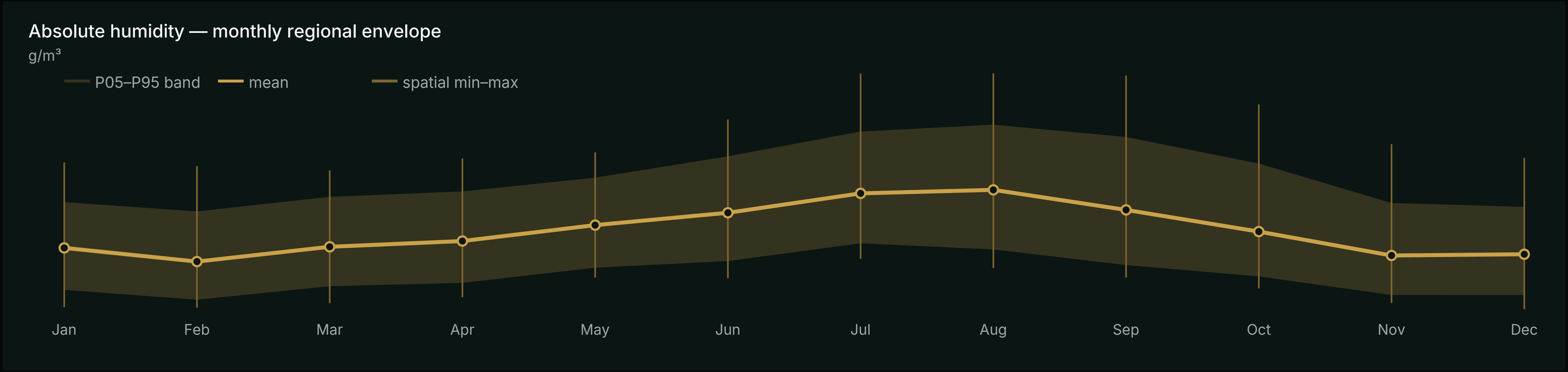


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (°C)	7.1	10.1	9.4	12.4	13.2	16.8	18.0	16.9	16.1	13.8	11.3	7.6
P05 (°C)	3.0	4.1	4.2	4.8	4.5	5.4	5.8	5.1	5.5	5.5	4.3	2.9
P95 (°C)	15.1	21.3	21.5	25.9	25.7	30.0	29.2	27.3	26.2	23.1	21.2	16.5

08.5

Monthly Thermodynamic Envelope

Absolute humidity - regional P05-P95 spread with mean by month

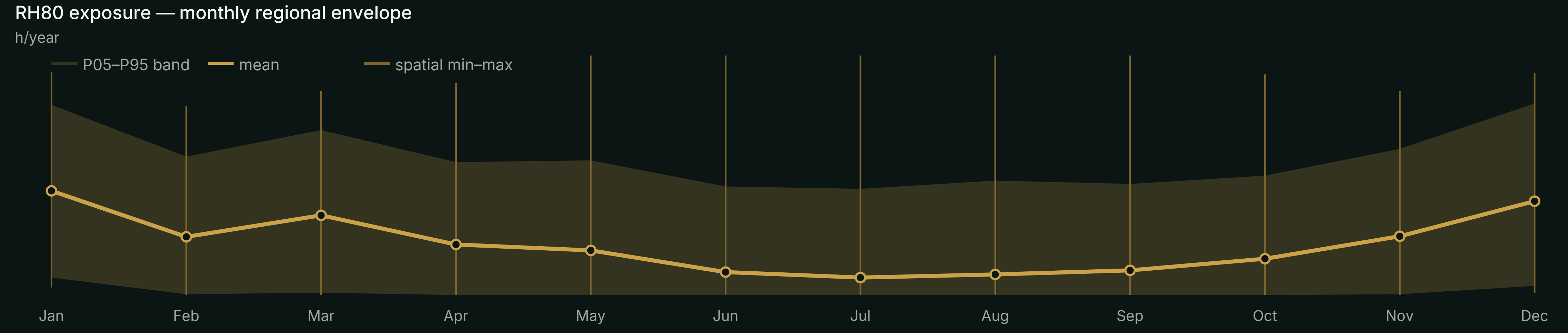


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (g/m³)	5.3	4.5	5.3	5.6	6.5	7.2	8.2	8.4	7.3	6.2	4.9	4.9
P05 (g/m³)	3.0	2.5	3.2	3.4	4.2	4.6	5.5	5.2	4.3	3.7	2.7	2.7
P95 (g/m³)	7.7	7.2	8.0	8.3	9.1	10.2	11.6	11.9	11.3	9.8	7.7	7.5

08.6

Monthly Thermodynamic Envelope

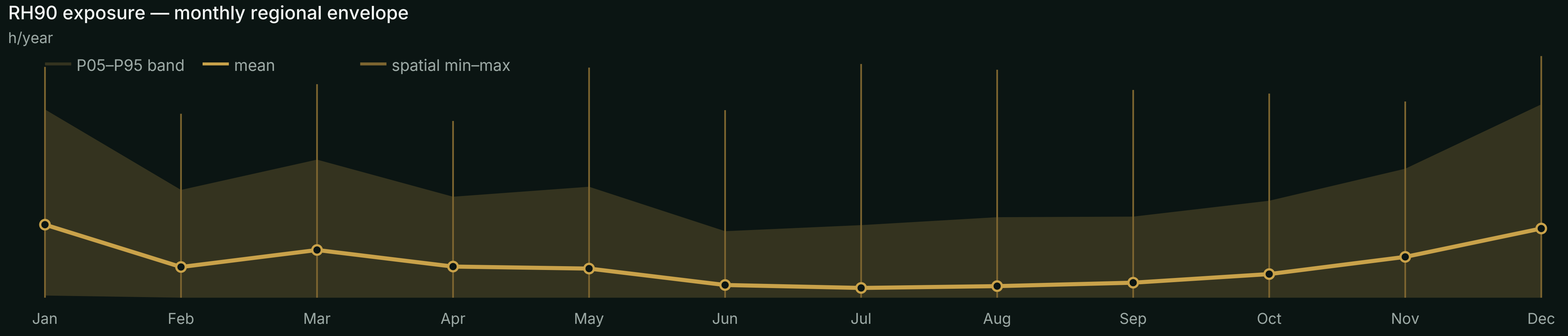
RH80 exposure - regional P05-P95 spread with mean by month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (h/year)	262.1	146.4	200.5	127.1	112.3	57.7	43.9	51.8	62.1	91.3	147.9	236.1
P05 (h/year)	44.0	2.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	23.0
P95 (h/year)	478.4	348.4	415.0	334.4	338.8	273.2	267.2	287.8	279.6	300.4	367.8	482.0

Monthly Thermodynamic Envelope

RH90 exposure - regional P05-P95 spread with mean by month

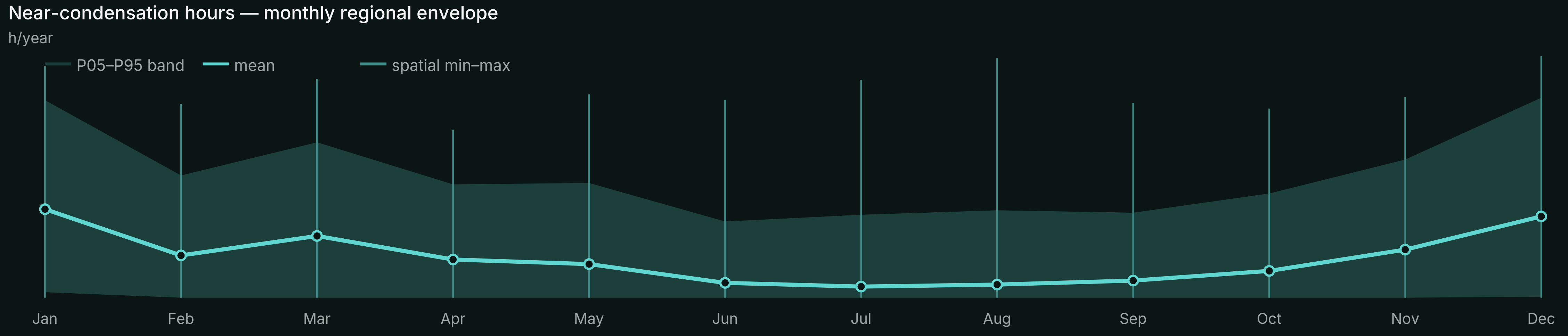


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (h/year)	101.2	42.6	66.1	43.2	40.3	17.6	13.5	16.0	20.8	32.7	56.6	95.9
P05 (h/year)	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P95 (h/year)	261.0	149.4	191.4	140.0	153.8	92.2	100.6	111.6	112.4	134.4	178.8	268.0

08.8

Monthly Thermodynamic Envelope

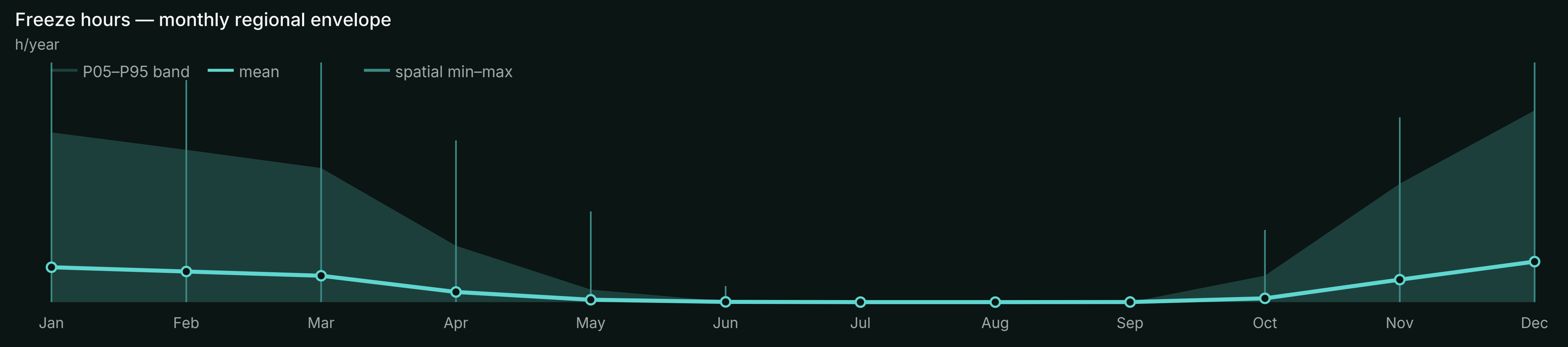
Near-condensation hours - regional P05-P95 spread with mean by month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (h/year)	155.0	74.0	108.0	66.8	58.8	25.9	19.4	22.9	30.0	46.9	84.1	142.3
P05 (h/year)	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
P95 (h/year)	345.8	214.0	272.0	198.4	200.8	133.4	145.2	153.0	148.8	182.4	241.8	350.0

Monthly Thermodynamic Envelope

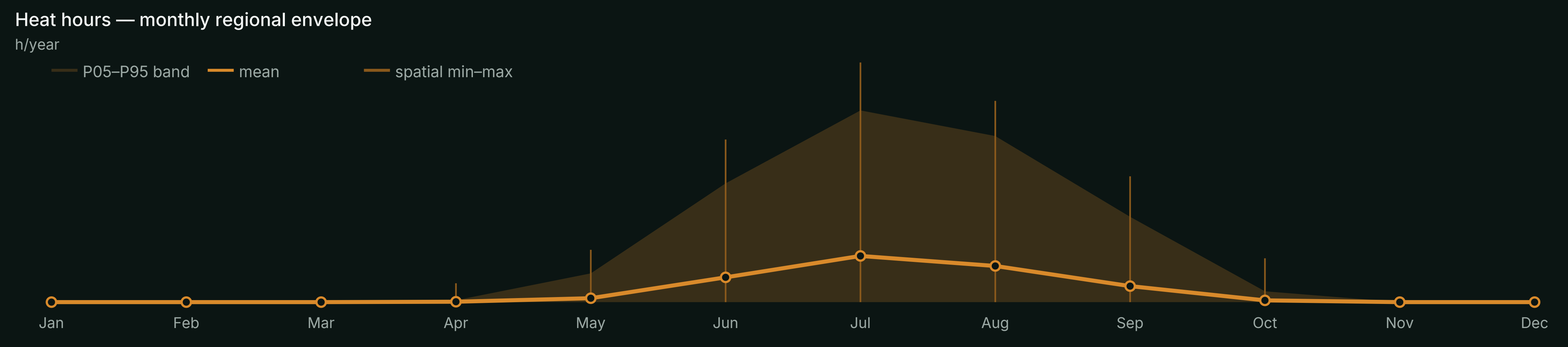
Freeze hours - regional P05-P95 spread with mean by month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (h/year)	90.8	79.7	68.7	26.4	6.2	0.62	0.0	0.0	0.21	9.8	58.5	105.4
P05 (h/year)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P95 (h/year)	441.8	396.4	349.0	146.8	32.6	2.0	0.0	0.0	0.0	69.0	308.4	499.0

Monthly Thermodynamic Envelope

Heat hours - regional P05-P95 spread with mean by month

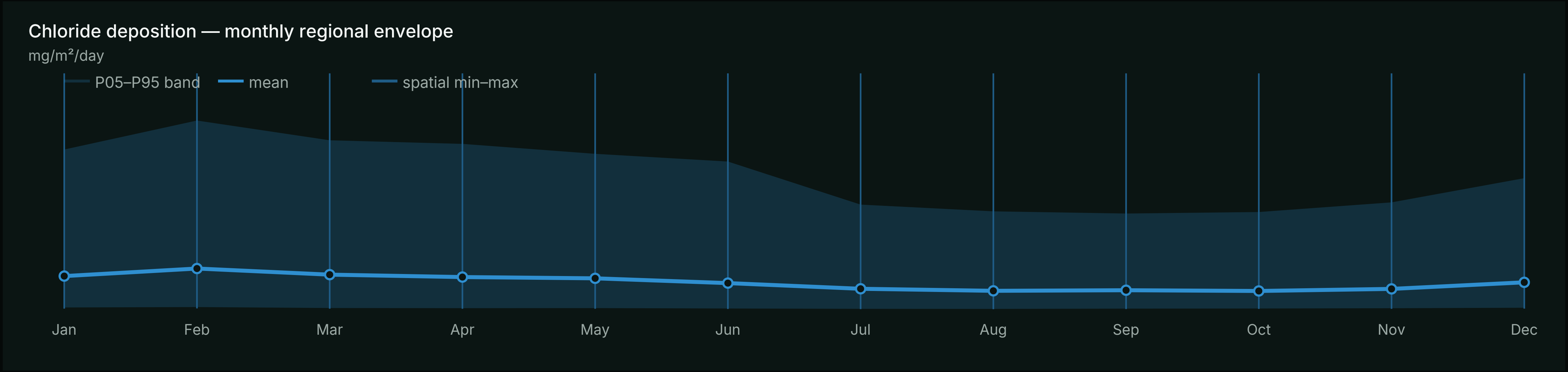


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (h/year)	0.0	0.0	0.0	0.84	8.3	52.6	98.0	76.7	34.0	3.7	0.002	0.0
P05 (h/year)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P95 (h/year)	0.0	0.0	0.0	4.0	61.0	252.0	406.8	352.4	181.0	23.0	0.0	0.0

08.11

Monthly Atmospheric Envelope

Chloride deposition - regional P05-P95 spread with mean by month

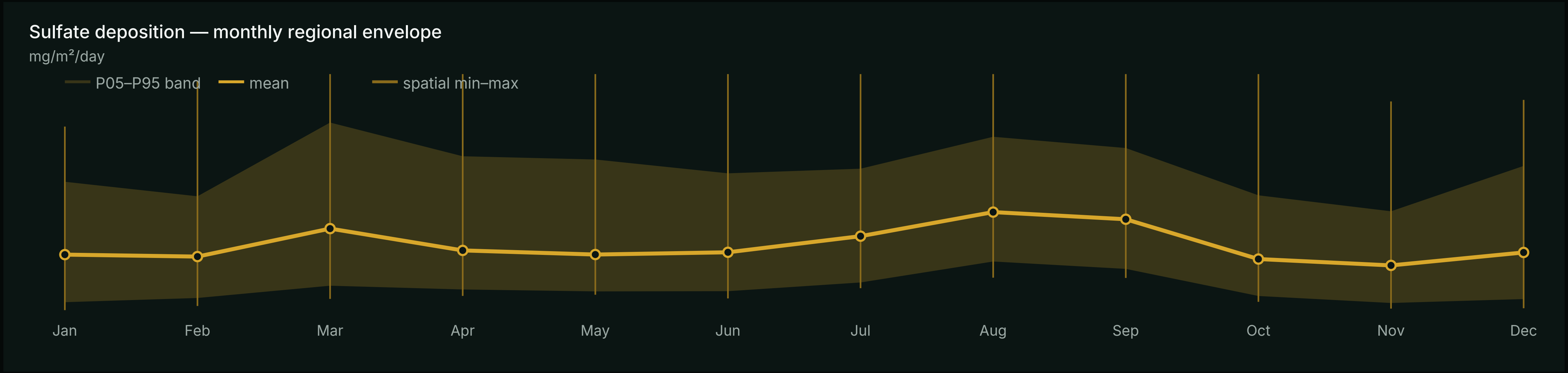


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (mg/m²/day)	4.8	5.9	5.1	4.7	4.5	3.8	3.0	2.7	2.8	2.7	3.0	3.9
P05 (mg/m²/day)	0.26	0.32	0.18	0.16	0.17	0.11	0.060	0.050	0.090	0.11	0.15	0.22
P95 (mg/m²/day)	23.3	27.6	24.7	24.2	22.7	21.6	15.3	14.3	14.0	14.2	15.6	19.1

08.12

Monthly Atmospheric Envelope

Sulfate deposition - regional P05-P95 spread with mean by month

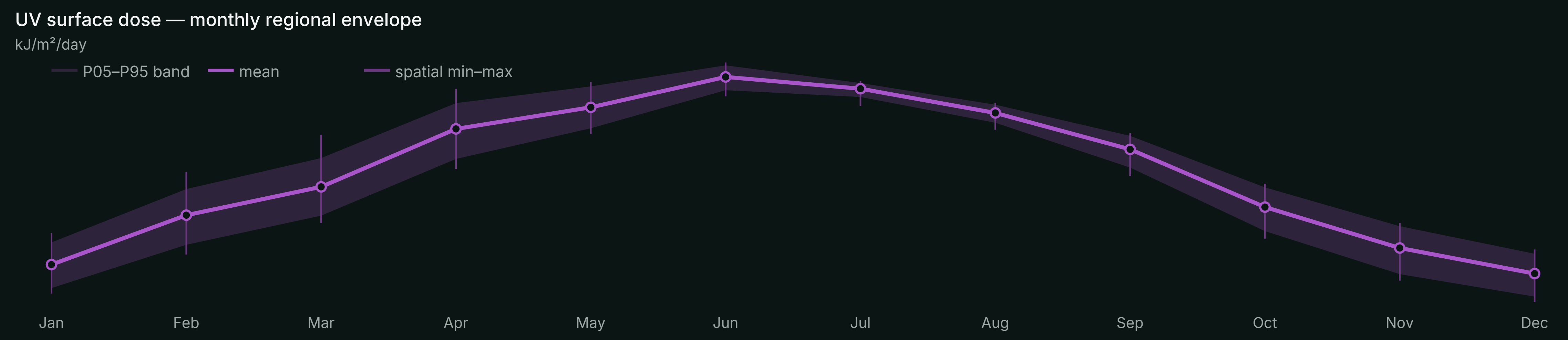


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (mg/m²/day)	1.6	1.6	2.3	1.7	1.6	1.7	2.1	2.7	2.5	1.5	1.3	1.7
P05 (mg/m²/day)	0.37	0.48	0.80	0.70	0.65	0.65	0.88	1.4	1.2	0.53	0.35	0.45
P95 (mg/m²/day)	3.5	3.1	5.0	4.2	4.1	3.7	3.8	4.7	4.4	3.1	2.7	3.9

08.13

Monthly Atmospheric Envelope

UV surface dose - regional P05-P95 spread with mean by month

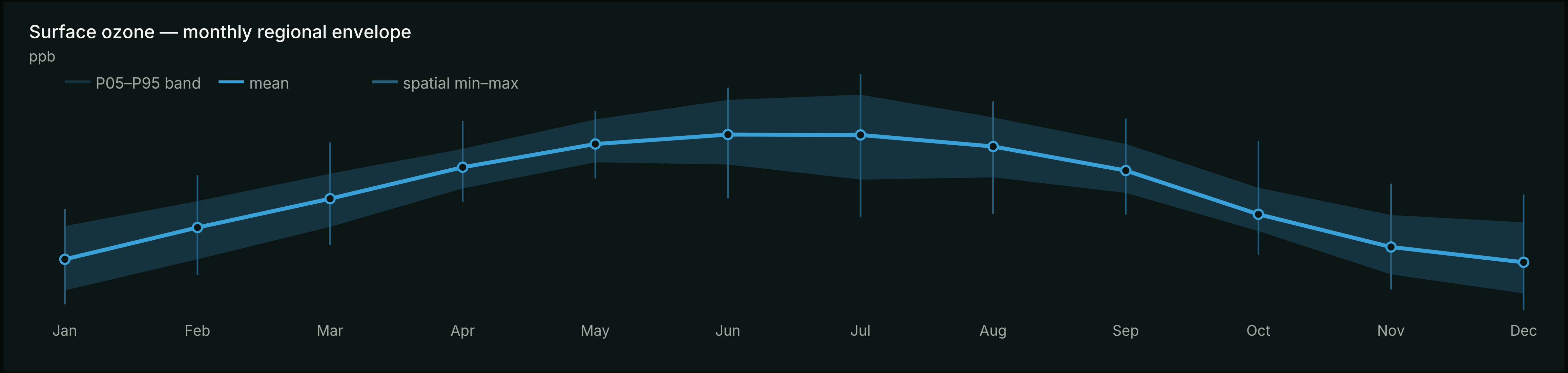


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (kJ/m²/day)	33.7	54.3	66.1	90.2	99.2	111.9	107.0	96.9	81.7	57.7	40.6	30.0
P05 (kJ/m²/day)	23.9	42.0	54.1	77.7	90.5	106.3	103.5	92.8	74.1	47.7	29.7	20.4
P95 (kJ/m²/day)	42.9	65.2	78.1	101.0	107.9	116.7	109.3	100.3	87.3	65.9	49.7	38.2

08.14

Monthly Atmospheric Envelope

Surface ozone - regional P05-P95 spread with mean by month

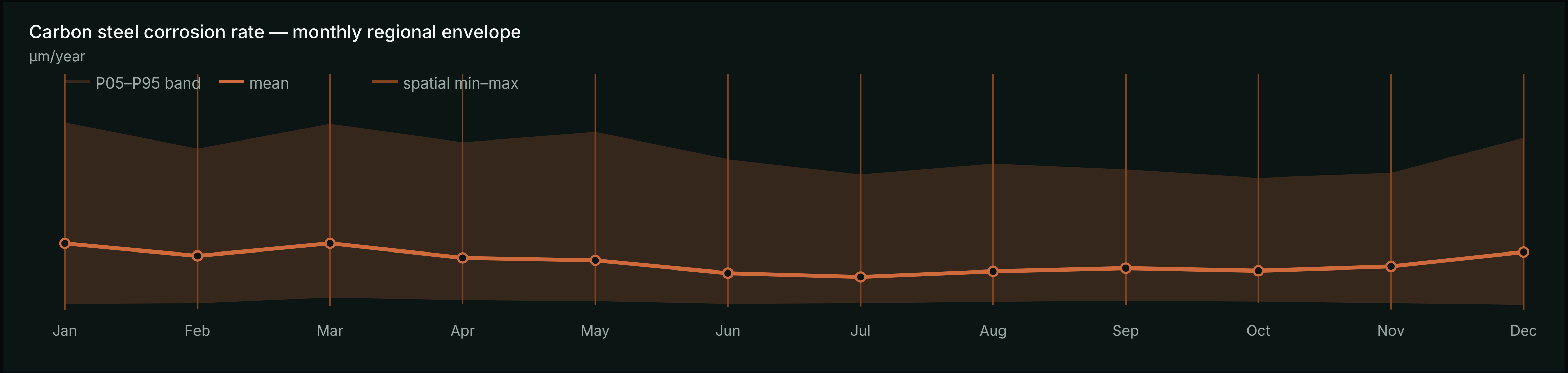


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (ppb)	21.3	27.1	32.4	38.2	42.5	44.3	44.2	42.1	37.6	29.6	23.5	20.7
P05 (ppb)	15.5	21.3	27.3	34.3	39.1	38.7	36.0	36.4	33.5	26.5	18.5	15.0
P95 (ppb)	27.4	32.0	37.1	41.6	47.1	50.6	51.6	47.4	42.5	34.5	29.4	28.1

08.15

Monthly Material Envelope

Carbon steel corrosion rate - regional P05-P95 spread with mean by month

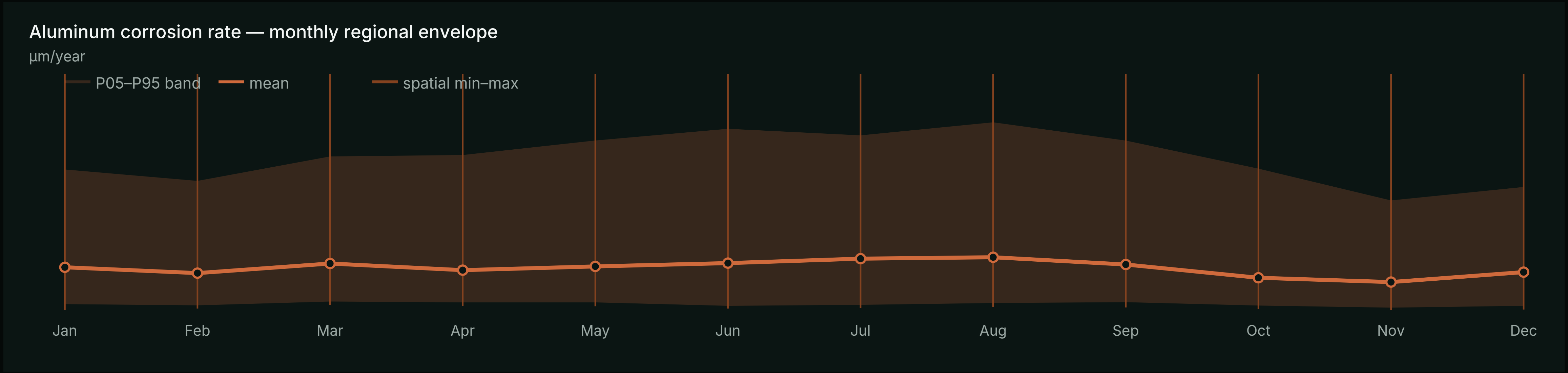


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (µm/year)	9.5	7.8	9.5	7.6	7.2	5.5	5.0	5.8	6.2	5.9	6.4	8.3
P05 (µm/year)	1.5	1.6	2.3	2.0	1.8	1.5	1.6	1.8	1.9	1.8	1.6	1.3
P95 (µm/year)	25.5	22.0	25.3	22.8	24.2	20.6	18.6	20.0	19.2	18.1	18.8	23.4

08.16

Monthly Material Envelope

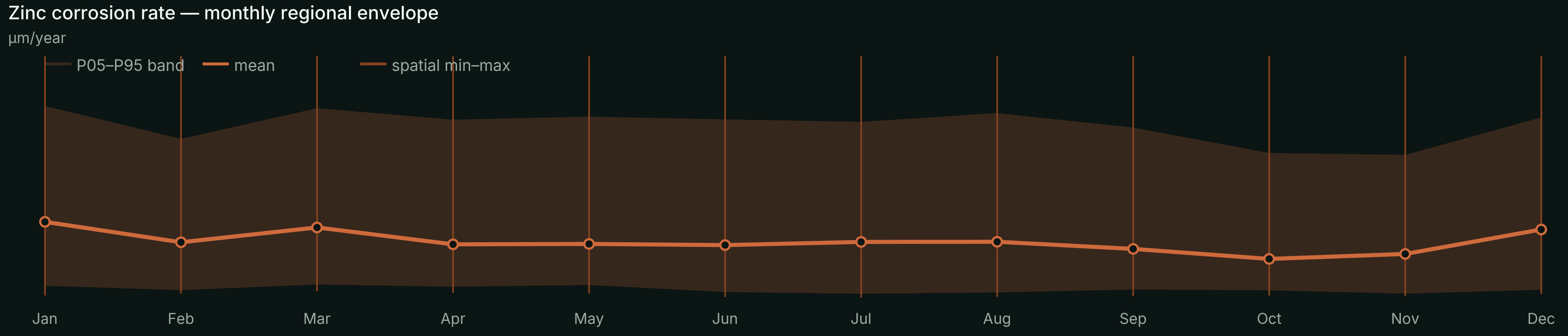
Aluminum corrosion rate - regional P05-P95 spread with mean by month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (µm/year)	0.068	0.060	0.073	0.064	0.069	0.074	0.080	0.082	0.072	0.053	0.047	0.061
P05 (µm/year)	0.016	0.014	0.019	0.018	0.018	0.013	0.015	0.017	0.018	0.014	0.011	0.013
P95 (µm/year)	0.21	0.19	0.23	0.23	0.25	0.26	0.26	0.27	0.25	0.21	0.16	0.18

Monthly Material Envelope

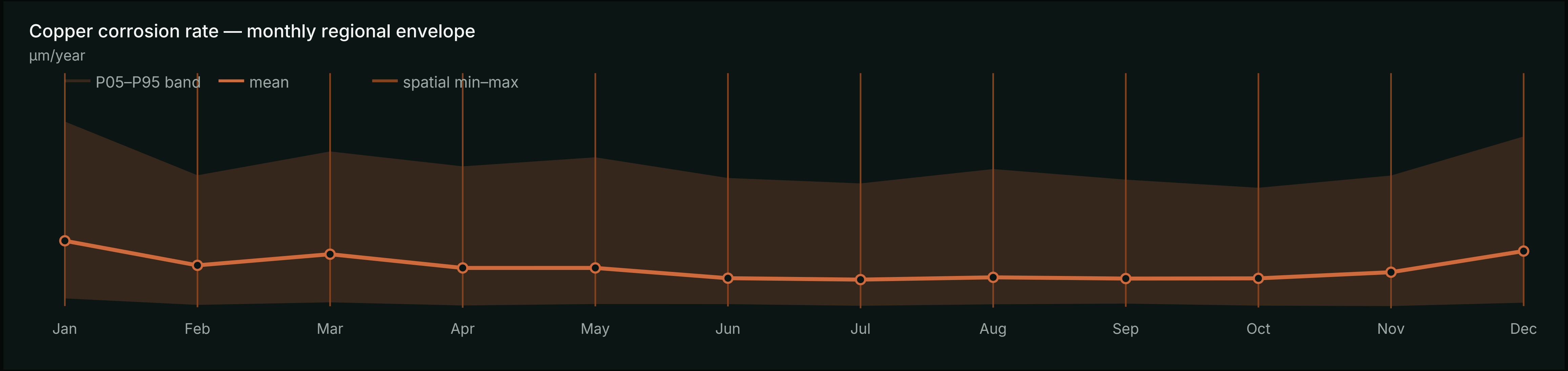
Zinc corrosion rate - regional P05-P95 spread with mean by month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (µm/year)	0.47	0.35	0.44	0.34	0.35	0.34	0.36	0.36	0.32	0.26	0.29	0.43
P05 (µm/year)	0.11	0.087	0.12	0.11	0.12	0.076	0.067	0.074	0.090	0.086	0.067	0.088
P95 (µm/year)	1.1	0.93	1.1	1.0	1.1	1.0	1.0	1.1	1.00	0.86	0.84	1.1

Monthly Material Envelope

Copper corrosion rate - regional P05-P95 spread with mean by month



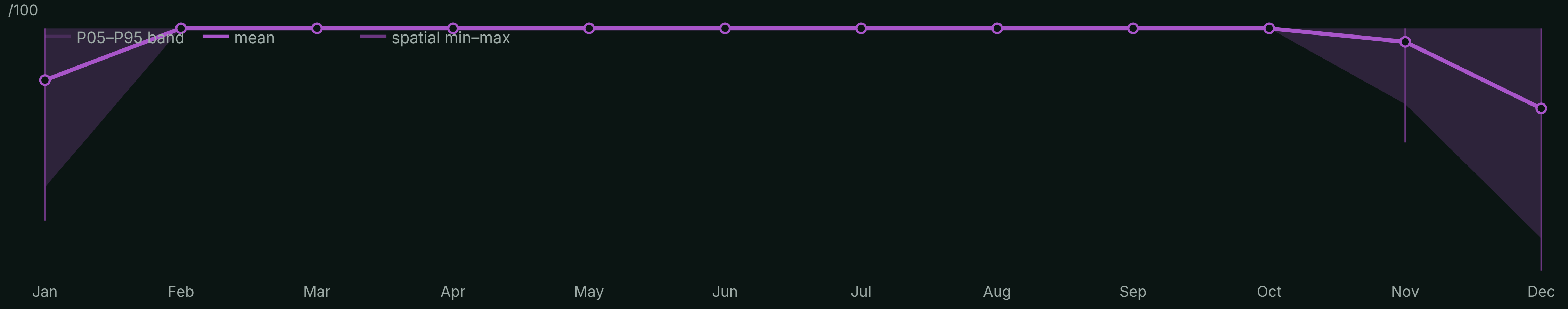
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (µm/year)	0.50	0.34	0.41	0.32	0.32	0.25	0.24	0.25	0.25	0.25	0.29	0.43
P05 (µm/year)	0.11	0.069	0.086	0.065	0.075	0.074	0.063	0.073	0.077	0.064	0.061	0.084
P95 (µm/year)	1.3	0.94	1.1	1.0	1.1	0.93	0.89	0.99	0.92	0.86	0.94	1.2

08.19

Monthly Material Envelope

UV / photo-oxidation score - regional P05-P95 spread with mean by month

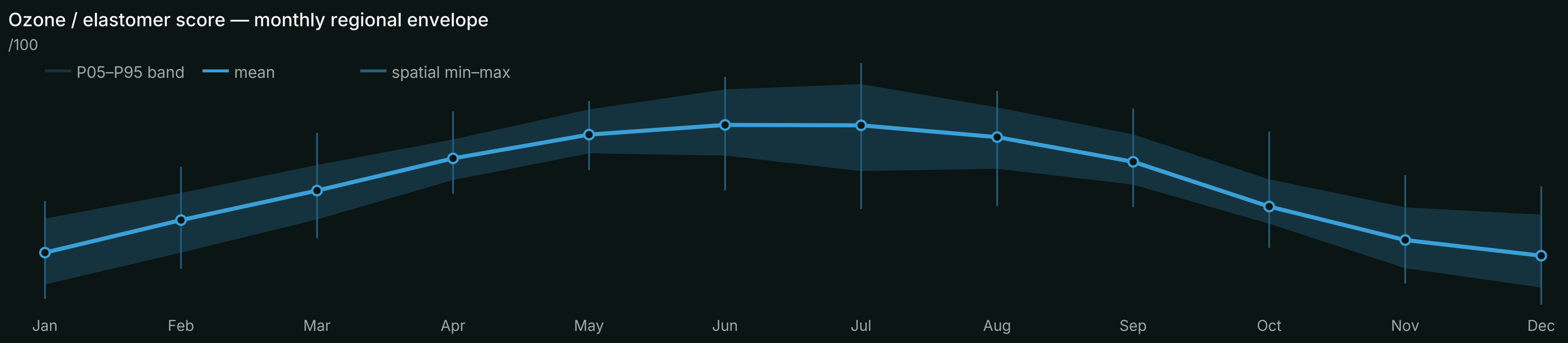
UV / photo-oxidation score — monthly regional envelope



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (/100)	89.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	97.3	84.1
P05 (/100)	68.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	84.9	58.2
P95 (/100)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Monthly Material Envelope

Ozone / elastomer score - regional P05-P95 spread with mean by month

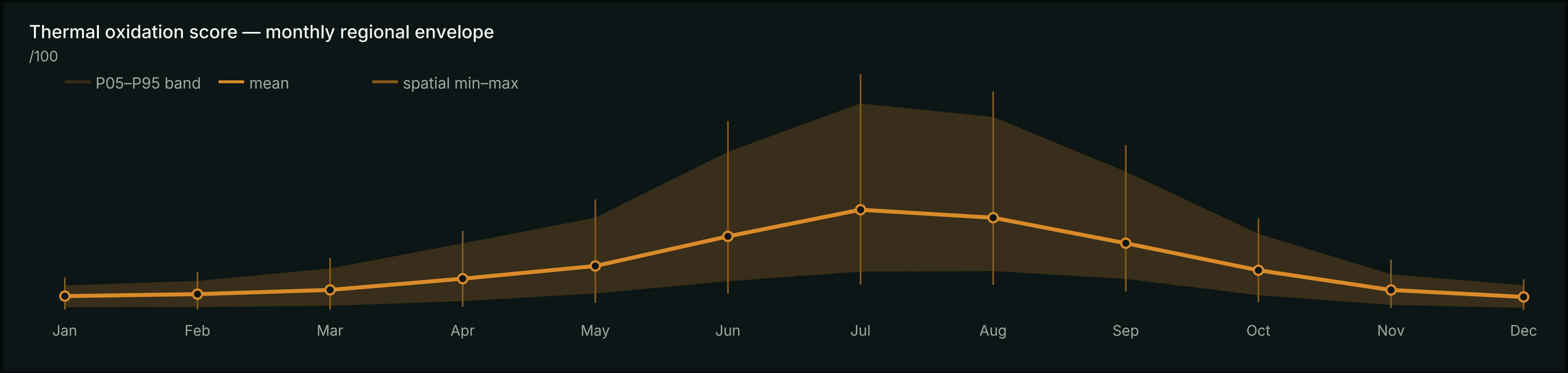


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (/100)	26.6	33.9	40.6	47.8	53.1	55.3	55.2	52.6	47.0	37.0	29.4	25.9
P05 (/100)	19.4	26.6	34.1	42.9	48.9	48.4	44.9	45.5	41.9	33.1	23.1	18.8
P95 (/100)	34.3	40.0	46.3	52.1	58.8	63.3	64.5	59.3	53.2	43.1	36.8	35.1

08.21

Monthly Material Envelope

Thermal oxidation score - regional P05-P95 spread with mean by month

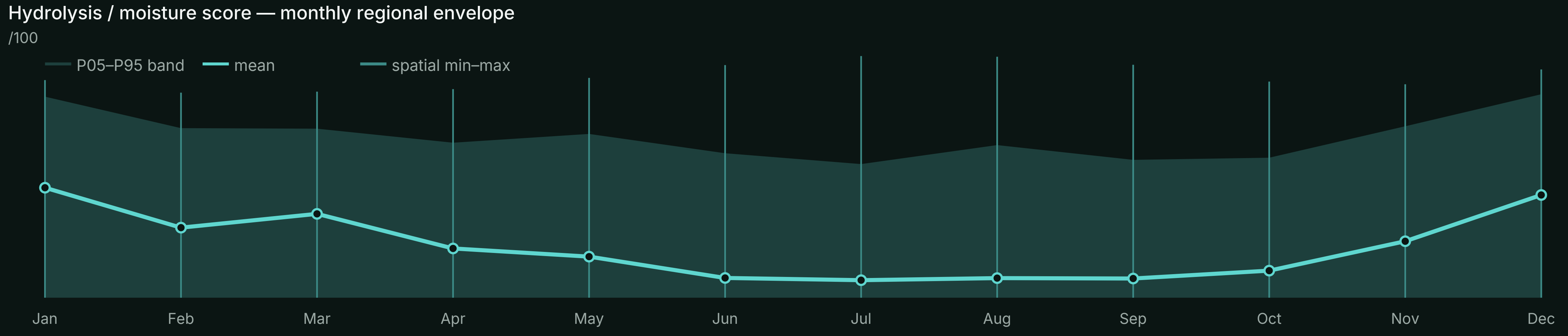


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (/100)	2.6	2.9	3.5	5.1	6.9	11.2	15.1	13.9	10.2	6.3	3.5	2.5
P05 (/100)	0.98	1.0	1.2	1.9	3.0	4.7	6.1	6.2	5.1	2.7	1.3	0.88
P95 (/100)	4.1	4.8	6.6	10.2	13.9	23.5	30.5	28.5	20.6	11.6	5.7	4.2

08.22

Monthly Material Envelope

Hydrolysis / moisture score - regional P05-P95 spread with mean by month

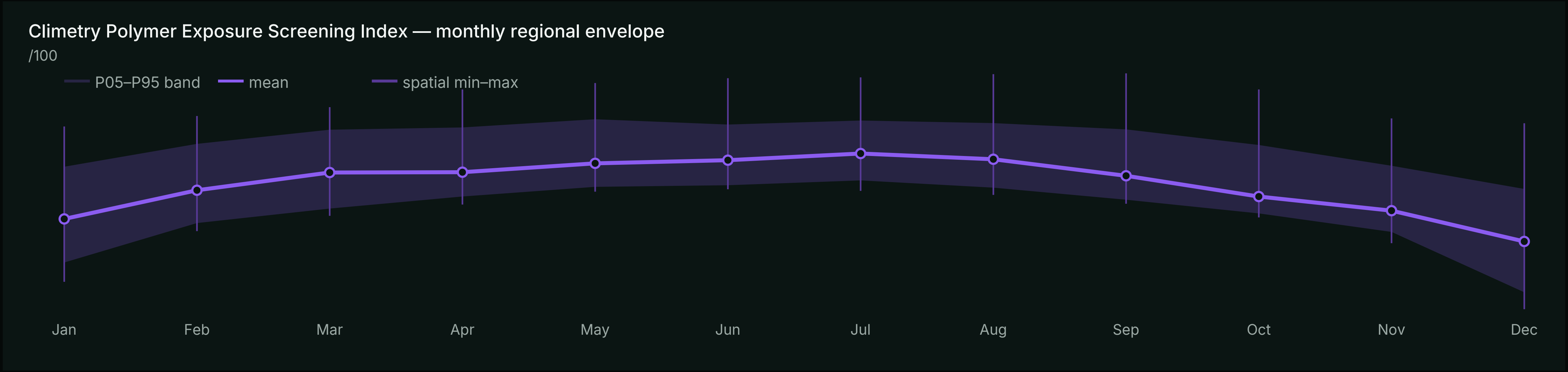


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (/100)	38.5	24.5	29.3	17.2	14.4	6.9	6.1	6.8	6.7	9.5	19.7	35.9
P05 (/100)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P95 (/100)	70.3	59.3	59.1	54.2	57.3	50.5	46.7	53.4	48.2	49.0	59.9	71.1

08.23

Monthly Material Envelope

Climetry Polymer Exposure Screening Index - regional P05-P95 spread with mean by month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (/100)	47.6	51.2	53.4	53.4	54.5	54.9	55.7	55.0	53.0	50.4	48.6	44.8
P05 (/100)	42.2	47.1	48.9	50.4	51.6	51.8	52.4	51.5	50.0	48.3	46.0	38.5
P95 (/100)	54.1	56.9	58.7	59.0	60.0	59.3	59.8	59.5	58.7	56.8	54.2	51.3

Engineering Decision Matrix

Each row fires from this region's own P95 - exposure finding, implication, screening action, verification

Exposure finding (this region)	Engineering implication	Screening action	Suggested verification
Marine chloride reaches 20.08 mg/m²/day at P95 (moderate salinity).	Persistent surface electrolyte; accelerated galvanic / crevice corrosion near coasts.	Coating or hot-dip galvanising, stainless or sealed interfaces at exposed faces; add corrosion margin.	Cyclic corrosion (ISO 9227 / ISO 16701) or salt-fog verification of the protection system.
RH ≥ 80 % for 3,934 h/year; 2,417 near-condensation h/year at P95.	Long time-of-wetness; sustained electrolyte films and moisture ingress into enclosures.	Drainage and sealing, conformal coating of electronics, ventilation / breather strategy.	Humidity + condensation testing (IEC 60068-2-30 / -2-38).
UV surface dose 73.2 kJ/m²/day (P50), near-uniform across the region (P95/P50 < 1.15).	Photo-oxidative chain scission and embrittlement of polymers, coatings and elastomers. Siting offers little mitigation.	UV-stabilised polymer grades, pigment / HALS additives, physical shielding of exposed parts.	Accelerated UV ageing (ISO 4892-2 / ASTM G154).
Surface ozone 36.4 ppb at P95.	Ozone cracking of strained ozone-sensitive elastomers (natural rubber, SBR, NBR).	Ozone-resistant elastomer chemistry (EPDM, CR) or antiozonant protection; limit static strain.	Ozone exposure test (ISO 1431-1).
1,275 h/year ≥ 35 °C at P95.	Thermal-oxidative ageing of polymers and elastomers; softening, outgassing, property drift.	Material temperature capability with margin, heat shielding, ventilation of hot pockets.	Thermal / heat-ageing test at the design service temperature.

Actions are screening recommendations for design review and qualification planning, not a final product release. Map every material selection and test severity to the applicable product-specific standard.

09.2

Typical vs Conservative Location

What changes from a P50 (typical) to a P95 (conservative) location within the region

Metric	P50 (typical)	P95 (conservative)	Difference	Factor	What it means
Carbon steel corrosion rate	5.8 µm/year	22.0 µm/year	16.2 µm/year	×3.8	A conservative sub-area sees roughly 3.8× the first-year steel corrosion of a typical one
Chloride deposition	0.88 mg/m²/day	20.08 mg/m²/day	19.20 mg/m²/day	×22.8	A conservative sub-area sees roughly 22.8× the marine chloride load of a typical one
RH80 exposure	1413 h/year	3934 h/year	2521 h/year	×2.8	A conservative sub-area sees roughly 2.8× the time of wetness (RH ≥ 80 %) of a typical one
Climetry Polymer Exposure Screening Index	51 /100	58 /100	6 /100	×1.1	Polymer-ageing exposure barely changes across the region - not a siting lever

The 'factor' column is the ratio P95 / P50 - it shows how much more exposure a conservative sub-area of the region carries than a typical one. For metrics with a factor near 1, location inside the region is not a meaningful design lever; for large factors, a fixed deployment coordinate should be confirmed with a Point Analysis.

Regional Recommendations

Screening guidance for siting and comparative design review

Recommendations

1. Use this region's P95 figures, not the mean, as the conservative screening basis for a new site whose exact location within the region is not yet fixed. These are screening recommendations, not a product release.

2. Spatially variable in this region (P95/P50 ≥ 1.15): chloride deposition, carbon steel corrosion rate, rh80 exposure, near-condensation hours. For a fixed deployment coordinate, confirm these with a Point Analysis before locking material or qualification decisions.

3. Effectively uniform across this region (P95/P50 < 1.15): uv surface dose, surface ozone, climetry polymer exposure screening index. Location offers little mitigation for these - the material and protection system are the effective design levers.

4. Carbon steel first-year corrosion runs from ~5.8 µm/year (P50) to ~22.0 µm/year (P95) - the conservative sub-areas warrant enhanced corrosion protection by default. Do not linearly extrapolate a first-year rate over service life.

5. Map final test severities and material selections to the applicable product qualification standard.

HOW TO READ THIS RESULT

A metric's P95 means the value is not exceeded at approximately 95% of analyzed California locations. This describes spatial coverage across the analysis grid, not failure probability, not a lifetime prediction, and not a certified ISO site classification.

PART A

A APPENDIX

Coverage, sources, traceability and complete regional metric values.

Appendix - Coverage and Sources

Where this regional dataset comes from and what it excludes

Analysis mode	Regional Climate Envelope
Coverage	Full regional analysis grid
Analyzed locations	673
Grid resolution	0.25°
Boundary source	Natural Earth 1:50m admin_1_states_provinces
Model status	Validated engineering screening model
Analysis snapshot	2026-09-08
Report generated	2026-09-08
Report revision	Regional Envelope v1.3
Model & data revision	CEY10 2015–2024 · NA chloride v2.4
PDF design system	PDF Design System v1.2

Climate model	CEY10 2015–2024
Chloride model	Climetry North America Chloride v2.4
Sulfate model	MERRA-2
UV / ozone model	ERA5 UV surface dose · CAMS EAC4 surface ozone
Locations with a metric legitimately absent	none

Appendix - Data-Layer Provenance

Source -> Resolution -> Period -> Transformation -> Validation -> Limitation, per data layer

CEY10 climate (temperature, humidity, dew point, hour counts)

Source	ERA5-Land hourly reanalysis
Resolution	~9 km, hourly
Period	2015-2024
Transformation	Representative-year selection per calendar month; hourly distribution preserved, not just monthly means
Validation	7,053 independent weather stations, 338,544 station-month comparisons (scientific-validation page)
Limitation	Grid-cell values, not point values; residual ~1 °C scatter is grid-vs-point elevation

Marine chloride deposition

Source	Climetry finite-volume marine transport model over ERA5 wind + ESA WorldCover + terrain
Resolution	high-resolution receptor grid
Period	monthly climatology
Transformation	Whitecap sea-salt source, advection-deposition, terrain and land-cover scavenging; day-weighted annual mean
Validation	Region-specific station comparison (see the Atmosphere methodology page: e.g. NA v2.4 n=237, rho=0.81)
Limitation	Engineering screening field, not a validated ISO 9225 wet-candle measurement; magnitude less constrained than rank

Appendix - Data-Layer Provenance

Source -> Resolution -> Period -> Transformation -> Validation -> Limitation, per data layer

Sulfate deposition (SO2-equivalent)

Source	MERRA-2 sulfate wet + dry deposition
Resolution	0.5 deg x 0.625 deg
Period	2020-2024
Transformation	ISO-derived SO2-equivalent screening proxy for the ISO 9223 dose-response
Validation	No independent Climetry station validation
Limitation	Not a certified or measured SO2 value; where MERRA-2 has no coverage a 5 mg/m²/day background is used and flagged

UV surface dose

Source	ERA5 downward UV at surface
Resolution	~31 km, monthly
Period	ERA5 climatology
Transformation	Monthly mean daily dose; input to the UV / photo-oxidation score
Validation	No independent Climetry station validation
Limitation	Clear-sky vs all-sky and local shading not resolved; treat as a regional screening dose

A.2.3

Appendix - Data-Layer Provenance

Source -> Resolution -> Period -> Transformation -> Validation -> Limitation, per data layer

Surface ozone

Source	CAMS EAC4 reanalysis surface ozone
Resolution	~80 km, monthly
Period	CAMS climatology
Transformation	Monthly mean concentration; input to the ozone / elastomer score
Validation	No independent Climetry station validation
Limitation	Coarse resolution; urban / roadside gradients not resolved

Appendix - Score Methodology

How the Corrosion Exposure Score and Climetry Polymer Exposure Screening Index are built - no black box

Corrosion Exposure Score (0-100)

Inputs - the first-year corrosion rate for carbon steel and for aluminium, each from the ISO 9223 Annex A dose-response (chloride + sulfate + temperature + RH; see the corrosion-rate appendix).

Normalisation - each rate is divided by a 'severe' engineering reference and capped at 100:

```
score = min(100, rate / severe_ref x 100)
```

severe_ref = 80 µm/year for carbon steel, 5 µm/year for aluminium (the same references Point Analysis uses).

Combination - the score is the worse of the steel and aluminium scores.

What 0-100 means

The score is the percentage of the severe screening reference reached; 100 means the modelled first-year rate is at or beyond that reference. It is a comparison and ranking number.

It is not a failure probability, a service-life estimate, or a certified ISO 9223 corrosivity class - the C1-C5 class is reported separately, per metal.

How every 0-100 score in this report is built

Both screening scores follow the same convention: an exposure value is divided by a documented 'severe' reference and capped at 100 - `min(100, value / severe_ref x 100)`.

Monthly, then averaged. Each channel / rate score is computed per calendar month from that month's mean input, and the annual score is the mean of the twelve monthly scores. This is not the same as scoring the annual-mean input: once a month crosses the reference, min(100, ...) clips it and the two results diverge.

What a 0-100 score means

The fraction of the severe screening reference reached, for location comparison and ranking. It is not a failure probability, a service-life estimate, a certified ISO 9223 corrosivity class, or a certified polymer classification.

Appendix - Climetry Polymer Exposure Screening Index

The four channels, their weights and severe references, and what the index is not

Climetry Polymer Exposure Screening Index (0-100) - v0.2

A weighted mean of four channels, each a 0-100 score against a severe reference (per the scoring convention on the previous page - monthly, then annual-averaged):

Channel	Weight	Severe reference	Input
UV / photo-oxidation	40 %	35 kJ/m²/day surface dose	ERA5 monthly mean daily UV dose
Ozone / elastomer	20 %	80 ppb (x mild Arrhenius temp. factor)	CAMS monthly surface ozone
Thermal oxidation	25 %	8x Arrhenius acceleration (Ea 65 kJ/mol, ref 25 °C)	CEY temperature
Hydrolysis / moisture	15 %	RH 95 % and 20 % of hours condensing (0.65 / 0.35 blend)	CEY RH + condensation

Combination - weighted mean of the available annual channel scores; a missing channel is dropped from the denominator and the remaining weights renormalised.

UV reference caveat. 35 kJ/m²/day is low relative to real sunny mid-latitude land, so the UV channel is saturated (= 100) for most of the year in such regions. California's annual UV dose is ~64-80 kJ/m²/day (P05-P95), over twice the reference; its annual UV score (~93-100) is set almost entirely by a few winter months dipping below 35, not by a graded response.

WHAT THIS INDEX IS - AND IS NOT

A comparative screening index for location ranking and qualification planning. It is NOT a lifetime model, NOT a material-specific ageing law, and NOT a certified polymer classification. The weights and every severe reference above are v0.2 screening placeholders - not calibrated against measured polymer service data - and are stated in full precisely so the index is auditable, not a black box.

A.4.1

Appendix - Annual Regional Summary

Every metric's annual Mean / P05 / P50 / P95

CLIMETRY

Metric	Unit	n	Mean	P05	P50	P95
Mean temperature	C	673	15.5	7.7	16.2	23.3
Relative humidity	%	673	50.6	26.3	53.4	73.8
RH80 hours	h/year	673	1539	96.0	1413	3934
RH90 hours	h/year	673	546.6	7.0	380.0	1706
Near-condensation hours	h/year	673	834.2	20.0	655.0	2417
Freeze hours	h/year	673	446.2	0.0	27.0	2150
Heat hours	h/year	673	274.0	0.0	38.0	1275
Chloride deposition	mg/m2/day	673	3.9	0.19	0.88	20.1
Sulfate deposition	mg/m2/day	673	1.9	0.87	1.6	3.4
UV surface dose	kJ/m2/day	673	72.4	63.9	73.2	79.7
Surface ozone	ppb	673	33.6	30.2	33.8	36.4
Moisture / condensation indicator	/100	673	27.0	0.65	21.4	78.8
Thermal exposure indicator	/100	673	20.2	0.0	2.9	97.0
Steel corrosion rate	um/year	673	7.7	2.2	5.8	22.0

A.4.2

Appendix - Annual Regional Summary

Every metric's annual Mean / P05 / P50 / P95

Metric	Unit	n	Mean	P05	P50	P95
Aluminum corrosion rate	um/year	673	0.065	0.020	0.040	0.23
Zinc corrosion rate	um/year	673	0.33	0.12	0.23	1.0
Copper corrosion rate	um/year	673	0.32	0.079	0.21	0.98
Corrosion exposure score	/100	673	9.6	2.8	7.2	27.5
UV / photo-oxidation score	/100	673	97.6	92.6	98.7	100.0
Ozone / elastomer score	/100	673	42.0	37.7	42.3	45.5
Thermal oxidation score	/100	673	5.7	2.5	5.6	10.8
Hydrolysis / moisture score	/100	673	24.0	0.40	17.9	69.3
Climetry Polymer Exposure Screening Index	/100	673	52.5	49.7	51.4	57.9

Appendix — Monthly Thermodynamics

Complete monthly regional statistics

Monthly Thermodynamics

Monthly P05–P95 values describe spatial variation across the analyzed regional grid for each calendar month. They do not represent uncertainty, failure probability or temporal variability at a single site.

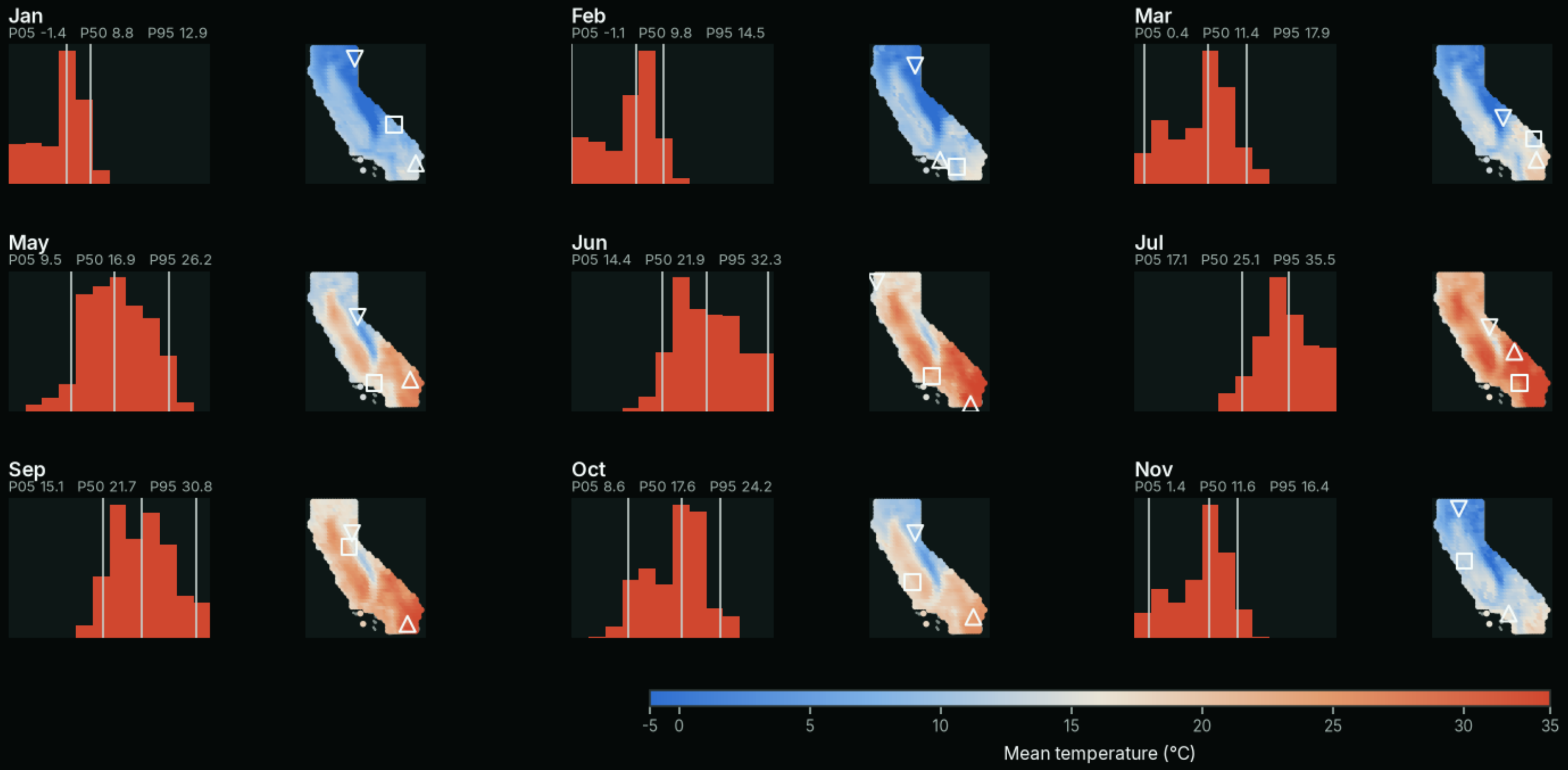
How to read this

Each following page gives the full Jan–December Mean / P05 / P50 / P95 for one metric, computed across every analyzed gridpoint for that month, with the same envelope chart grammar used in the main report.

Metric	Monthly breakdown
Mean temperature	Included on the following page(s)
Relative humidity	Included on the following page(s)
Dew point	Included on the following page(s)
Dew-point depression	Included on the following page(s)
Absolute humidity	Included on the following page(s)
RH80 exposure	Included on the following page(s)
RH90 exposure	Included on the following page(s)
Near-condensation hours	Included on the following page(s)
Freeze hours	Included on the following page(s)
Heat hours	Included on the following page(s)

Mean temperature — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · °C

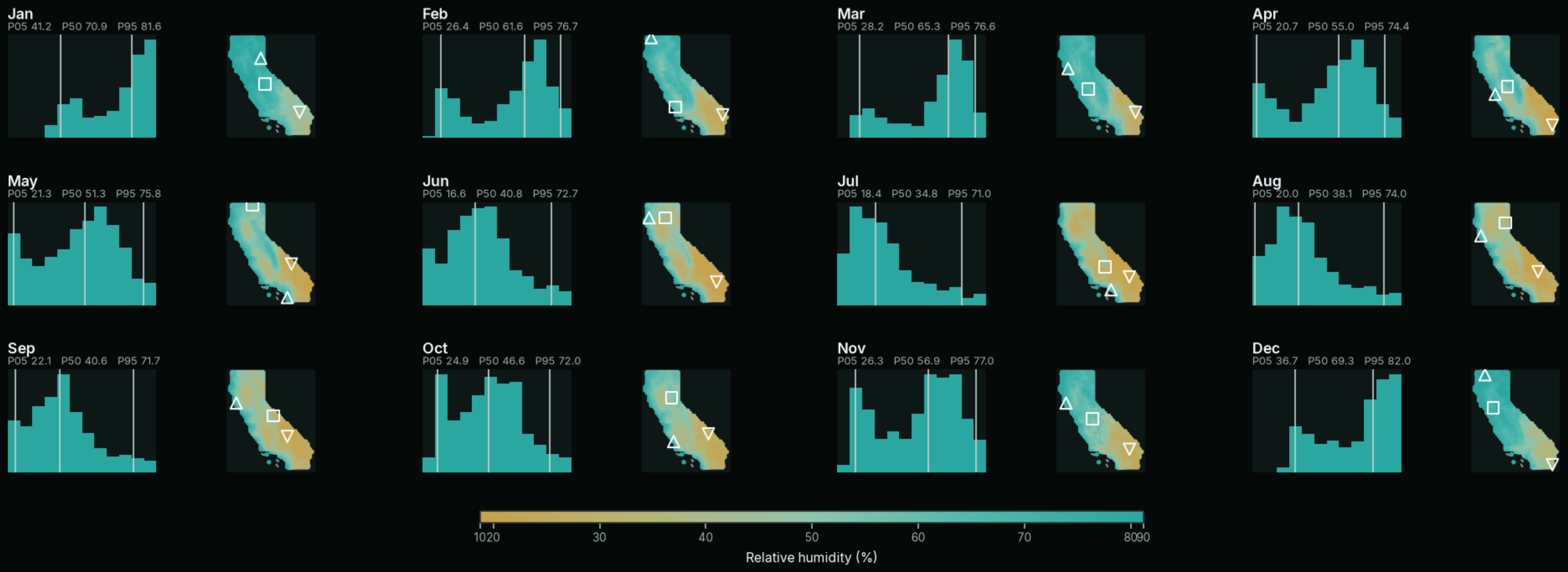


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.5.2

Relative humidity — monthly

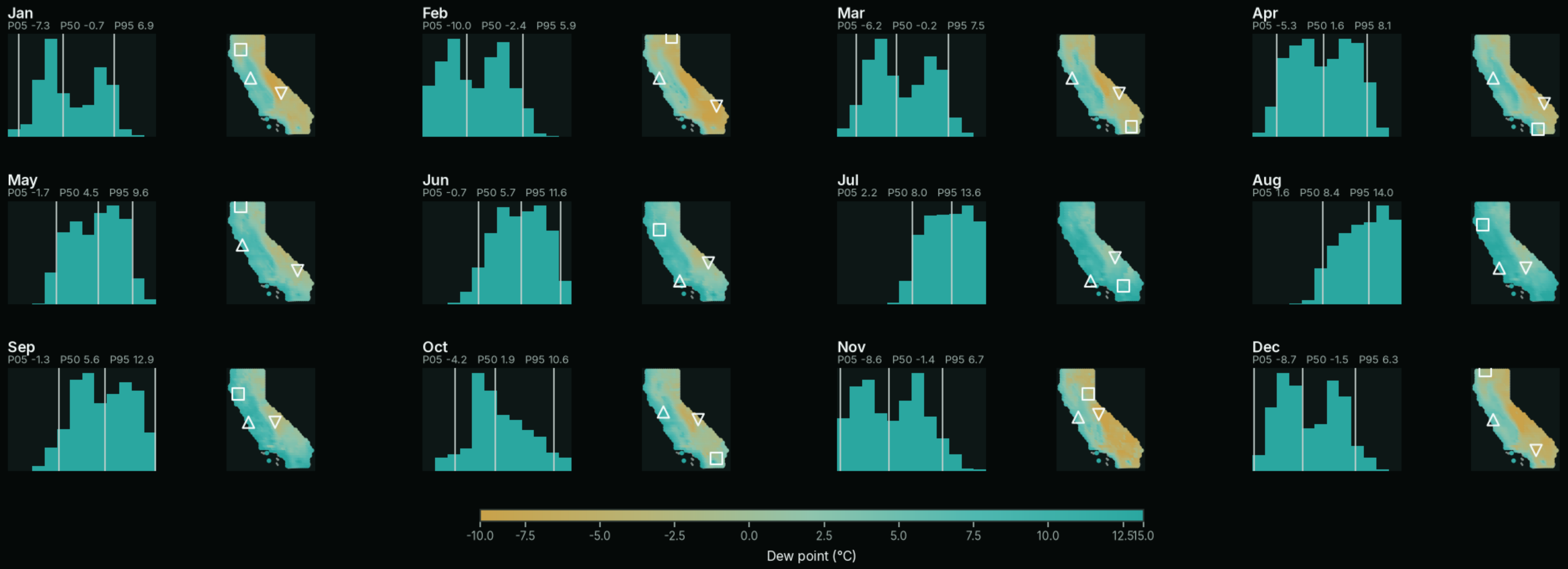
Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · %



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Dew point — monthly

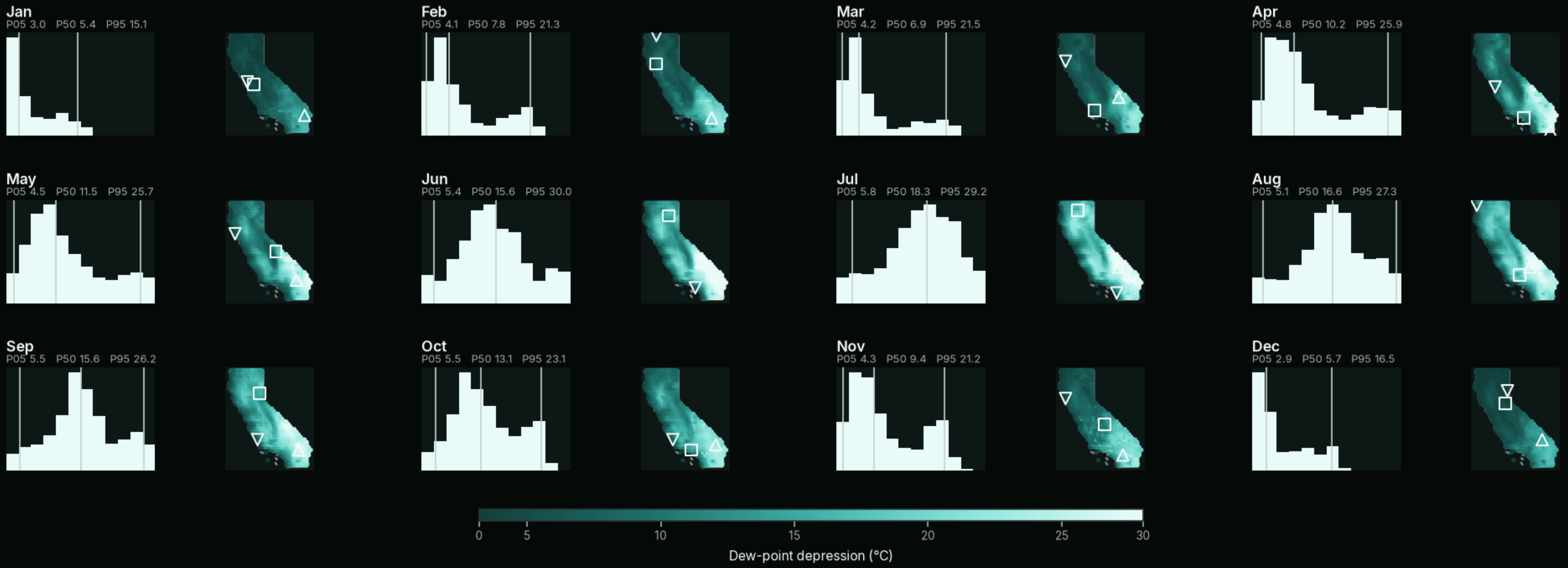
Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · °C



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Dew-point depression — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · °C



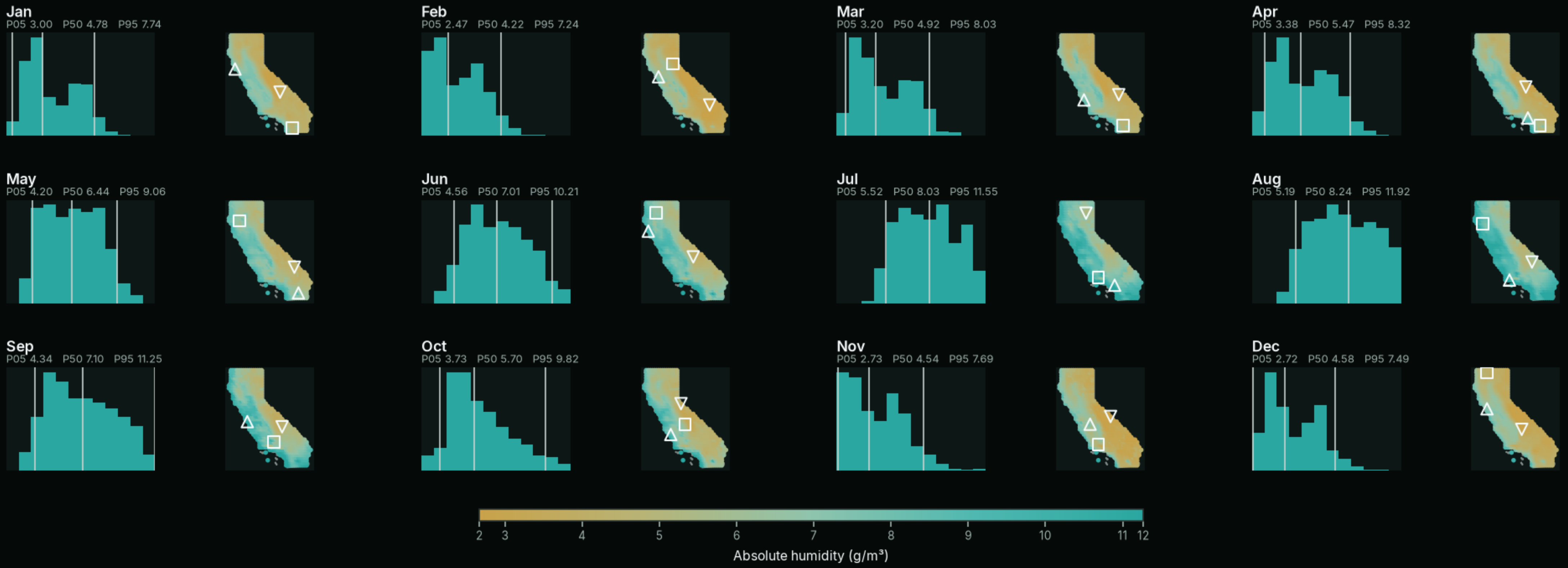
Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.5.5

Absolute humidity — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · g/m³

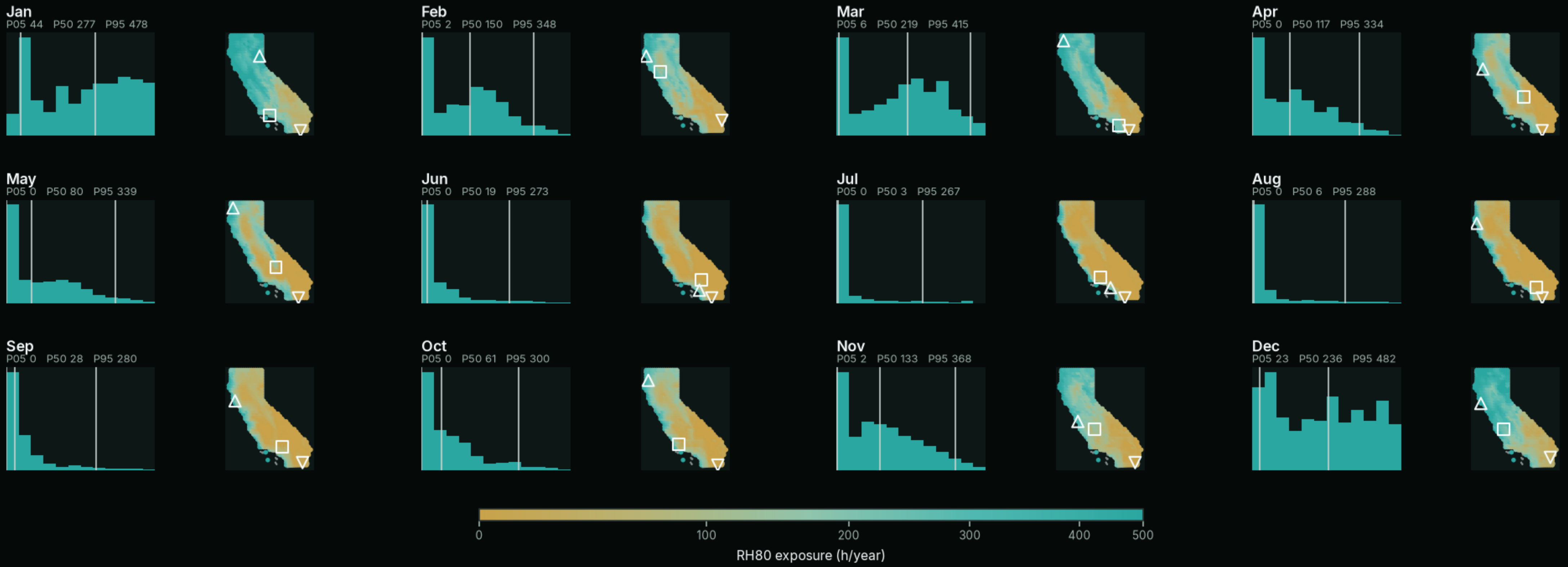
CLIMETRY



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

RH80 exposure — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · h/month

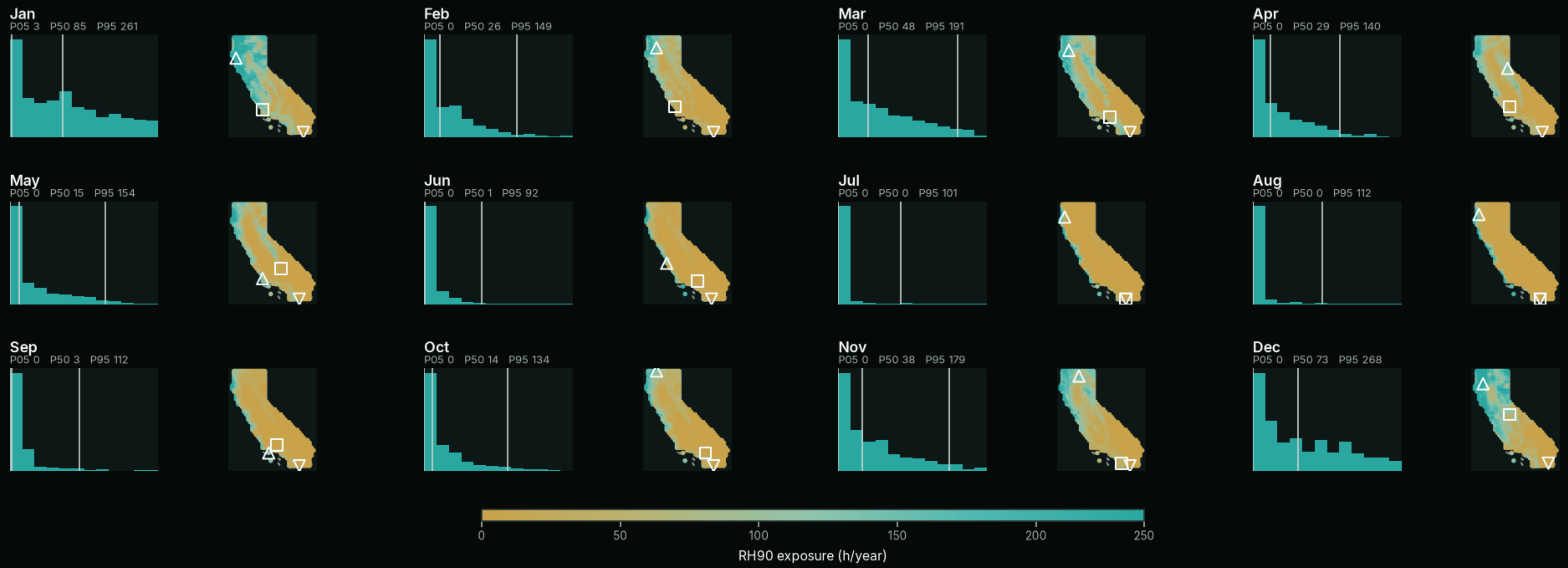


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.5.7

RH90 exposure — monthly

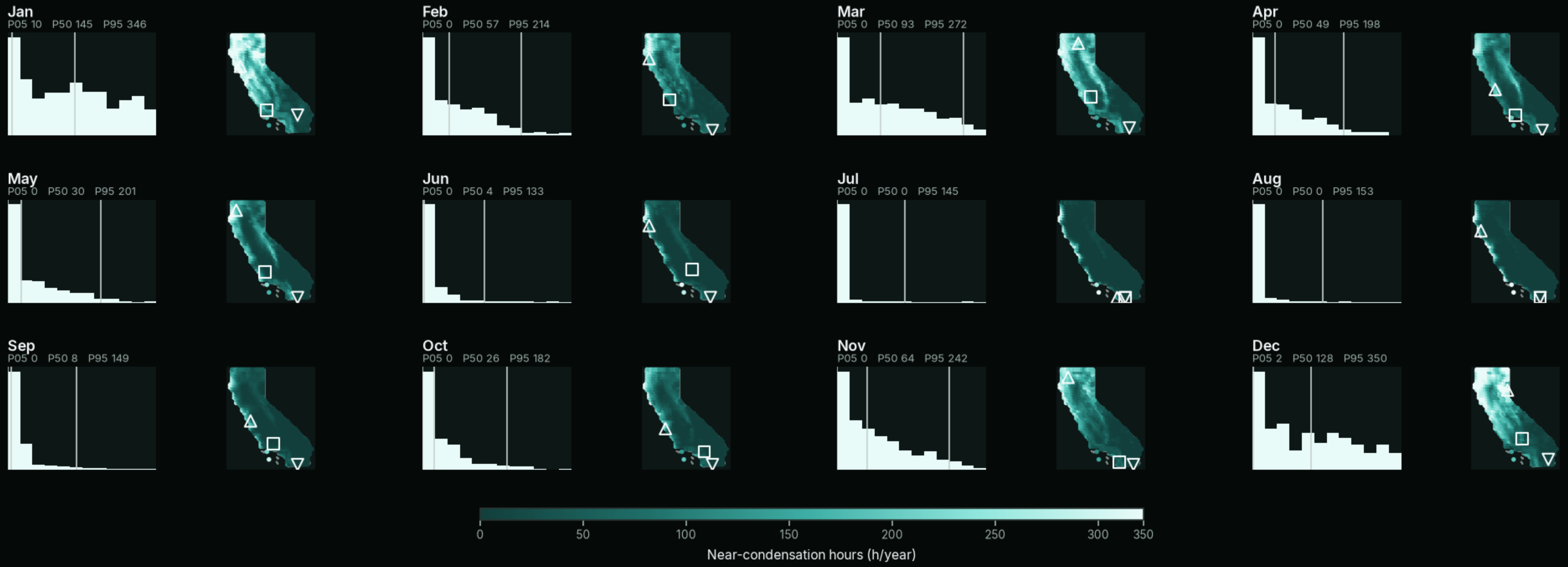
Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · h/month



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Near-condensation hours — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · h/month

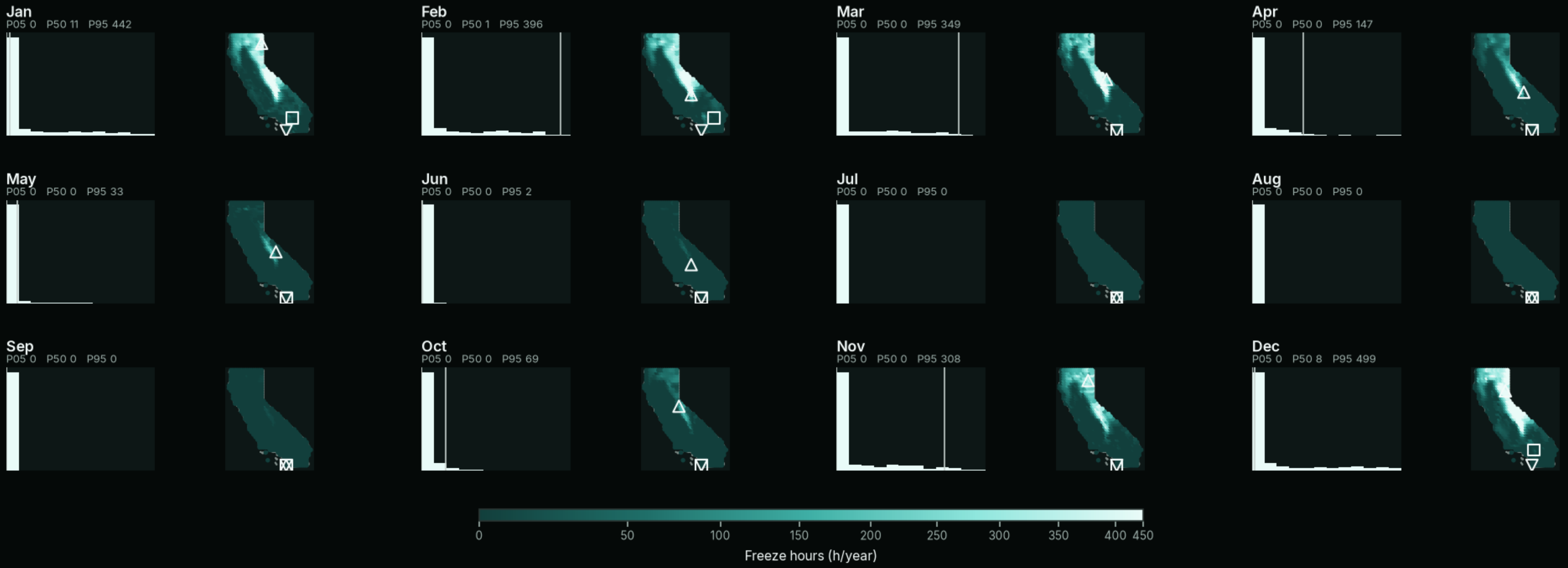


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.5.9

Freeze hours — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · h/month



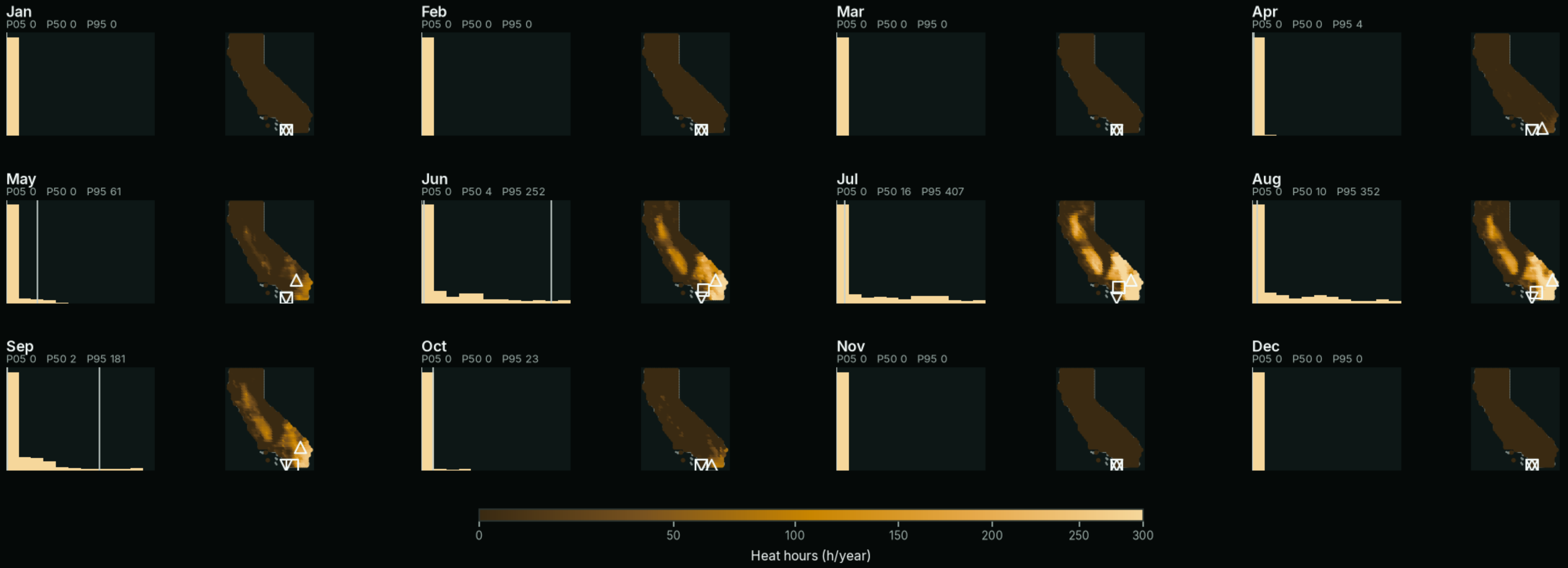
Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.5.10

Heat hours — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · h/month

CLIMETRY



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.6

Appendix — Monthly Atmosphere

Complete monthly regional statistics

Monthly Atmosphere

See the first monthly appendix section for the meaning of monthly P05–P95.

How to read this

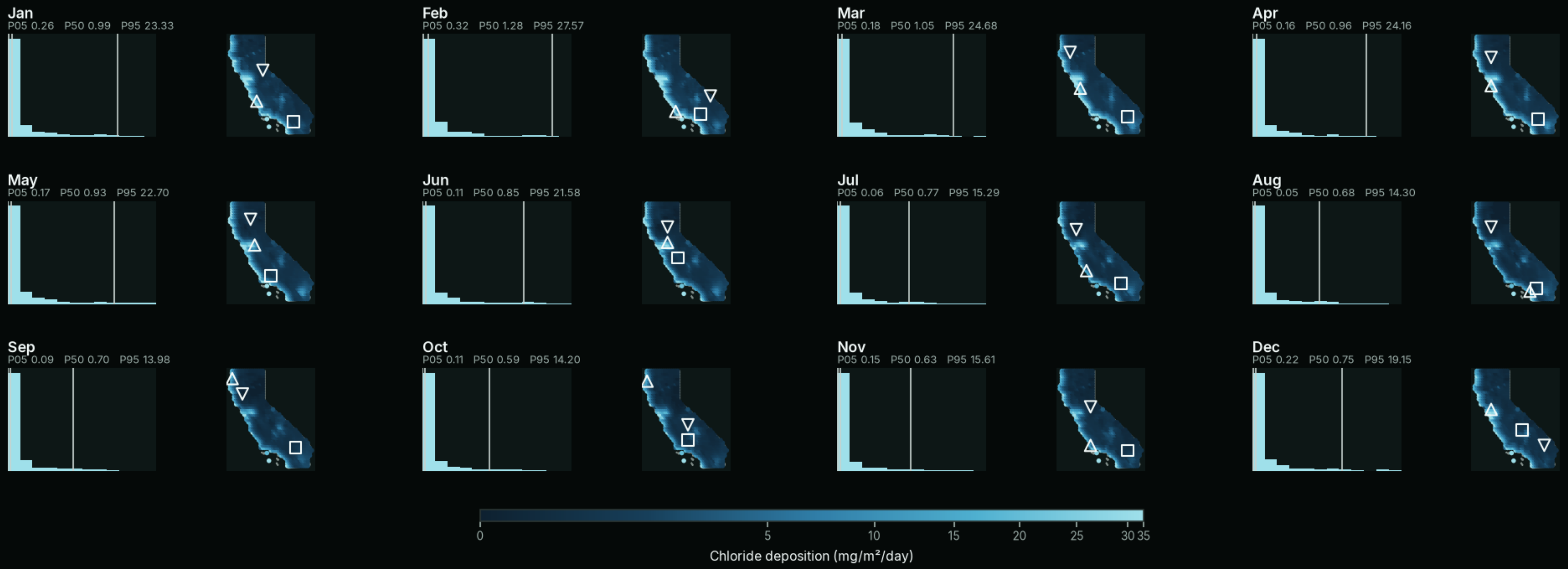
Each following page gives the full Jan–December Mean / P05 / P50 / P95 for one metric, computed across every analyzed gridpoint for that month, with the same envelope chart grammar used in the main report.

Metric	Monthly breakdown
Chloride deposition	Included on the following page(s)
Sulfate deposition	Included on the following page(s)
UV surface dose	Included on the following page(s)
Surface ozone	Included on the following page(s)

A.6.1

Chloride deposition — monthly

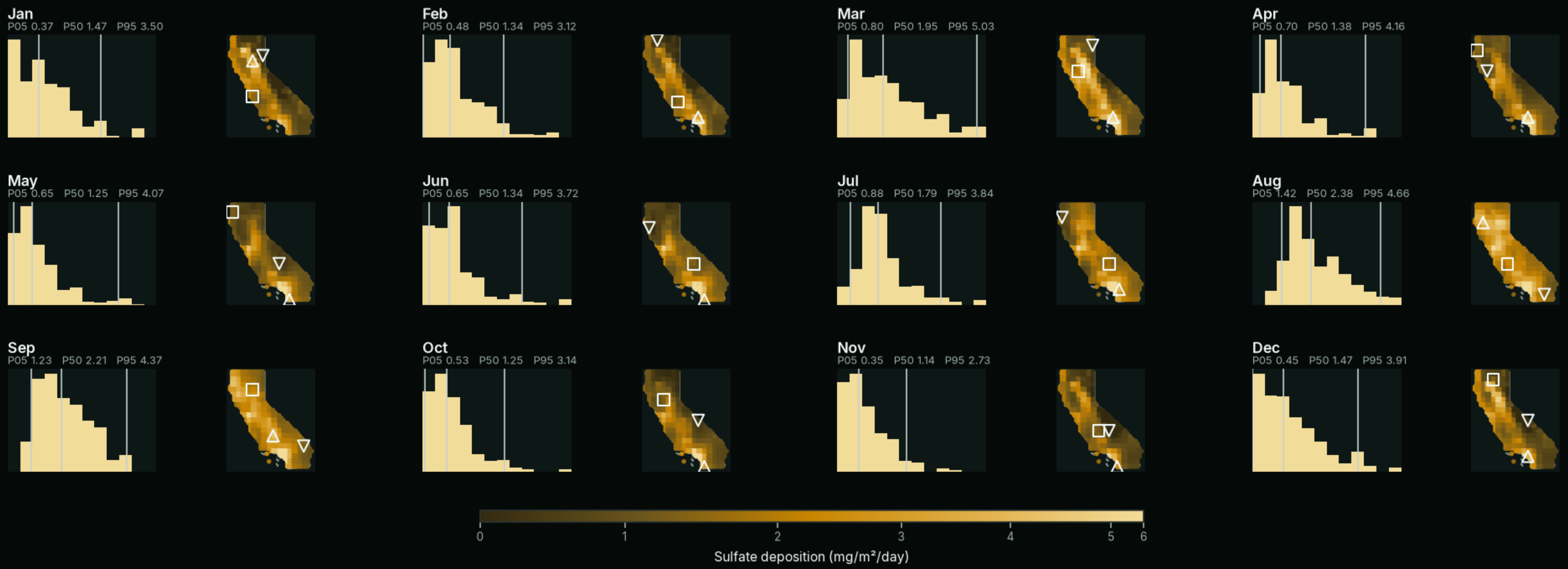
Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · mg/m²/day



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Sulfate deposition — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · mg/m²/day

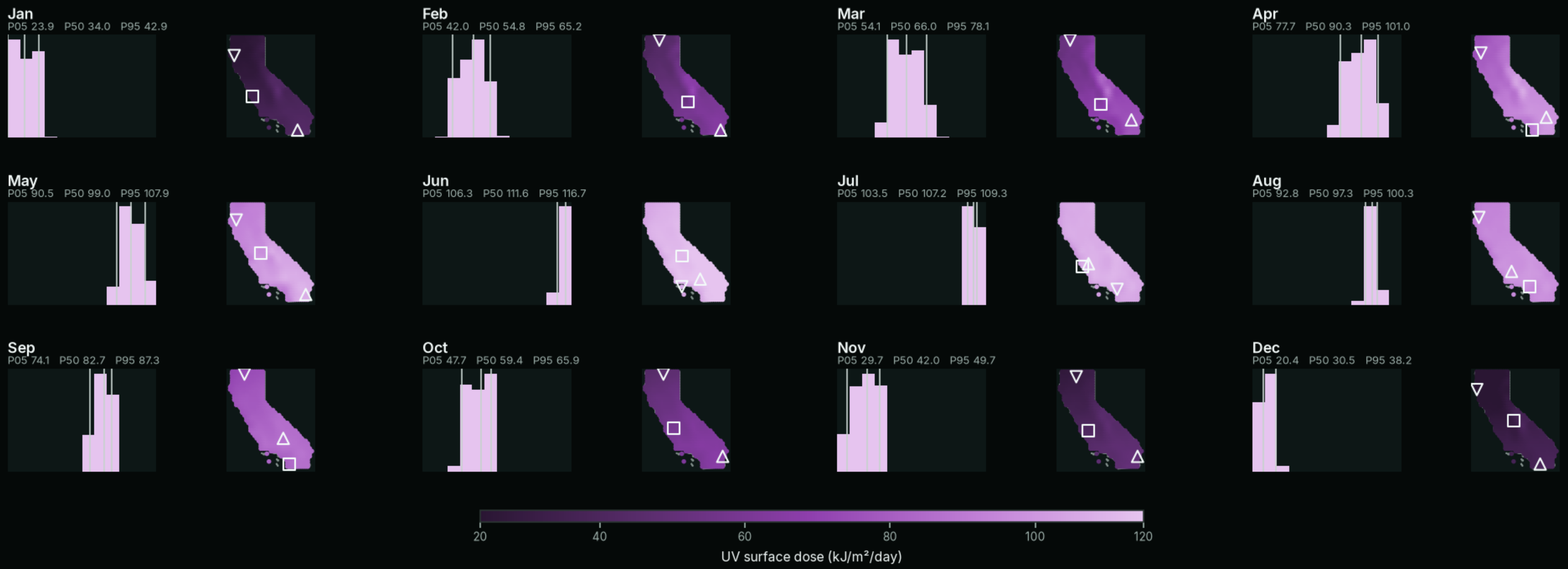


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.6.3

UV surface dose — monthly

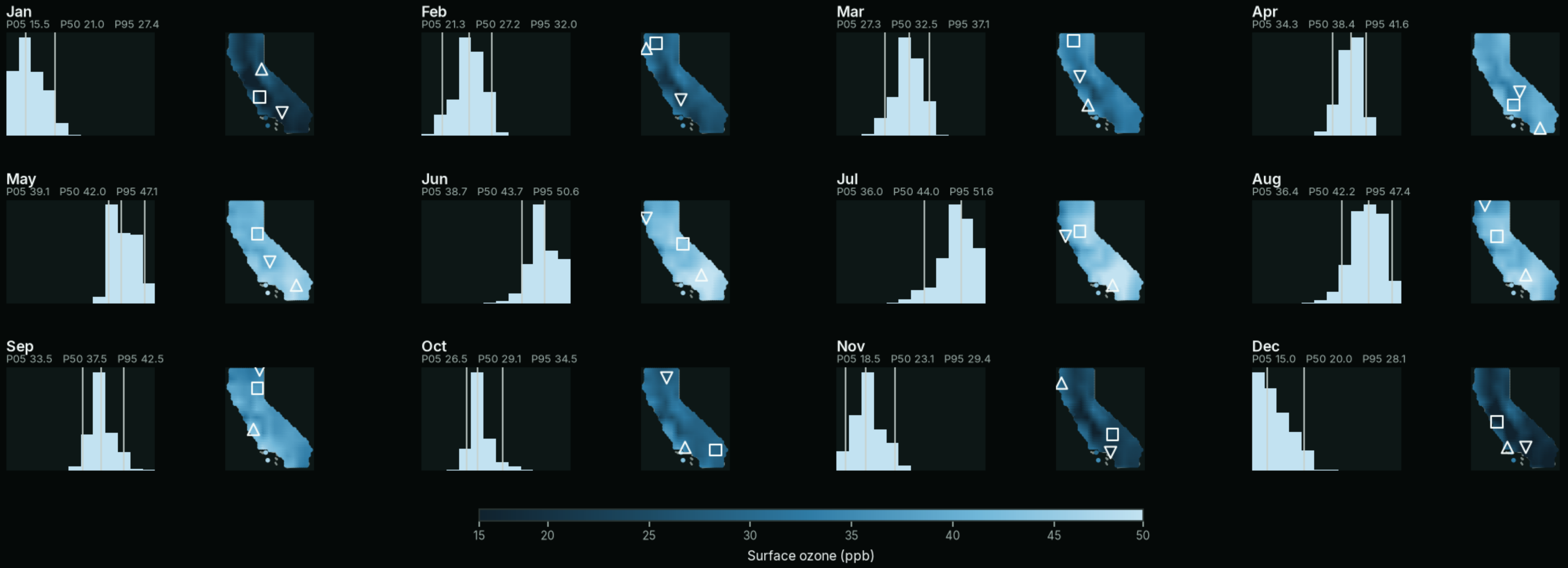
Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · kJ/m²/day



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Surface ozone — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · ppb



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Appendix — Monthly Materials

Complete monthly regional statistics

Monthly Materials

See the first monthly appendix section for the meaning of monthly P05–P95.

How to read this

Each following page gives the full Jan–December Mean / P05 / P50 / P95 for one metric, computed across every analyzed gridpoint for that month, with the same envelope chart grammar used in the main report.

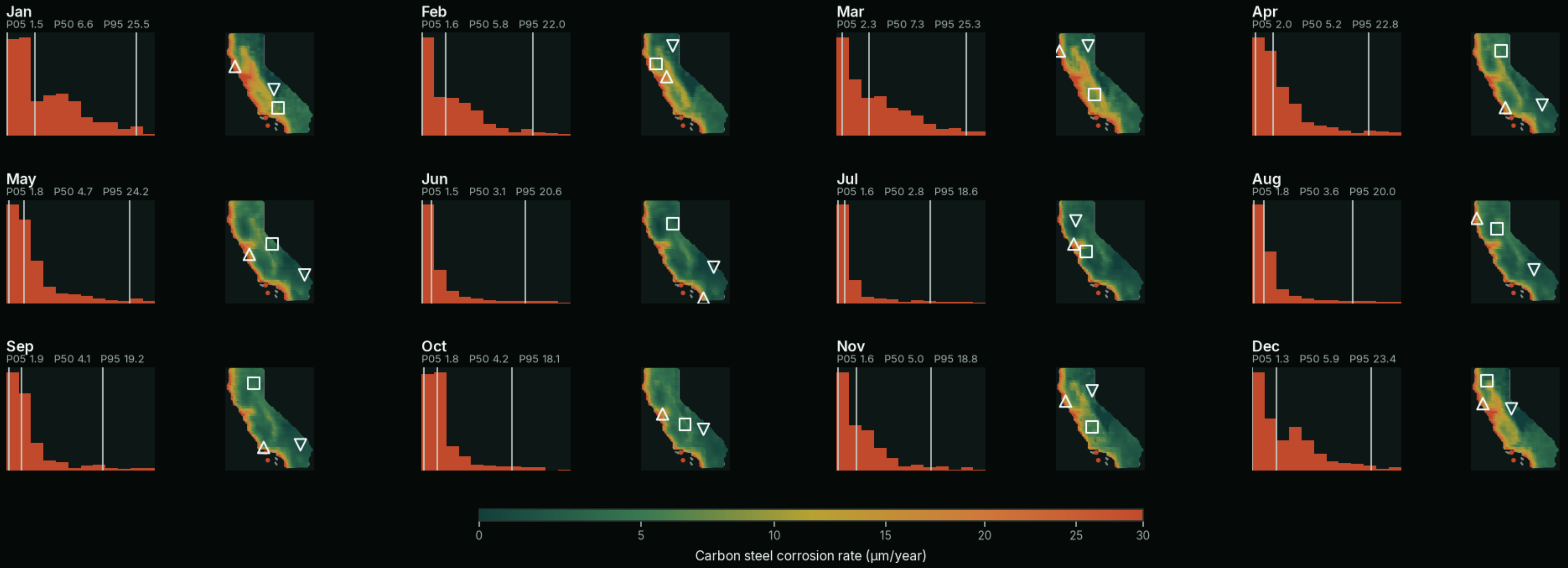
Metric	Monthly breakdown
Carbon steel corrosion rate	Included on the following page(s)
Aluminum corrosion rate	Included on the following page(s)
Zinc corrosion rate	Included on the following page(s)
Copper corrosion rate	Included on the following page(s)
UV / photo-oxidation score	Included on the following page(s)
Ozone / elastomer score	Included on the following page(s)
Thermal oxidation score	Included on the following page(s)
Hydrolysis / moisture score	Included on the following page(s)
Climetry Polymer Exposure Screening Index	Included on the following page(s)

A.7.1

■ CLIMETRY

Carbon steel corrosion rate — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · µm/year

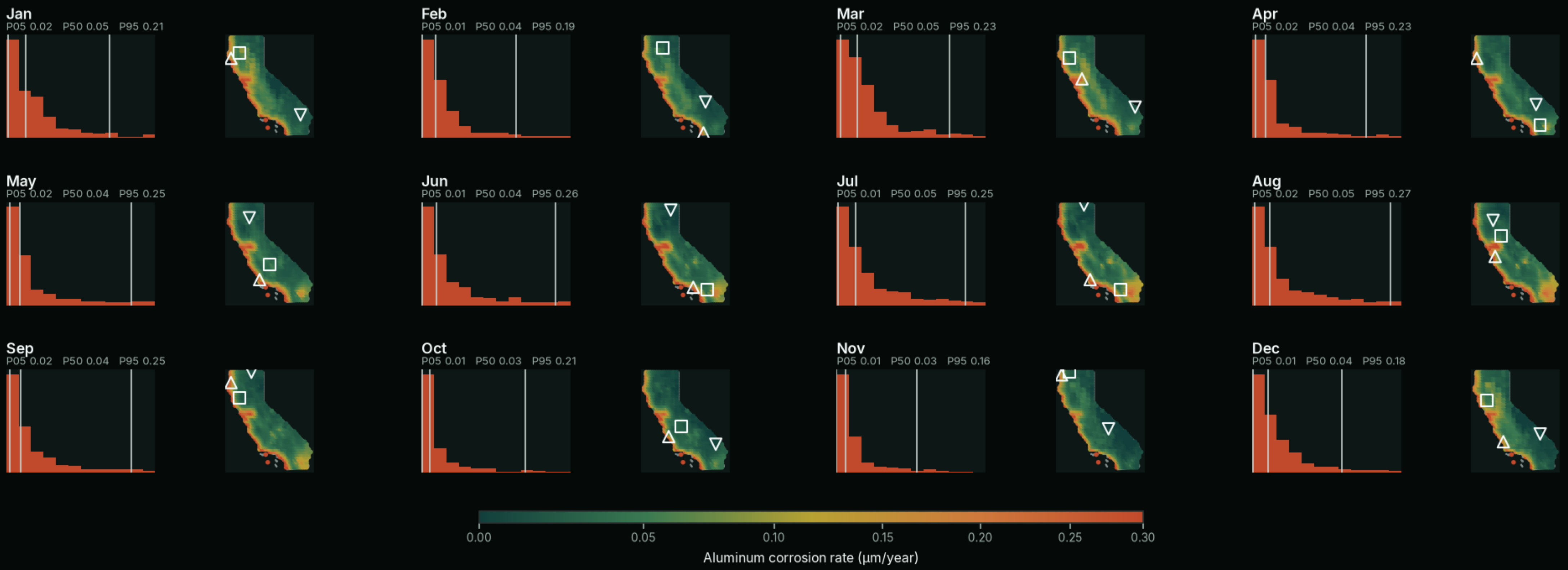


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.7.2

Aluminum corrosion rate — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · µm/year

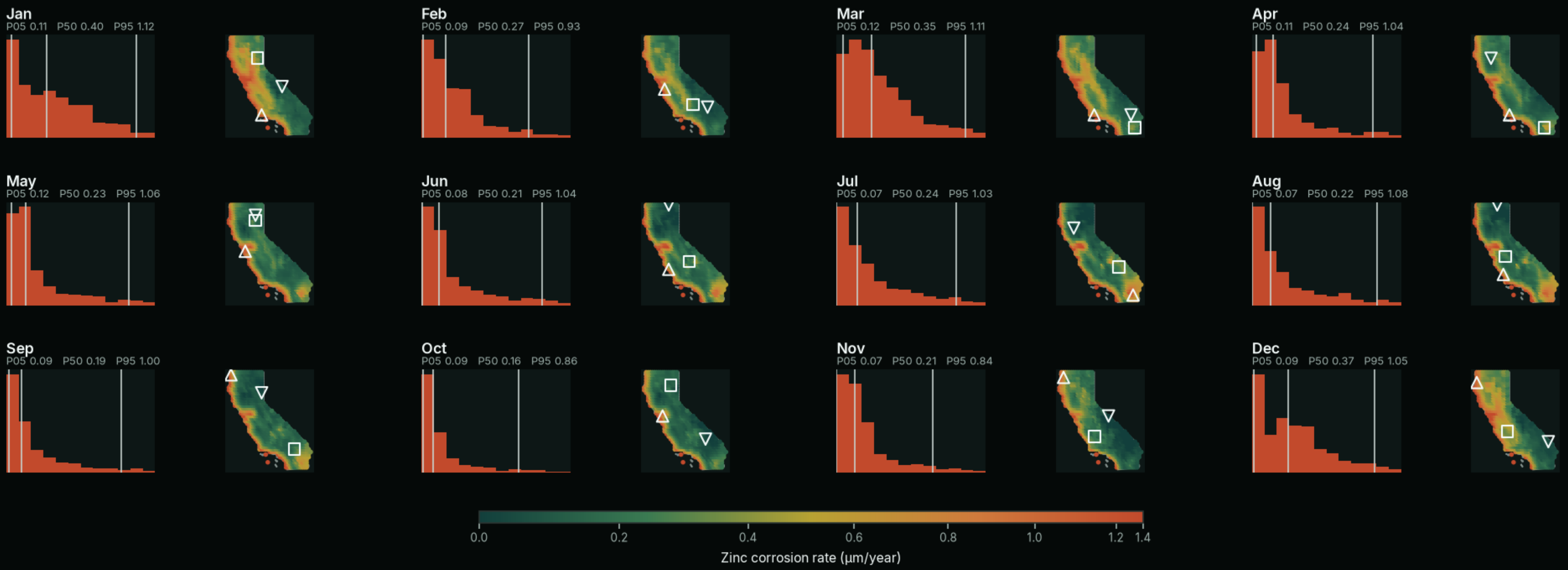


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.7.3

Zinc corrosion rate — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · µm/year

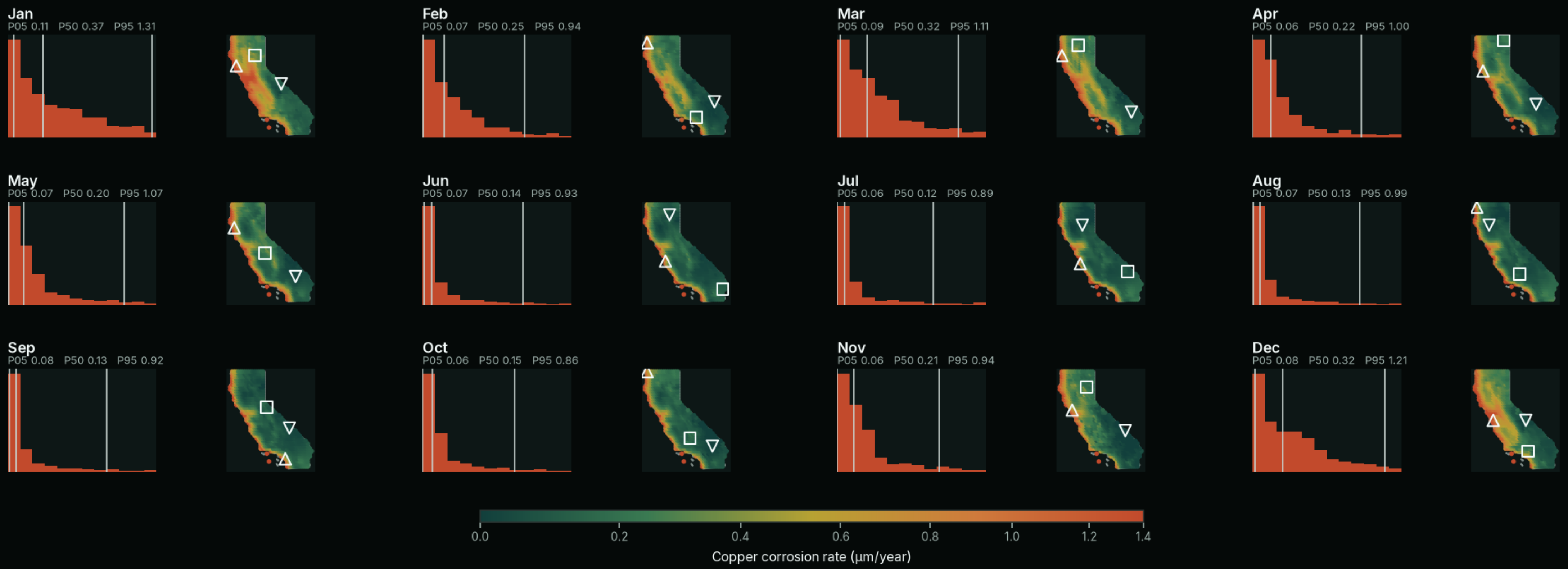


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.7.4

Copper corrosion rate — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · µm/year

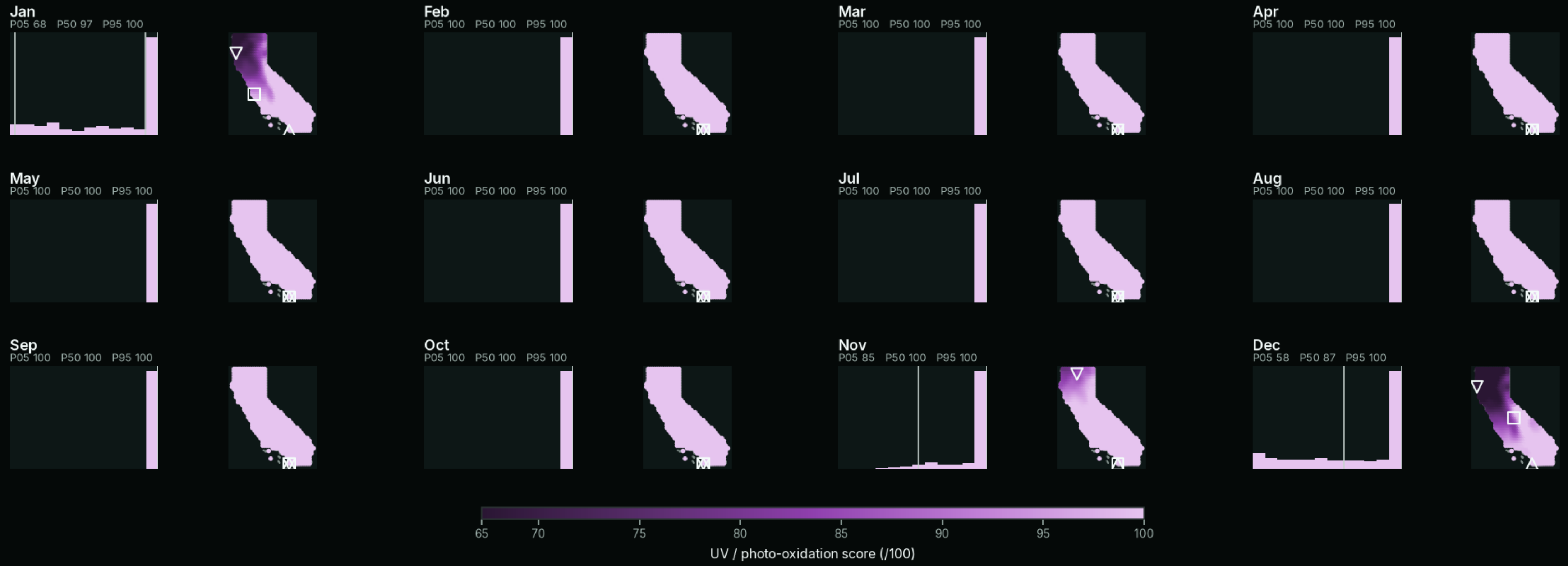


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.7.5

UV / photo-oxidation score — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · 0-100 index

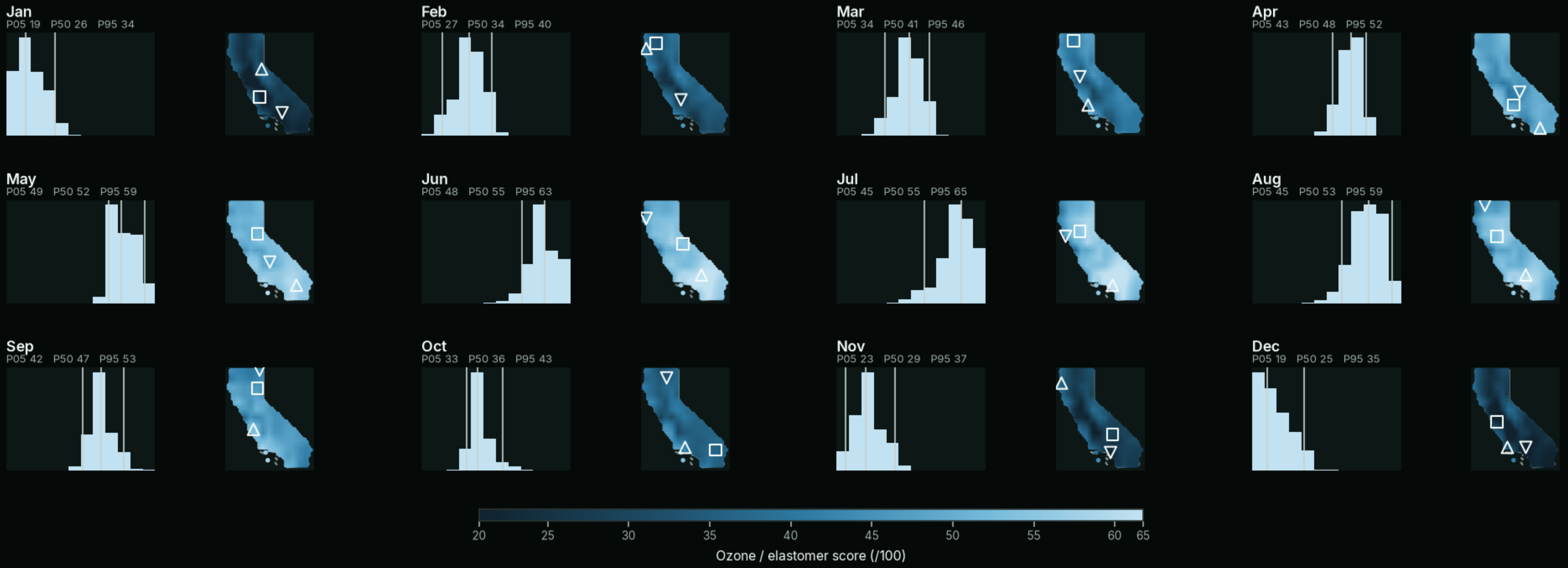


Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

A.7.6

Ozone / elastomer score — monthly

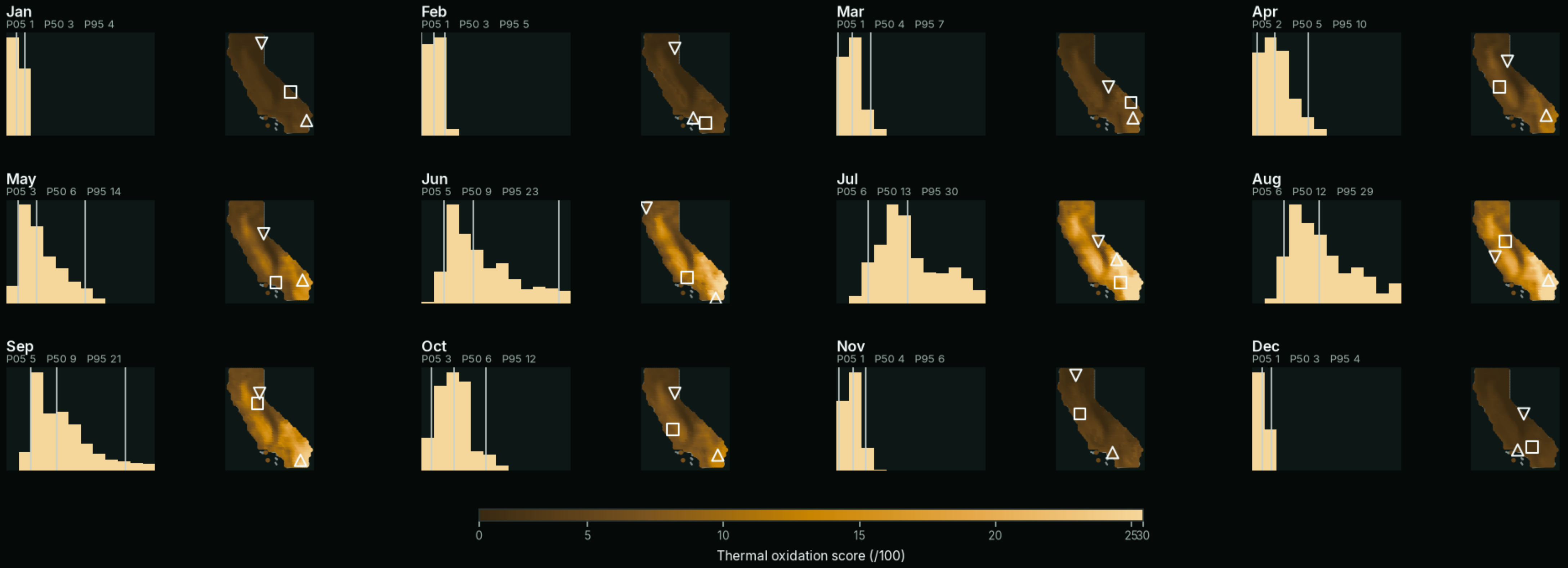
Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · 0-100 index



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Thermal oxidation score — monthly

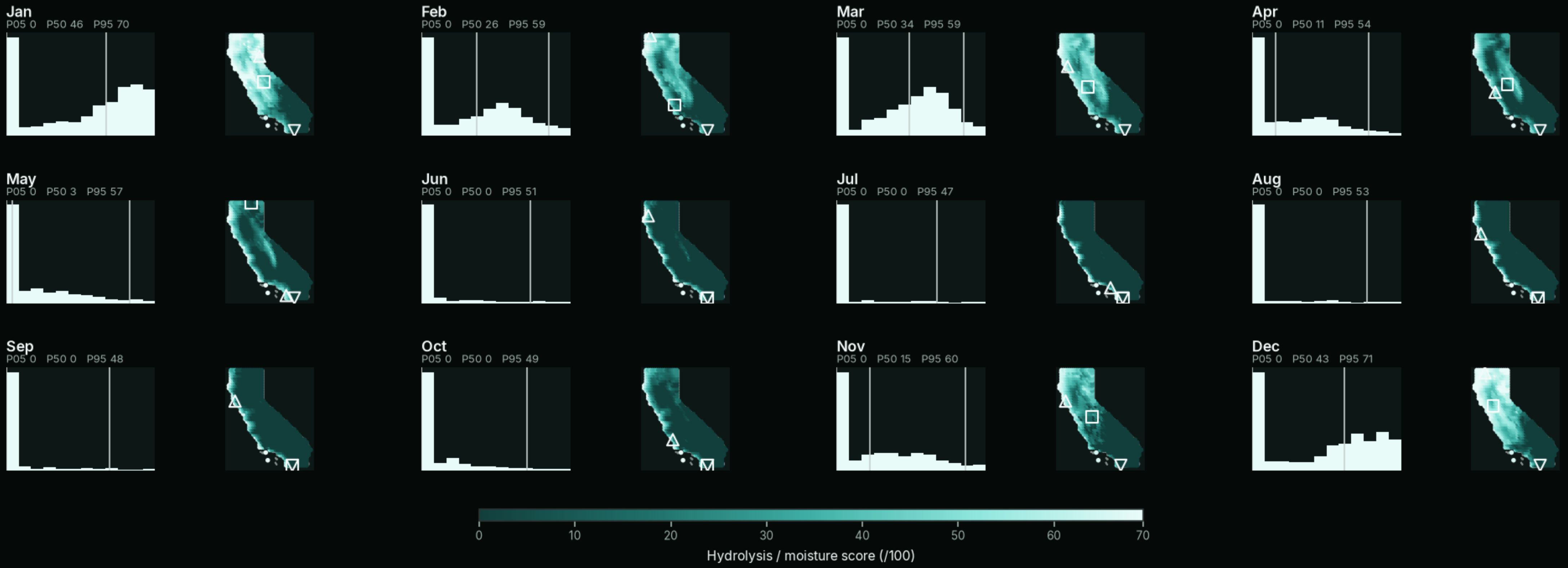
Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · 0-100 index



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Hydrolysis / moisture score — monthly

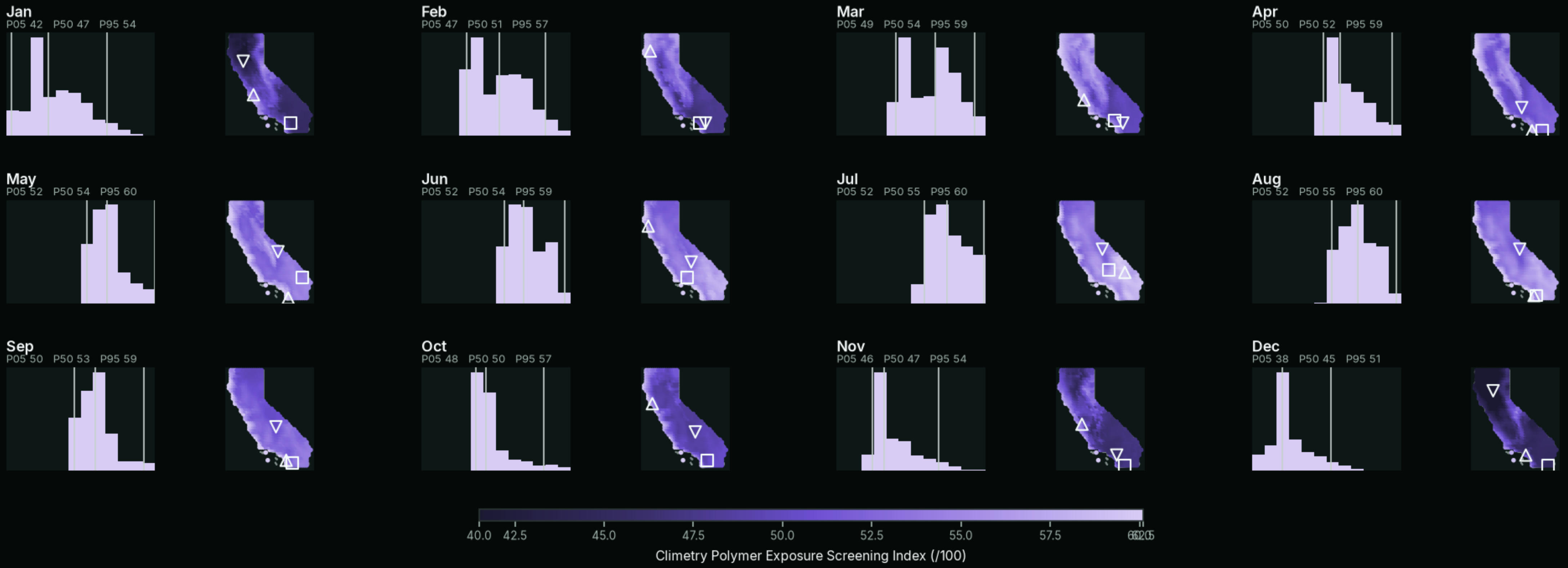
Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · 0-100 index



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Climetry Polymer Exposure Screening Index — monthly

Distribution and spatial location by calendar month · 673 gridpoints · shared colour scale · 0-100 index



Triangles ring the real gridpoints nearest P05 (down), P50 (square) and P95 (up) that month. Back to annual distribution & map →

Appendix - Metric Definitions

What each thermodynamic and atmospheric metric is, why it matters, and how Climetry computes it

Mean temperature

The CEY annual-mean air temperature at 2 m. It sets the baseline for every temperature-driven ageing process and, together with humidity, controls condensation and time of wetness.

Relative humidity

The CEY annual-mean relative humidity. Two sites with the same mean RH can still differ sharply in their high-humidity tails, which is why the RH80 and RH90 hour counts are reported separately.

RH80 hours

Hours per representative year where relative humidity is at least 80%. RH80 is used as a moisture exposure threshold because many materials, coatings, connectors and outdoor enclosures experience elevated wetness and corrosion susceptibility when air remains persistently humid. Climetry counts these hours from hourly climate data instead of relying only on monthly or annual averages.

RH90 hours

Hours per representative year where relative humidity is at least 90%. RH90 represents more severe humidity exposure. It is especially relevant for electronics, insulation systems, corrosion-sensitive metals and locations where drying potential is limited. RH90 is reported separately because two locations with similar mean RH can have very different high-humidity tails.

Appendix - Metric Definitions

What each thermodynamic and atmospheric metric is, why it matters, and how Climetry computes it

Near-condensation hours

Hours per representative year where the local air state indicates near-condensation or surface-wetting potential. The base model compares air temperature and dew point; where surface temperature is unknown, Climetry uses a screening approximation based on dew-point spread and humidity. Interpret this as condensation exposure potential, not a guarantee that a specific product surface was wet.

Freeze hours

Hours per representative year with air temperature at or below 0 °C. Drives freeze-thaw damage in porous materials and sealed assemblies, and thermal-cycling fatigue where paired with warm hours.

Heat hours

Hours per representative year with air temperature at or above 35 °C. Drives thermal-oxidative ageing of polymers and elastomers and accelerates outgassing and softening.

Chloride deposition

Screening estimate of airborne sea-salt chloride deposited per day ($mg/m^2/day$), from Climetry's finite-volume marine transport model. The primary driver of atmospheric corrosivity near coasts and the input to the ISO 9223 corrosion dose-response below.

Appendix - Metric Definitions

What each thermodynamic and atmospheric metric is, why it matters, and how Climetry computes it

Sulfate deposition

MERRA-2 sulfate wet + dry deposition background ($mg/m^2/day$), used as an ISO-derived SO_2-equivalent screening proxy for pollution-driven corrosivity. Not a certified SO_2 measurement.

UV surface dose

Mean daily surface ultraviolet dose ($kJ/m^2/day$) from ERA5. Drives photo-oxidative ageing of polymers, coatings and elastomers.

Surface ozone

Mean surface ozone concentration (ppb) from CAMS. Drives ozone cracking of elastomers and contributes to polymer chain scission.

Dew point

The temperature to which air must cool for water vapour to start condensing. Together with air temperature it determines condensation risk and time of wetness. Evaluated at every one of the region's 8,760 hourly states and then aggregated - shown only where the region's hourly artifact is available.

A.8.4

Appendix - Metric Definitions

What each thermodynamic and atmospheric metric is, why it matters, and how Climetry computes it

Dew-point depression (temperature - dew point)

The gap between air temperature and dew point. A small depression means the air is close to saturation and surfaces are near the wetting point; a large depression means strong drying potential. One of the most useful single indicators for condensation and corrosion screening in reliability work. Evaluated hourly (temperature minus dew point) and then aggregated.

Absolute humidity

The actual mass of water vapour per cubic metre of air (g/m³). Unlike relative humidity it does not depend on temperature, so it is the better measure of the moisture reservoir available to drive absorption, hydrolysis and coating blistering. Evaluated at every hourly (temperature, dew-point) state and then aggregated - never from a mean, which would bias this non-linear quantity.

Spatial variation class

How much a metric changes across the region, stated explicitly as the ratio P95/P50 (how much higher the conservative sub-area runs than a typical one): Low below 1.15, Moderate 1.15 to 1.5, High above 1.5. Only a Low class supports a statement that location within the region provides little mitigation; a Moderate or High class means a fixed deployment coordinate should be confirmed with a Point Analysis. The ratio measures relative spread only - the absolute difference and its engineering consequence are in the P50-to-P95 practical-difference table.

A.9

Appendix - How Corrosion Rates Are Calculated

The ISO 9223 Annex A dose-response basis behind every metal-corrosion figure

CLIMETRY

How corrosion rates are calculated

Climetry estimates first-year atmospheric corrosion for carbon steel, zinc, copper and aluminium using the ISO 9223 Annex A dose-response functions. Each function takes four environmental inputs and returns a corrosion rate directly in µm/year:

1.	Air temperature (°C) - CEY annual mean
2.	Relative humidity (%) - CEY annual mean
3.	Chloride deposition (mg/m²/day) - Climetry marine transport model
4.	Sulfate as SO_2-equivalent (mg/m²/day) - MERRA-2, or a 5 mg/m²/day background where absent

The general form (carbon steel shown) is a sum of a pollution term and a chloride term, each an exponential in humidity and temperature:

```
r = 1.77 · SO₂^0.52 · e^(0.020·RH + f_T) + 0.102 · Cl^0.62 · e^(0.033·RH + 0.040·T)
```

where f_T is a piecewise temperature term (positive below 10 °C, negative above). Zinc, copper and aluminium use the same structure with their own ISO 9223 coefficients.

What the number means - and does not

The result is a first-year screening corrosion rate. Real long-term loss is sub-linear as protective patinas form, so multi-year loss is lower than rate × years.

Feeding a single month's mean through the same curve gives the monthly ISO-style screening estimate used in the monthly appendix - a real computation on real monthly climate, but an extrapolation of an annual-average formula, never an ISO class.

> SCREENING, NOT CERTIFICATION
>
> These rates and the ISO corrosivity classes derived from them are engineering screening indicators. Map the final material selection to the applicable product-specific qualification standard and, where it matters, to site measurements.

Background and worked examples: getclimetry.com/resources/basics