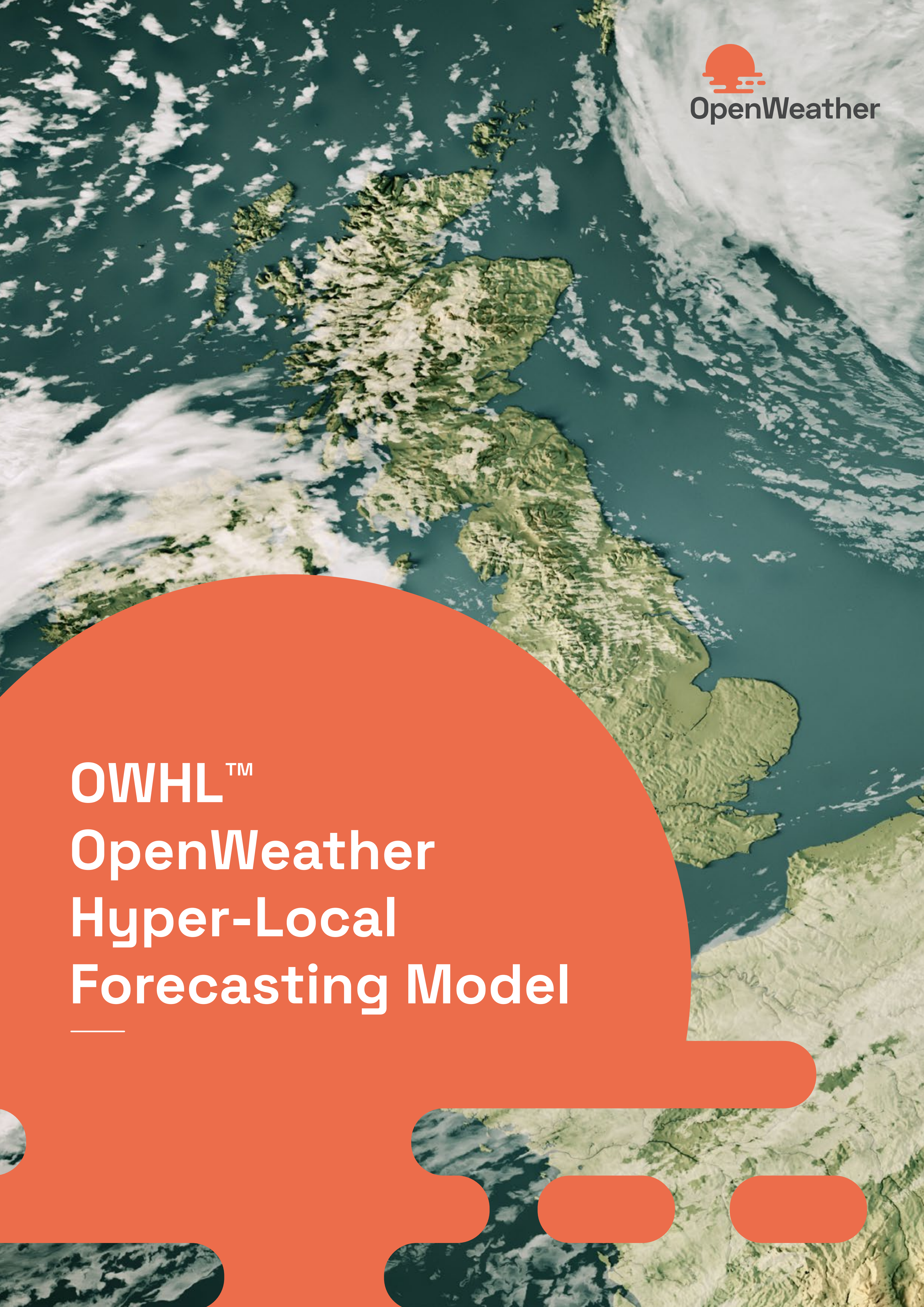


OpenWeather

OWHL™ OpenWeather Hyper-Local Forecasting Model

Overview

OWHL ™ OpenWeather Hyper-Local Forecasting Model enables the delivery of weather data with high resolution and exceptional speed, ensuring timely and precise forecasts. It is an advanced system delivering precise, hyper-local weather forecasts that meet critical business requirements. It assimilates data from weather stations, radar, satellite imagery, global forecasting models, into sophisticated numerical weather prediction models. Machine learning refines these inputs detecting anomalies, incorporating new observations, and producing forecasts for local microclimates. Updated roughly every 10 minutes, OWHL ™ ensures accurate, timely insights essential for diverse commercial applications.

OWHL ™Key features:

High-resolution frequently updated forecasting at multiple ranges, with short-range forecasts provide a 100 m resolution updated every 1 minute, mid-range and long-range forecasts come at a 2 km resolution updated hourly.

An **advanced AI system** uses proprietary machine learning algorithms to deliver highly accurate predictions.

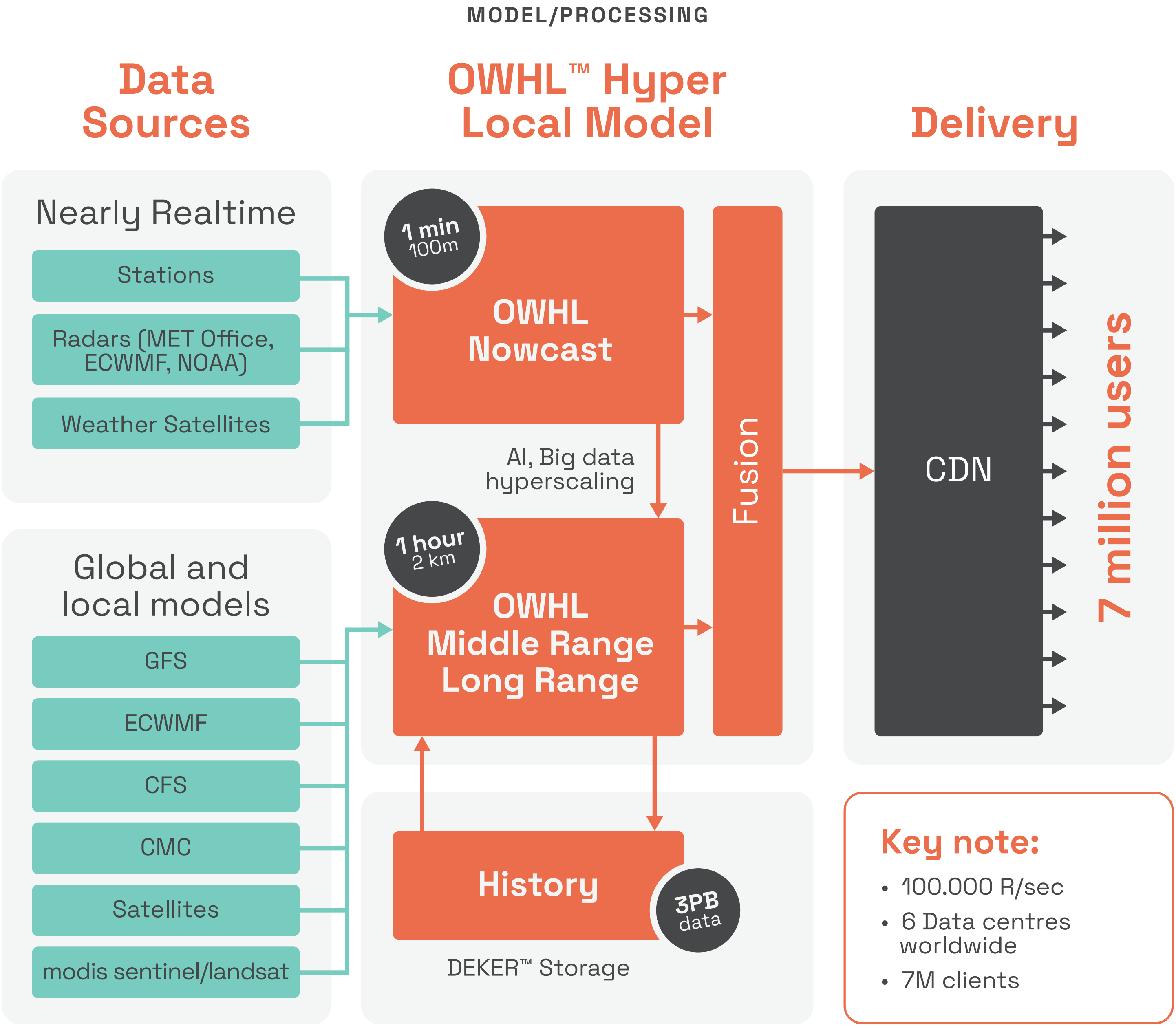
A **history archive** spanning over 40 years provides extensive data for retrospective analysis and long-term forecasting.

Global coverage is achieved through integrated data from radar networks, weather stations, satellites, and established models like ECMWF, NOAA, and the MetOffice.

Quick delivery by leveraging distributed data centers (US, UK, Germany, Singapore) with minimal latency.

OpenWeather Hyper Local Forecasting System

The OpenWeather modelling system blends global model outputs with radar, satellite, and thousands of station/IoT observations. By using machine learning it corrects biases and produces a single, unified forecast with frequent (every 10 minutes) updates. It offers “NIR” (Nowcasting Immediate Range) for the next 3 hours and extends out to weekly and monthly horizons by incorporating global and climate models.



Key note:

- 100.000 R/sec
- 6 Data centres worldwide
- 7M clients

OpenWeather's forecasting system comprises two major modules:

1. OWHL™ NIR Nowcast Short-Range Forecast

The OWHL NIR (Nearly Real-Time) forecasting system uses an extensive range of global data sources, each contributing to accuracy, resolution, and timeliness.

Weather stations provide highly precise measurements with an accuracy of ±0.1°C for temperature, ±0.5 m/s for wind speed, and ±2% for humidity. They operate at a fine resolution of approximately 10 meters and offer near-instantaneous updates with latency measured in fractions of a second. This makes them essential for real-time monitoring and verifying forecast models.

Radar systems, sourced from agencies such as the Met Office, ECMWF, and NOAA, provide detailed precipitation data with an accuracy of ±1 dBZ and can distinguish between rain and snow with about 85-90% accuracy. Their resolution ranges from 250 meters to 1 kilometer, depending on the radar type and range. With a latency of only a few minutes, radar is crucial for tracking storm development and short-term severe weather forecasting.

Meteorological satellites offer broader coverage, capturing large-scale atmospheric patterns. Their temperature retrievals have an uncertainty of ±0.5°C, and cloud detection accuracy is around 90%. Depending on the sensor type, resolution varies from 1 kilometer (high-resolution visible imagery) to 5 kilometers (infrared and microwave sensors). However, they introduce a latency of up to 10 minutes due to data transmission and processing. Satellites are invaluable for monitoring global weather systems, tracking storms, and analyzing cloud cover.

By integrating data from these sources, Openweather achieves a balance between local precision and large-scale atmospheric analysis, leading to more accurate and timely weather predictions. This data undergoes rigorous quality control and integration processes, producing a refined global forecast at a resolution of approximately 100 m. Short-term forecasts are updated every 1 minute, offering accurate weather predictions for up to 3 hours ahead.

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2. OWHL™ Middle-Range and Long-Range Forecast

For medium and longer-term forecasts, OpenWeather utilizes deterministic outputs from respected global numerical weather prediction models. The OWML™ ML module aggregates and normalizes data from these sources, employing advanced AI technologies to manage data gaps and enhance forecasting resolution up to 1 km, with forecast horizons extending up to 1.5 years. Forecasts are recalculated every 1 hour, with data continually archived for historical analyses and future model enhancements.

List of models:

The **OWHL™ NIR (OpenWeather Nowcast Model)** provides immediate short-term forecasts for 0–3 hours ahead. It achieves high-resolution forecasting with resolutions ranging from 100 meters to 1 kilometer. Utilizing real-time radar, satellite imagery, and sensor data, this model updates every minute. The OWHL ™ NIR employs AI-enhanced precipitation tracking, delivering precise predictions, particularly effective in urban and densely populated regions worldwide.

The **NOAA GFS (Global Forecast System)** is designed for medium-range forecasting, offering predictions up to 16 days in advance. Initially, it provides a high resolution of 13 kilometers, tapering to 34 kilometers after the first 10 days. The GFS model updates four times daily, covering global atmospheric conditions comprehensively. It is widely recognized for its open-access data, which supports broad-scale weather analysis and predictions globally.

The **ECMWF IFS (Integrated Forecasting System)** excels in medium-range forecasting, known for its superior accuracy and sophisticated 4D-Var data assimilation techniques. It operates at approximately 9 kilometers resolution for deterministic forecasts and about 18 kilometers for ensemble forecasts, updating twice daily. Its industry-leading probabilistic ensemble forecasts and storm tracking capabilities make it an essential tool for weather prediction at a global scale, particularly for Europe and the North Atlantic region.

The **GEM (CMC, Canadian Meteorological Centre)** specializes in medium-range forecasts tailored to North America, providing resolutions of approximately 25 kilometers. Integrated into the North American Ensemble Forecast System (NAEFS), the GEM model effectively captures North American geography, complex terrains, and high-latitude weather patterns. It is updated twice daily.

The **NOAA CFS (Climate Forecast System)** focuses on extended-range forecasting, providing seasonal climate anomaly predictions with resolutions around 56 kilometers. Updated daily, it employs ensemble methods for long-range outlooks, utilizing coupled ocean-atmosphere modeling. It effectively predicts seasonal temperature and precipitation trends on a global scale.

The **WRF (Weather Research and Forecasting) Models** provide high-resolution regional forecasts, typically between 1 to 3 kilometers resolution. These models are highly detailed and customizable, regularly updated hourly or as required. They are ideal for forecasting localized weather events, including thunderstorms, urban microclimates, and severe weather conditions, tailored to specific regional needs.

Delivery with Global Content Data Network (CDN)

OpenWeather's Global Content Data Network (CDN) distributes data worldwide with low latency and high availability (99.9% availability), enabling minute-by-minute local forecasts to reach users quickly. Forecast data from the OWHL™ Hyper Local model is disseminated via OpenWeather's robust Content Data Network (CDN). This infrastructure comprises strategically placed data centers in the US, UK, Germany, India and Singapore.

High availability of
99.9%

Scalability with up to
100,000 requests per second

Strategically placed data centers
in the US, UK, Germany, and Singapore for minimal latency (6 data centers)

Serves
7 million users
for local forecasts and updates

DEKER™

Data storage DEKER™

Openweather DEKER™ data base stores over 3 PB of historical weather data produced by OWHL™ Middle-Range and Long-Range Forecast component. DEKER™ is a Python-based platform developed by OpenWeather, designed to efficiently store and access extensive weather data. It supports scalable storage of large virtual arrays through tiling, enabling efficient management of substantial datasets. DEKER™ facilitates parallel processing of these array tiles and incorporates its own locking mechanism to allow concurrent read and write operations, enhancing data handling efficiency. The platform also offers flexible data slicing using timestamps and named labels, and supports industry-standard formats like NumPy and Xarray, simplifying integration into existing workflows. Additionally, DEKER™ provides storage-level data compression and chunking via HDF5, optimizing storage efficiency.