2026 AASHTOWare CONNECT

Delivering Worldwide Climatic Data to Transportation Professionals

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iENGINEERING
Listen. Understand. Solve. Deliver.

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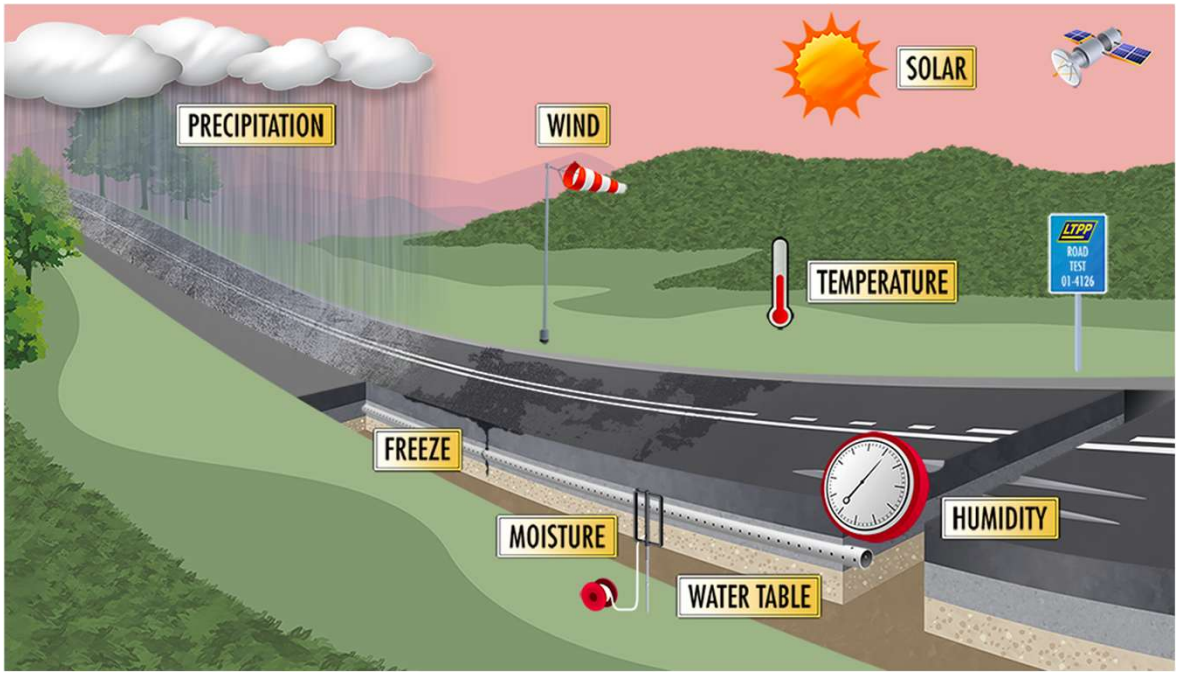
Why Climate Data Matters for Transportation

Climate Forces Acting on Transportation Infrastructure

Every road, bridge, and drainage structure is continuously exposed to multiple climate stressors simultaneously. This diagram illustrates the six key variables that are used in transportation engineering:

- Precipitation
- Wind
- Temperature
- Freeze-Thaw
- Moisture & Humidity
- Solar Radiation



Sources of Climatic Data for Transportation

Traditional Limitations

- **National Climate Data Center (NCEI):** Data Gaps & Inconsistent Historical Records
- **NOAA NWS Weather Stations:** Sparse Coverage — Rural & Remote Sites Unmonitored
- **State RWIS Stations: Limited to Road Corridors:** No National Network
- **U.S. Climate Reference Network:** Only ~114 Stations — Too Sparse for Site-Specific Use
- **ASOS/AWOS Airport Stations:** Airport-Focused — Not Representative of Road Conditions

MERRA-2 Advantages

- Global Coverage
- Hourly Resolution
- 45+ Year Record
- Zero Missing Values
- Any Project Location
- The Exact Values Needed for Engineering Decisions

MERRA Data to Drive Engineering Needs

Temperature — At Any Elevation

Humidity — Specific And Relative

Wind — Full Wind Speed Vector

Solar — Direct, Net Shortwave

Precipitation — Total Rainfall

Freeze-Thaw — Temperature Crossing 0°C

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MERRA Data to Drive Engineering Needs

Temperature — At Any

Humidity — Specific And

MERRA-2 contains hundreds of atmospheric, land surface, and radiation variables – we have only scratched the surface.

Precipitation — Total Rainfall

Freeze-Thaw — Temperature Crossing 0°C

Why Choose MERRA-2 for Transportation?

- **Complete Global Coverage** — No Gaps, No Missing Data
- **Hourly Temporal Resolution** — Finer Granularity Vs Weather Stations
- **Long Historical Record Since 1980** — 45+ Years of Consistent Data
- **No Missing Values** — Gap-Free Quality-Controlled Dataset

207,936
Grid Points Worldwide

45+
Years of Data

82+ Billion
Data Records

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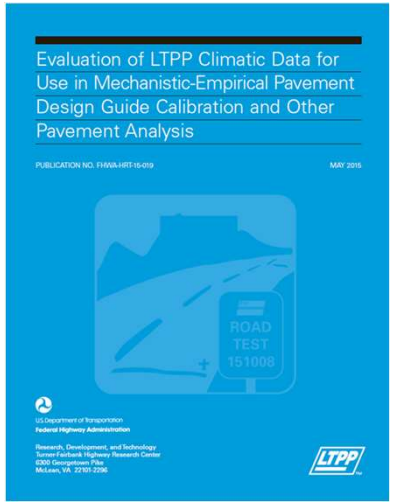
MERRA-2 Validation for Pavement Engineering

- **Strong Correlation** — Matches Weather Station Observations
- **Accurate Pavement Modeling** — Successfully Compared To MEDPG Results
- **Freeze-Thaw Performance** — Useful For Deterioration Modeling
- **MEPDG Validated** — Suitable For MEPDG Calibration
- **Universal Coverage** — Fills Gaps Where Weather Stations Are Unavailable

FHWA Publication (FHWA-HRT-15-019)



The LTPP InfoPave Climate Tool

What It Is

- Web-based database delivering MERRA-2 climate data
- Developed under FHWA LTPP
- infopave.fhwa.dot.gov
- Used by DOTs & researchers

What It Delivers

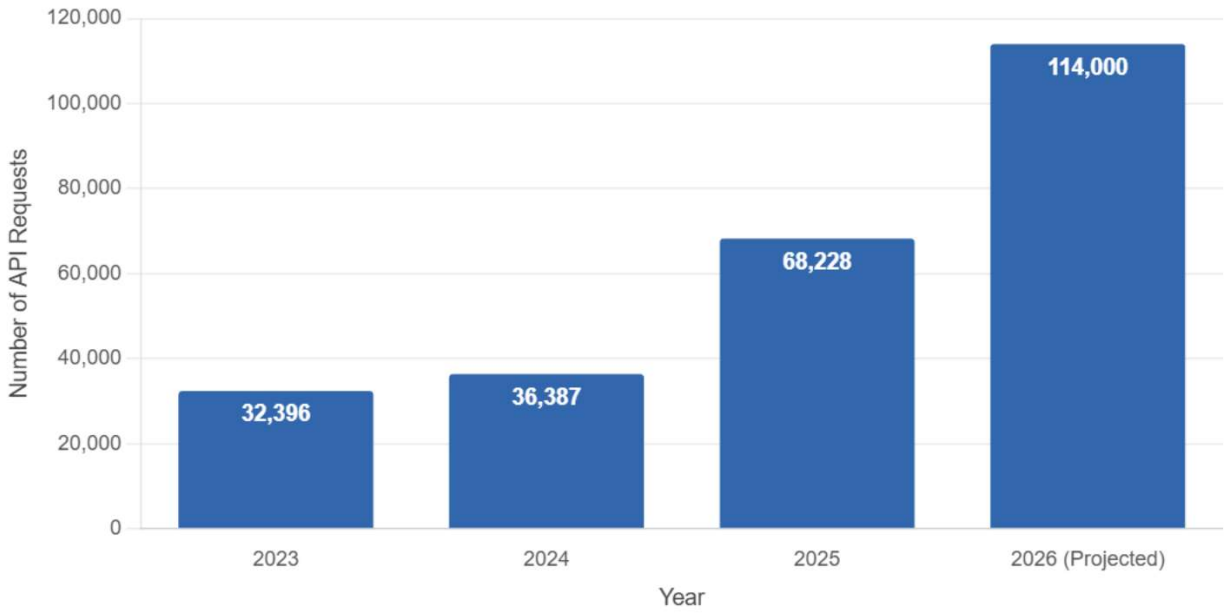
- Hourly, Daily, Monthly, and Annual data
- Hourly Climatic Data in HCD file format
- Data for any global location
- Seamless integration with engineering workflows

LTPP Climate API

- RESTful API for Access
- Query by GPS Coordinates
- Already proven with PavementME
- Ready for AASHTOWare Integration

Climate Tool Usage Has Gone Viral!

The current LTPP Climate Tool API has seen substantial growth. From 32,000 queries to over 114,000 projected in three years.



Limitation of Current API Implementation

Current API

Limited to AASHTOWare PavementME/ EICM use only

HCD Format with basic attributes only

A Fraction of available MERRA-2 attributes exposed

Enhanced API (Coming)

37 Additional Attributes for Production and Research Use – Temperature (9), Solar (11), Precipitation (10), Humidity (3), and Wind (4)

Delivered Hourly, Daily, Monthly & Annual

The current API exposes only a fraction of available MERRA-2 data; the enhanced version unlocks 37 additional attributes across temperature, solar, precipitation, humidity, and wind — delivering richer inputs for advanced pavement and bridge design, at any time scale, and built to AASHTOWare OpenAPI standards.

Use Case: AASHTOWare Pavement Design

Integration — Powers Pavement ME/EICM

MEPDG Calibration — Climate Inputs

Hourly Inputs — ME Design Calibration

Solar Radiation — Thermal Gradient Analysis

Freeze-thaw — Forecast Pavement Cracking

Any Location — No Weather Station Needed

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Use Case: AASHTOWare Bridge Design/Rating

Thermal Expansion — Deck Expansion/Contraction

Humidity Data — Deck Deterioration

Wind Loading — Aerodynamic Stability Analysis

Lifecycle Planning — Long Term Climate Trends

Freeze-Thaw — Drives Corrosion Modeling

Remote Sites — Data for any Location

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Use Case: AASHTOWare Bridge Management

MERRA-2 Climate Input

Temperature & Freeze-Thaw — Annual Cycles, Extreme Temp Ranges, Pavement Temp Profiles

Humidity & Precipitation — Corrosion Exposure Index, Scour & Flood Frequency

Wind & Solar — Thermal Load, Surface Energy Balance & Bridge Deck Temp.

Climate-Powered BrM Workflows

Element Deterioration — Climate Severity Index Drives Decay Rates by Bridge Element Type

Inspection Scheduling — High Freeze-Thaw & Humidity Corridors Triggered More Often.

Preservation Actions — Optimal Treatment Timing Based on Climate-Adjusted Service Life

Lifecycle Cost Analysis — Climate-weighted LCCA for Bridge Preservation Program Budgeting

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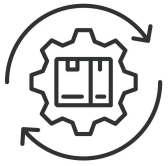
One Dataset – Many Uses

Drainage & Hydraulics — IDF curves • Flood risk • Culvert sizing

Climate Resilience — 45-yr trends • Vulnerability • Scenarios

Airport Infrastructure — FAARFIELD • Frost depth • Wind analysis



Asset Management — Lifecycle • Severity index • Budgeting

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Opportunities:

- Integration with BrM and BrD/BrR – all States benefit
- Pilot an enhanced MERRA-2 API integration directly into a State DOT application. iENGINEERING provides support for technical integration. State DOT provides the project data and validation.

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