

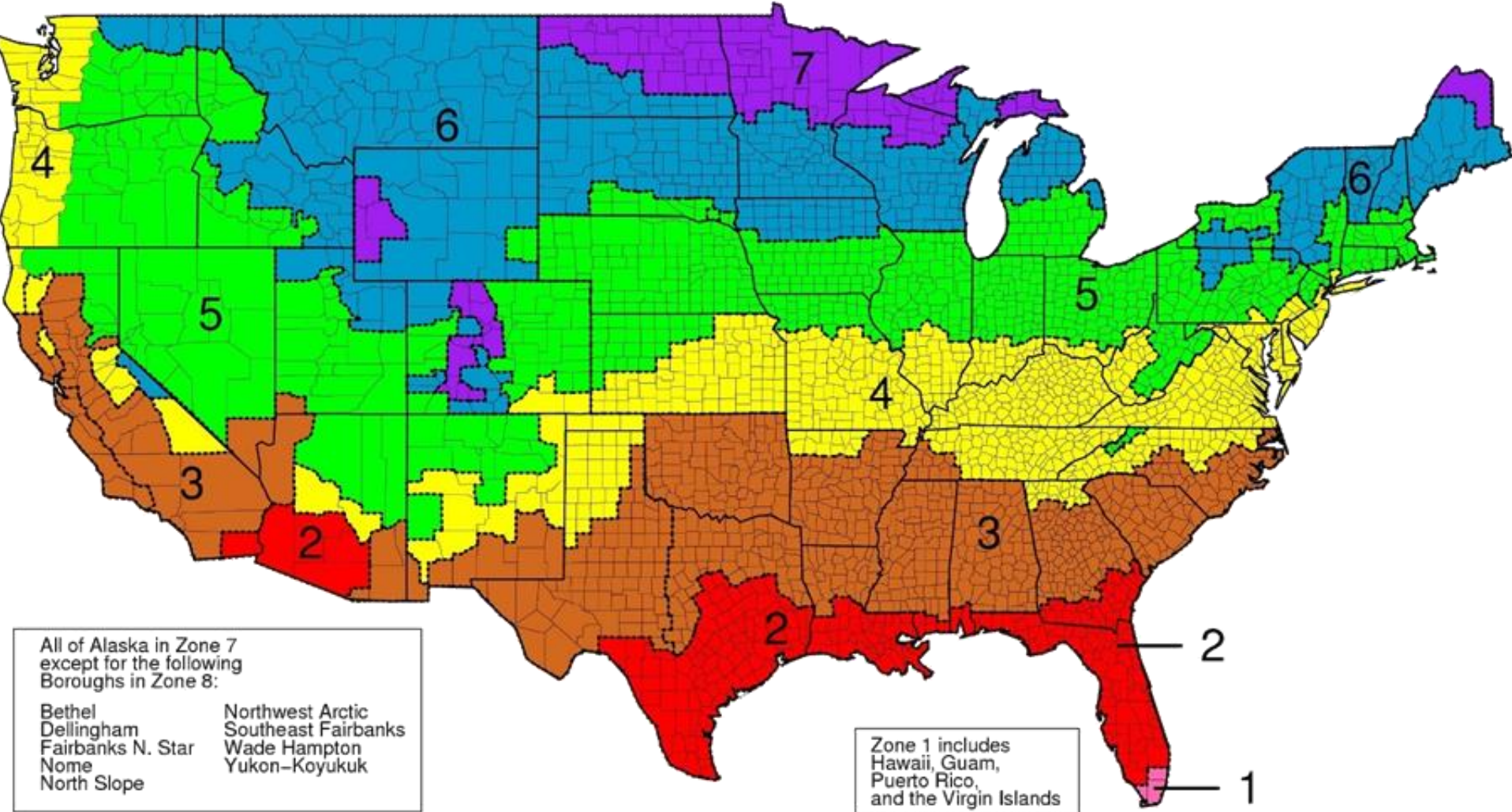
VISUALIZING CLIMATES AND HUMIDIFICATION TO FIGHT PANDEMICS

RELATIVE HUMIDITY PROFILES FOR US CITIES BASED ON ASHRAE CLIMATE ZONES

1. CLIMATE ZONE MAP
2. VISUALIZING CLIMATE OVERVIEW
3. ZONE 1A – MIAMI, FL
4. ZONE 2A – HOUSTON, TX
5. ZONE 2B – PHOENIX, AZ
6. ZONE 3A – ATLANTA, GA
7. ZONE 3B – LAS VEGAS, NV
8. ZONE 3C – LOS ANGELES, CA
9. ZONE 4A – NEW YORK CITY, NY
10. ZONE 4B – ALBUQUERQUE, NM
11. ZONE 4C – SAN FRANCISCO, CA
12. ZONE 5A – CHICAGO, IL
13. ZONE 5B – DENVER, CO
14. ZONE 5C – SEATTLE, WA
15. ZONE 6A – MINNEAPOLIS, MN
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17. ZONE 7 – DULUTH, MN
18. ZONE 8 – FAIRBANKS, AK

ASHRAE CLIMATE ZONES AND ASHRAE STANDARD 169-2013

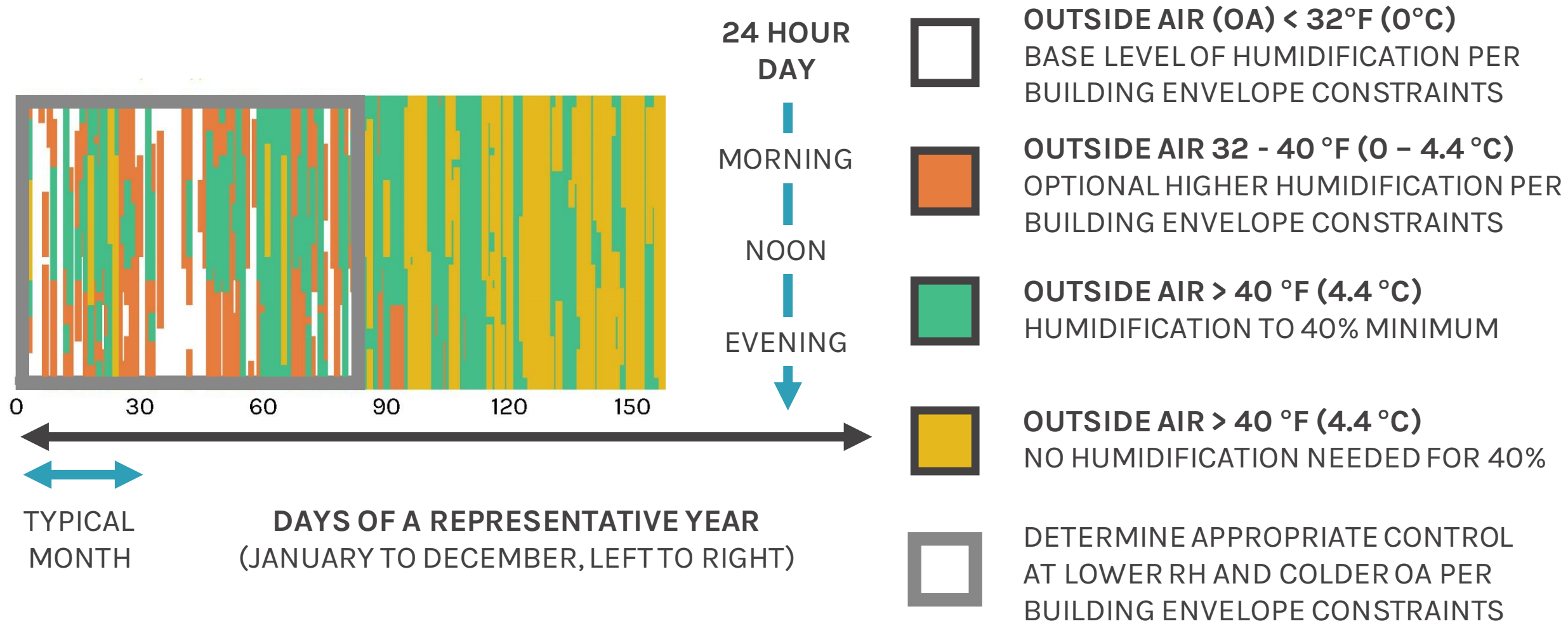
CLIMATE ZONE VARIATION BY LOCATION IN THE UNITED STATES



Thermal Zone	Name
0	Extremely Hot – Humid (0A), Dry (0B)
1	Very Hot – Humid (1A), Dry (1B)
2	Hot – Humid (2A), Dry (2B)
3A and 3B	Warm – Humid (3A), Dry (3B)
3C	Warm – Marine (3C)
4A and 4B	Mixed – Humid (4A), Dry (4B)
4C	Mixed – Marine
5A and 5B	Cool– Humid (5A), Dry (5B)
5C	Cool – Marine (5C)
6A and 6B	Cold – Humid (6A), Dry (6B)
7	Very Cold (7)
8	Subarctic/Arctic (8)

VISUALIZING RELATIVE HUMIDITY OPERATION BY LOCATION

RELATIVE HUMIDITY NEEDS VARY GREATLY BY LOCATION AND ELEVATION

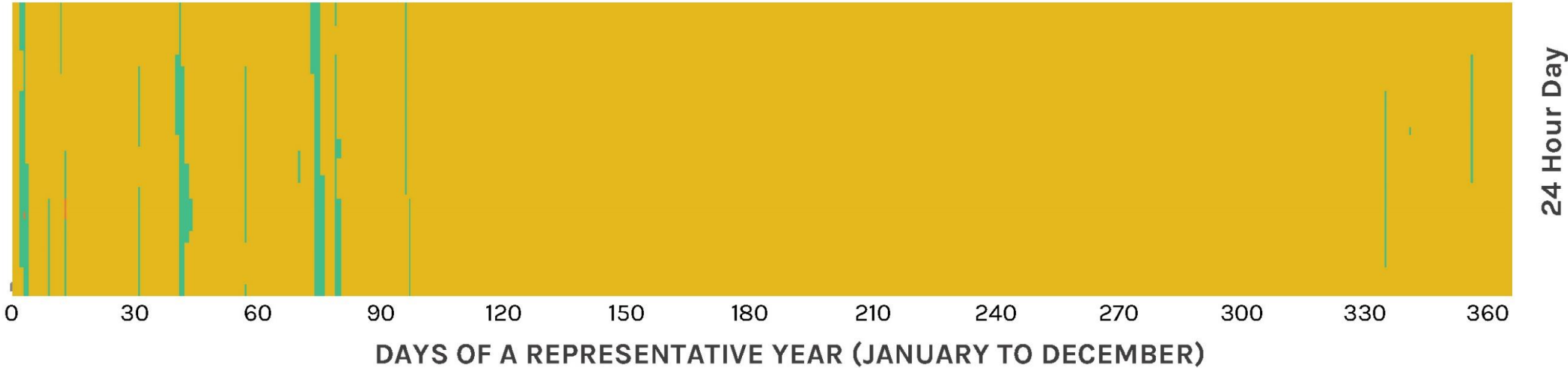


ASHRAE CLIMATE ZONE 1A

VERY HOT - HUMID
MIAMI, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 0% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 0% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 4% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 96% OF DAYS PER YEAR

MIAMI, USA
7 FEET ABOVE SEA LEVEL
LATITUDE: 25.8 / LONGITUDE: -80.27



* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY ELEVATED OUTDOOR HUMIDITY REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM LIMITED AND MAY PROCLUDE ITS INSTALLATION
- MINIMAL POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM MAY NOT BE VIABLE GIVEN ITS LIMITED USE

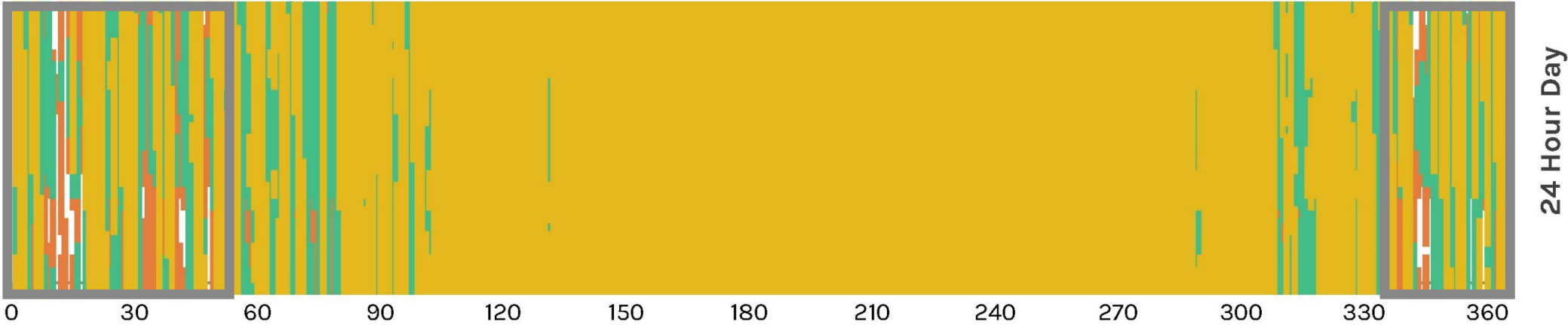
ASHRAE CLIMATE ZONE 2A

HOT - HUMID

HOUSTON, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 2% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 4% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 15% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 79% OF DAYS PER YEAR

HOUSTON, USA
108 FEET ABOVE SEA LEVEL
LATITUDE: 29.98 / LONGITUDE: -95.37



DETERMINE APPROPRIATE
CONTROL AT LOWER RH*

DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY ELEVATED OUTDOOR HUMIDITY REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM IS LIMITED TO LATE FALL THROUGH EARLY SPRING
- LOW POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- CONSIDER SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM FOR LATE FALL TO EARLY SPRING

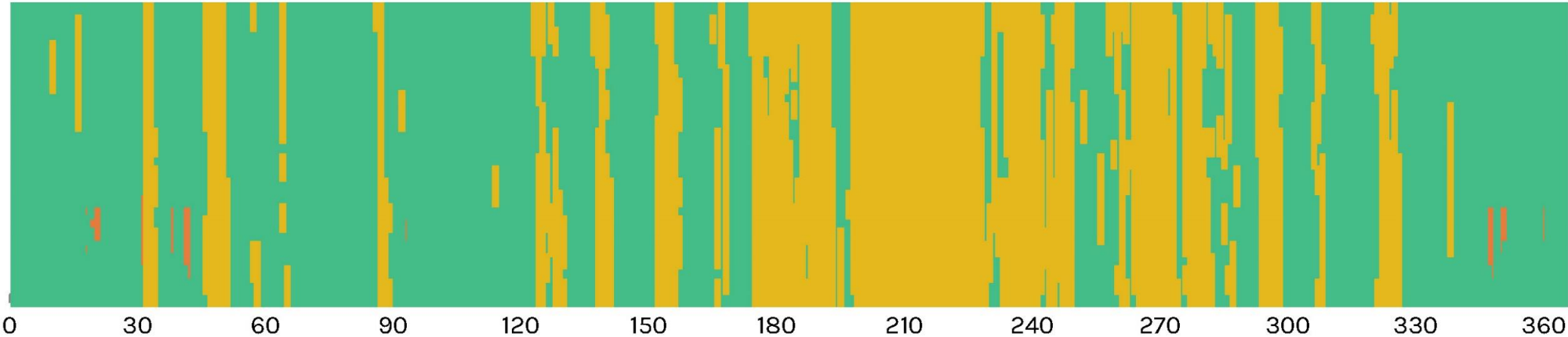
ASHRAE CLIMATE ZONE 2B

HOT - DRY

PHOENIX SKY HARBOR INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 0% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 1% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 68% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 31% OF DAYS PER YEAR

Phoenix Sky Harbor Intl Ap, USA
1105 FEET ABOVE SEA LEVEL
LATITUDE: 33.45 / LONGITUDE: -111.98



DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY DRY CONDITIONS WITH SHORTENED PERIODS OF ELEVATED HUMIDITY PRIMARILY IN SUMMER
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM THROUGHOUT THE YEAR
- LOW POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM FOR THE MAJORITY OF THE YEAR

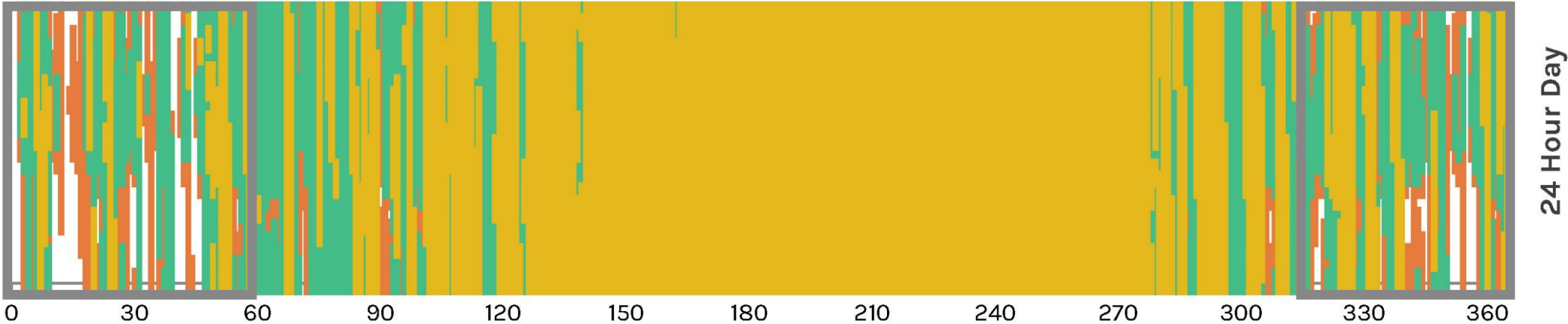
ASHRAE CLIMATE ZONE 3A

WARM - HUMID

ATLANTA, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 6% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 8% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 25% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 61% OF DAYS PER YEAR

ATLANTA, USA
1033 FEET ABOVE SEA LEVEL
LATITUDE: 33.65 / LONGITUDE: -84.43



DETERMINE APPROPRIATE
CONTROL AT LOWER RH*

DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY ELEVATED OUTDOOR HUMIDITY REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM IS LIMITED TO FALL THROUGH SPRING
- SOME POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

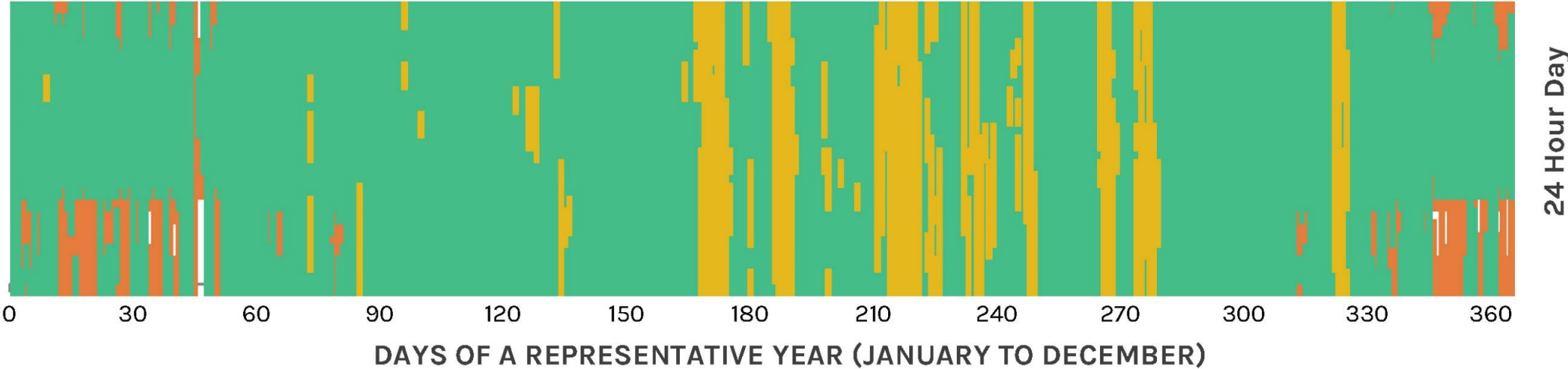
ASHRAE CLIMATE ZONE 3B

WARM - DRY

LAS VEGAS MCCARRAN INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 1% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 6% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 82% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 11% OF DAYS PER YEAR

Las Vegas Mccarran Intl Ap, USA
2125 FEET ABOVE SEA LEVEL
LATITUDE: 36.08 / LONGITUDE: -115.15



* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY DRY CONDITIONS WITH SHORTENED PERIODS OF ELEVATED HUMIDITY PRIMARILY IN SUMMER
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM THROUGHOUT THE YEAR
- LOW POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

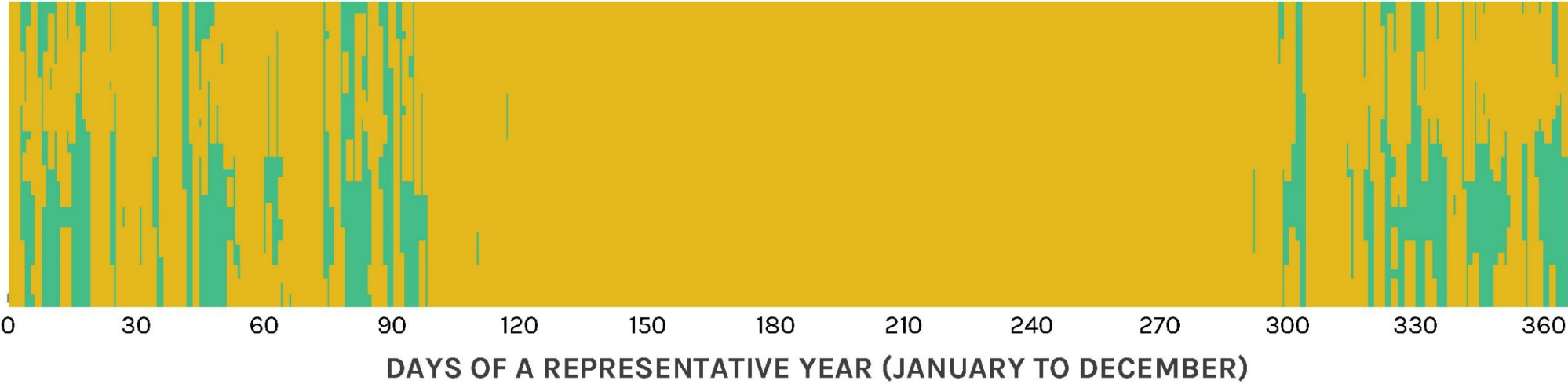
ASHRAE CLIMATE ZONE 3C

WARM - MARINE

LOS ANGELES INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 0% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 0% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 19% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 81% OF DAYS PER YEAR

Los Angeles Intl AP, USA
98 FEET ABOVE SEA LEVEL
LATITUDE: 33.933 / LONGITUDE: -118.4



* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY ELEVATED OUTDOOR HUMIDITY REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM IS LIMITED TO LATE FALL THROUGH EARLY SPRING
- MINIMAL POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- CONSIDER SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM FOR LATE FALL TO EARLY SPRING

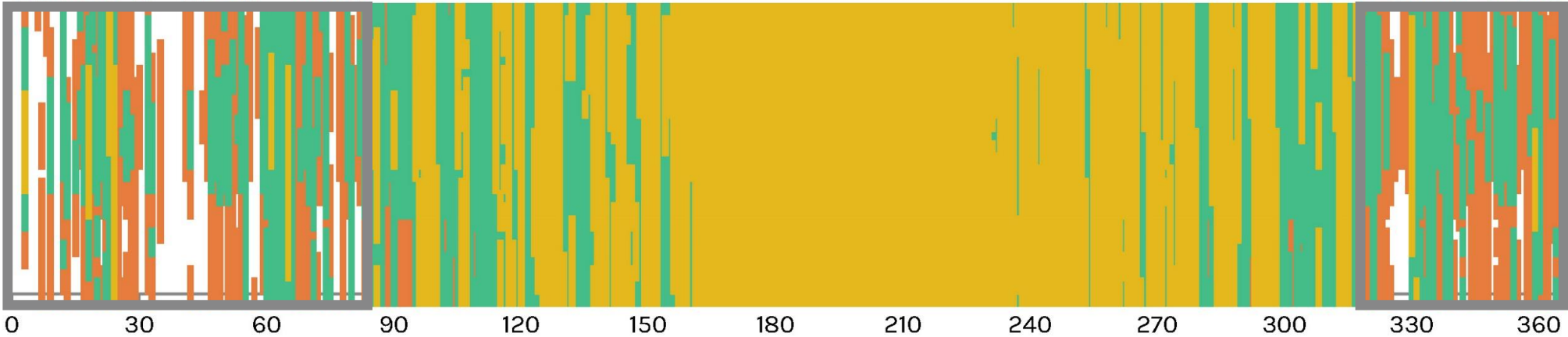
ASHRAE CLIMATE ZONE 4A

MIXED – HUMID

NEW YORK – KENNEDY INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 10% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 15% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 29% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 46% OF DAYS PER YEAR

New York-Kennedy Intl AP, USA
16 FEET ABOVE SEA LEVEL
LATITUDE: 40.65 / LONGITUDE: -73.8



DETERMINE APPROPRIATE
CONTROL AT LOWER RH*

DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- ELEVATED OUTDOOR HUMIDITY IN SUMMER/FALL REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM IS LIMITED TO FALL THROUGH SPRING
- POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

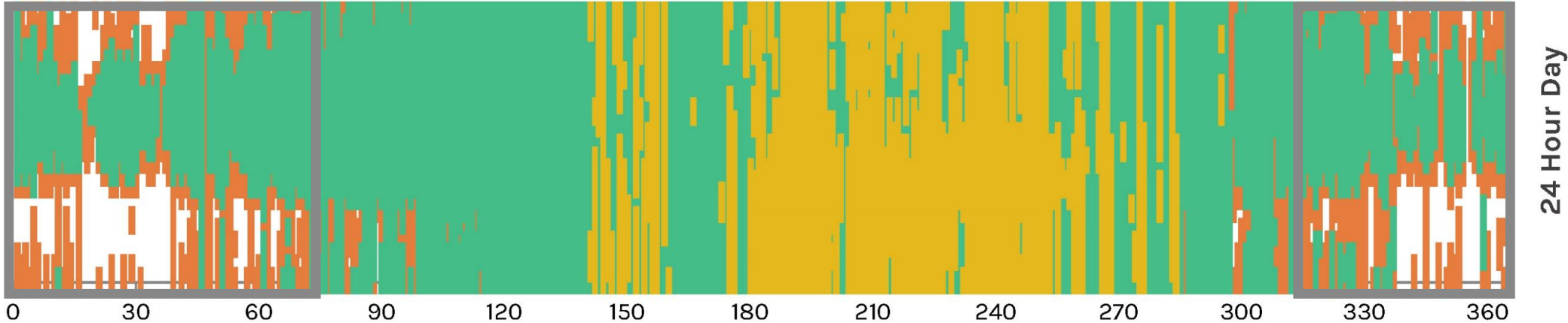
ASHRAE CLIMATE ZONE 4B

MIXED - DRY

ALBUQUERQUE INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 10% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 13% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 55% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 22% OF DAYS PER YEAR

Albuquerque Intl Arpt Isis, USA
5310 FEET ABOVE SEA LEVEL
LATITUDE: 35.04 / LONGITUDE: -106.62



DETERMINE APPROPRIATE CONTROL AT LOWER RH*
DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY DRY CONDITIONS WITH SHORTENED PERIODS OF ELEVATED HUMIDITY PRIMARILY IN SUMMER
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM THROUGHOUT THE YEAR
- POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

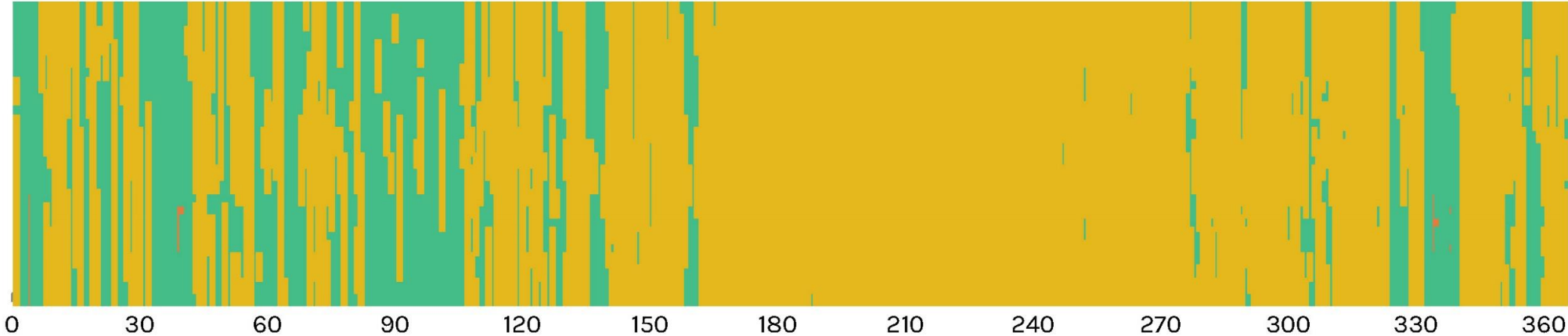
ASHRAE CLIMATE ZONE 4C

MIXED - MARINE

SAN FRANCISCO INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 0% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 0% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 32% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 68% OF DAYS PER YEAR

San Francisco Intl AP, USA
7 FEET ABOVE SEA LEVEL
LATITUDE: 37.617 / LONGITUDE: -122.4



DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY ELEVATED OUTDOOR HUMIDITY REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM IS LIMITED TO LATE FALL THROUGH EARLY SPRING
- MINIMAL POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM FOR LATE FALL TO EARLY SPRING

ASHRAE CLIMATE ZONE 5A

COOL - HUMID

CHICAGO OHARE INTL AP, USA

OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 22% OF DAYS PER YEAR

OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 13% OF DAYS PER YEAR

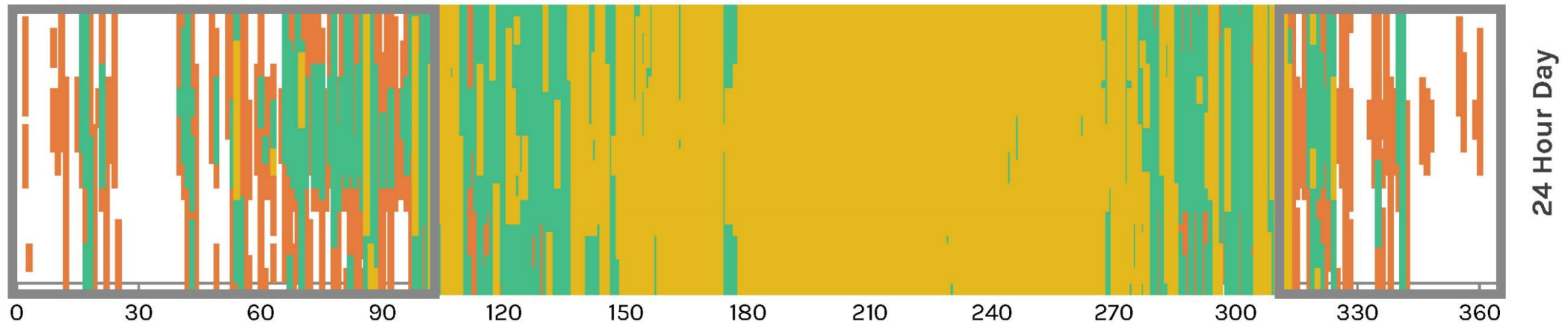
OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 22% OF DAYS PER YEAR

OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 43% OF DAYS PER YEAR

Chicago Ohare Intl Ap, USA

659 FEET ABOVE SEA LEVEL

LATITUDE: 41.98 / LONGITUDE: -87.92



24 Hour Day



DETERMINE APPROPRIATE
CONTROL AT LOWER RH*

DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- ELEVATED OUTDOOR HUMIDITY IN SUMMER REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM IS LIMITED TO FALL THROUGH SPRING
- EXTENDED PERIODS OF FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

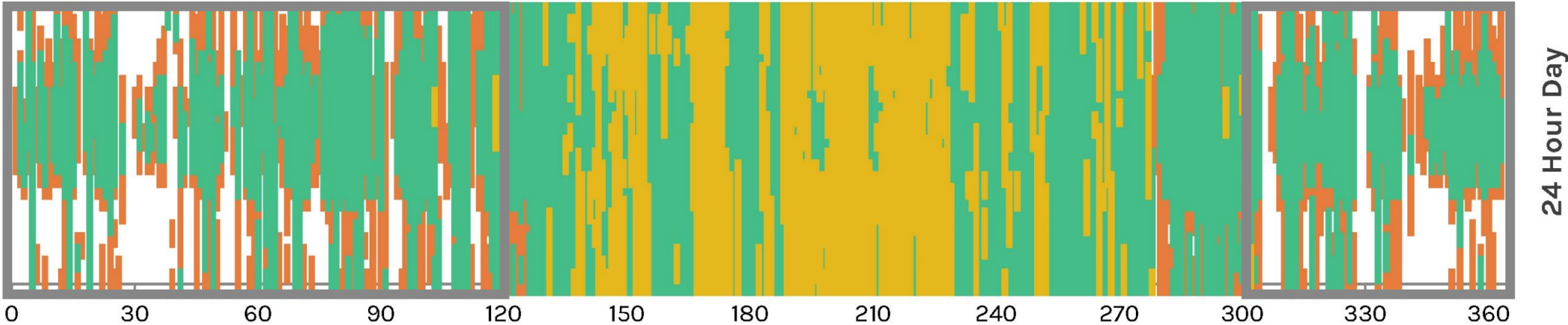
ASHRAE CLIMATE ZONE 5B

COOL - DRY

DENVER INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 19% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 14% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 48% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 19% OF DAYS PER YEAR

Denver Intl Ap, USA
5412 FEET ABOVE SEA LEVEL
LATITUDE: 39.83 / LONGITUDE: -104.65



DETERMINE APPROPRIATE
CONTROL AT LOWER RH*

DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY DRY CONDITIONS WITH SHORTENED PERIODS OF ELEVATED HUMIDITY PRIMARILY IN SUMMER
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM THROUGHOUT THE YEAR
- REGULAR PERIODS OF FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

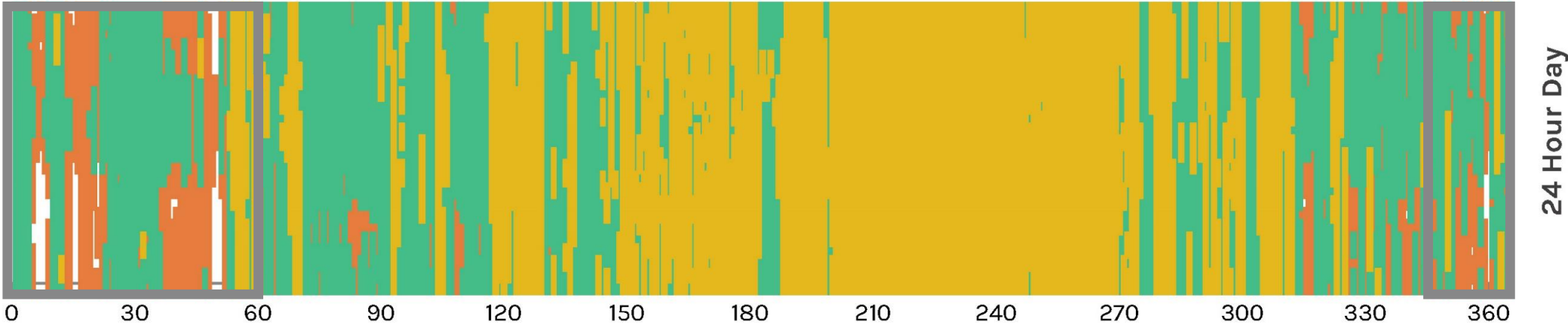
ASHRAE CLIMATE ZONE 5C

COOL - MARINE

SEATTLE-TACOMA INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 2% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 12% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 42% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 44% OF DAYS PER YEAR

Seattle-Tacoma Intl AP, USA
400 FEET ABOVE SEA LEVEL
LATITUDE: 47.443 / LONGITUDE: -122.306



DETERMINE APPROPRIATE
CONTROL AT LOWER RH*

DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY ELEVATED OUTDOOR HUMIDITY REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION IS LIMITED TO FALL THROUGH SPRING
- SOME POTENTIAL FOR FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY (60%) OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

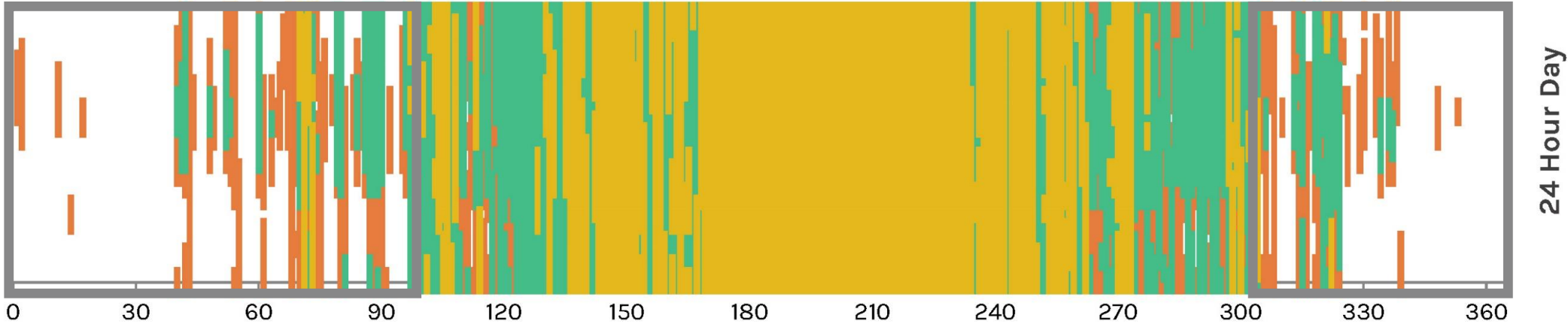
ASHRAE CLIMATE ZONE 6A

COLD - HUMID

MINNEAPOLIS ST PAUL INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 31% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 11% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 23% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 35% OF DAYS PER YEAR

Minneapolis St Paul IntL Arp, USA
833 FEET ABOVE SEA LEVEL
LATITUDE: 44.88 / LONGITUDE: -93.23



DETERMINE APPROPRIATE CONTROL AT LOWER RH*
DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)
* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- ELEVATED OUTDOOR HUMIDITY IN SUMMER/FALL REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM IS LIMITED TO FALL THROUGH SPRING
- EXTENDED PERIODS OF FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

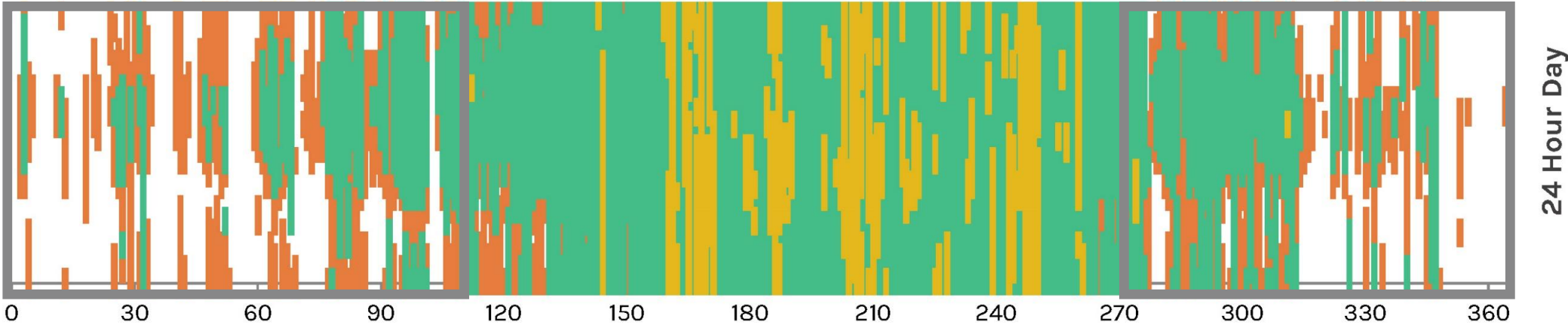
ASHRAE CLIMATE ZONE 6B

COLD - DRY

HELENA REGIONAL AIRPORT, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 28% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 16% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 49% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 7% OF DAYS PER YEAR

Helena Regional Airport, USA
3828 FEET ABOVE SEA LEVEL
LATITUDE: 46.6 / LONGITUDE: -111.97



DETERMINE APPROPRIATE
CONTROL AT LOWER RH*

DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- CONSISTENTLY DRY CONDITIONS WITH LIMITED PERIODS OF ELEVATED HUMIDITY PRIMARILY IN SUMMER
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM THROUGHOUT THE YEAR
- EXTENDED PERIODS OF FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

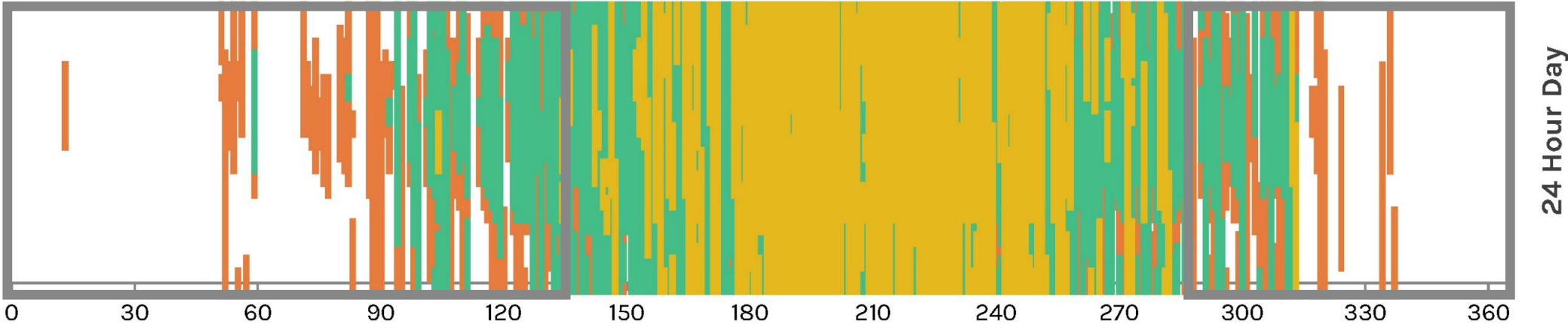
ASHRAE CLIMATE ZONE 7

VERY COLD

DULUTH, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 40% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 11% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 24% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 25% OF DAYS PER YEAR

DULUTH, USA
1417 FEET ABOVE SEA LEVEL
LATITUDE: 46.83 / LONGITUDE: -92.18



DETERMINE APPROPRIATE
CONTROL AT LOWER RH*

DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- ELEVATED OUTDOOR HUMIDITY IN SUMMER REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM IS PRIMARILY LIMITED TO FALL THROUGH SPRING
- EXTENDED PERIODS OF FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

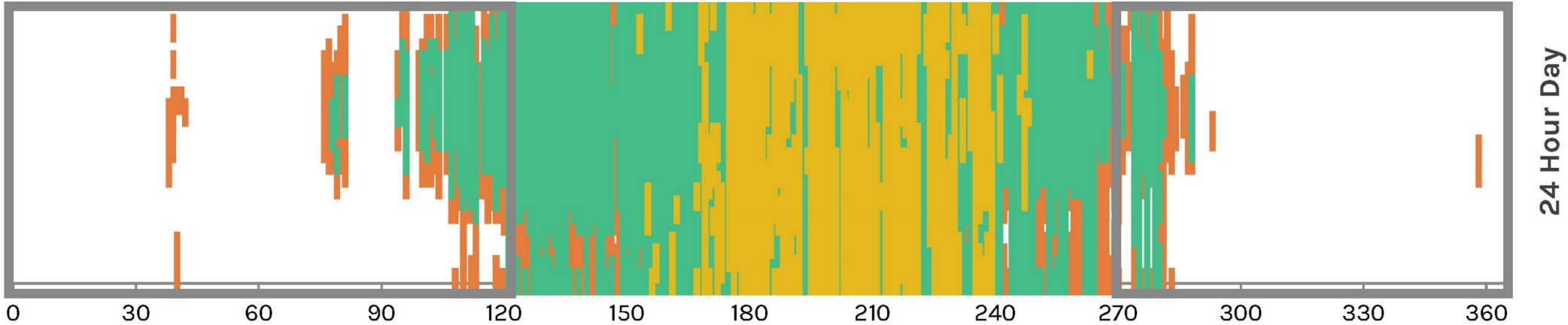
ASHRAE CLIMATE ZONE 8

SUBARTIC/ARTIC

FAIRBANKS INTL AP, USA

- OUTSIDE AIR (OA) < 32F (0C), BASE LEVEL OF HUMIDIFICATION* - 51% OF DAYS PER YEAR
- OA = 32F-40F (0C-4.4C), OPTIONAL HIGHER LEVEL OF HUMIDIFICATION* - 7% OF DAYS PER YEAR
- OA > 40F (4.4C), HUMIDIFICATION TO 40% MINIMUM - 27% OF DAYS PER YEAR
- OA > 40F (4.4C), NO HUMIDIFICATION NEEDED FOR 40% MIN - 15% OF DAYS PER YEAR

Fairbanks Intl Arpt, USA
436 FEET ABOVE SEA LEVEL
LATITUDE: 64.82 / LONGITUDE: -147.85



DETERMINE APPROPRIATE CONTROL AT LOWER RH*
DAYS OF A REPRESENTATIVE YEAR (JANUARY TO DECEMBER)

* PER BUILDING ENVELOPE CONSTRAINTS

OBSERVATIONS

- ELEVATED OUTDOOR HUMIDITY IN SUMMER REQUIRES DEHUMIDIFICATION TO LOWER INDOOR RELATIVE HUMIDITY
- NEED FOR SUPPLEMENTAL HUMIDIFICATION TO 40% RH MINIMUM THROUGHOUT THE YEAR
- EXTENSIVE PERIODS OF FREEZING IN THIS CLIMATE

RECOMMENDATIONS

- PROVIDE HVAC SYSTEMS THAT MAINTAIN UPPER LIMIT RELATIVE HUMIDITY OF 60% OR LESS
- PROVIDE SUPPLEMENTAL HUMIDIFICATION TO 40% MINIMUM TOGETHER WITH ABILITY TO REDUCE WITH OA TEMPERATURES BELOW 40 °F (4.4 °C)

Design a
Better Future

SMITHGROUP