# Game Day: Smart Weather for Safe and Efficient Smart Stadiums and Venues

LIVE EARTH

fathym®

# The Problem

Weather poses a unique set of challenges to decision-makers at outdoor arenas and stadiums, who are tasked with keeping the safety and comfort of spectators, athletes and performers at the forefront of all decisions. Furthermore, tactical decisions around weather with regards to turf management, event set-up, and crowd management on game day are required in order to keep everyone safe and the event running smoothly when the weather becomes impactful. Managing stadium and arena-specific events like concerts and athletic matches presents special challenges, and severe weather significantly impacts the event experience.

Good weather forecast information is vital for decisions that are being made, from when to water the turf, to the timing of moving spectators out of the stands due to lightning or other hazardous weather.

Additionally, weather information is just one dataset decision-makers have to manage. Handling large crowds can pose its own challenges, including security, accidents, damage to property or even medical emergencies. Merging multiple data feeds into one monitoring platform speeds up response times and optimizes security efforts. Consolidated alert-driven systems are invaluable when large groups of people rely on information and accurate decisions from the stadium's operations staff to keep them safe while enjoying the event.

When incidents occur, stadium command centers could be much more efficient in their response. Most command centers are equipped with multiple screens, all displaying different data feeds including information around stadium security, crowd flow, event parking, vehicle traffic and weather. These disparate systems create unnecessary confusion in a day and age where there are technologies that can ease the burden.

# Road and Sidewalk Safety

Operations staff at stadiums in states where winter weather is a concern often have to deal with the effects of snow and ice on pavement surfaces like sidewalks, parking lots and the stands themselves. These conditions are hazardous to fan safety in and out of the event.

Typical weather forecasts do not offer accurate information about how precipitation is going to affect pavement surfaces and roads. In instances where this information is provided, many of those forecasts are simply based on mapping atmospheric precipitation forecasts to a location and inferring the impact to the ground or road surface. In other words, precipitation type and rate converts to road condition state. This road forecast approach is too simplistic and produces false positives, leading to costly delays, accidents and maintenance issues.

Fathym's pavement surface forecast engine relies on cutting-edge machine learning from a global network of fixed and mobile sensor observations, and a proprietary method of blending sensor data with model output data to create highly-accurate, hyper-local pavement and atmospheric forecasts.

Fathym's surface forecasts provide stadiums with more useful and accurate information about the impacts of weather events on sidewalks, parking lots and roads for improved guest and worker safety and situational awareness for maintenance crews. Better road and sidewalk condition forecasts can allow stadiums to plan on increased traffic delays or send out maintenance crews.

## Hyper-Local Forecasts

Though weather forecasts may predict severe weather a few days in advance, the high degree of variability means the risk of adverse weather may not be known until the day of an event. Most atmospheric weather models give a broad, region-wide forecast, making it difficult to know in advance whether that 30 percent chance of thunderstorms will bring safety concerns to a stadium's exact location. Fathym's point-based forecasts allow for the prediction of weather for any geo-location, meaning a stadium can hone in on the forecast for their particular latitude and longitude, rather than the broad region.

# When Lightning Strikes

One of the more serious weather-related issues for open-air stadiums is lightning. Teams are allowed to play in sleet, snow and rain, but current rules require games to halt for strikes occurring within a certain radius of the stadium. The rules for what must be done when lightning is detected within a certain distance of the stadium where an NCAA game is being played are as follows: when lightning strikes within 15 miles (24.12 km) of a stadium, on-field officials should be notified; when lightning strikes within 10 miles (16.09 km) of the stadium, officials must use the public address system to notify attendees of the weather situation and suggest they evacuate for a safer environment; when lightning strikes within six miles (9.66 km) of the stadium, the game will be postponed until the time when no lightning has been detected within six miles for at least 30 minutes.

Lightning can strike miles from the storm that produces it, making it difficult to know when and where a strike will occur. Over the last decade, the National Oceanic and Atmospheric Administration reported 376 fatalities from lightning strikes in the U.S. Sixty-three percent of these fatalities are related to leisure activities.

Tracking weather is an unpredictable process, and fan and team safety is reliant on timely forecast information. Stopping a game due to lightning or adverse weather unnecessarily can result in safety issues, upset fans and economic loss. Increased warning on storms and their potential timing and impact reduces uncertainty and ensures that operations staff make better informed decisions.

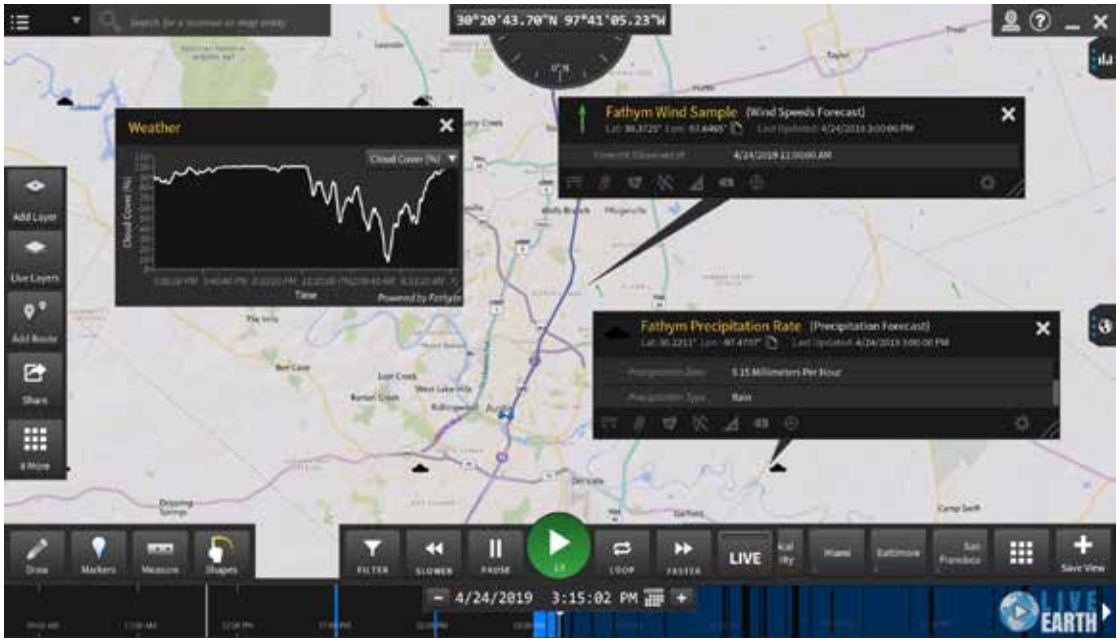

[1] https://www.omicsonline.org/open-access/ncaa-football-and-cloudtoground-lightning-a-probability-analysis-2167-0587.1000112.php?aid=21124
[2] https://www.weather.gov/safety/lightning-victims

# Real-Time Weather Data

Fathym's forecasts can be supplemented with low-cost fixed weather and environmental monitoring stations. These modular environmental monitoring stations provide observations of weather conditions that are then fed back into Fathym's machine learning forecast engine. Fathym's weather stations can report on ground and air temperature, humidity, rainfall, high winds, slick pavement conditions and more.

Fathym's modular weather stations can also include video cameras for increased observational awareness. Cameras can help operators to not only see the weather and pavement conditions of a given location but also add another level of security, giving them the information needed to keep spectators safe.

# Visualizing Weather Data Along with Other Critical Data



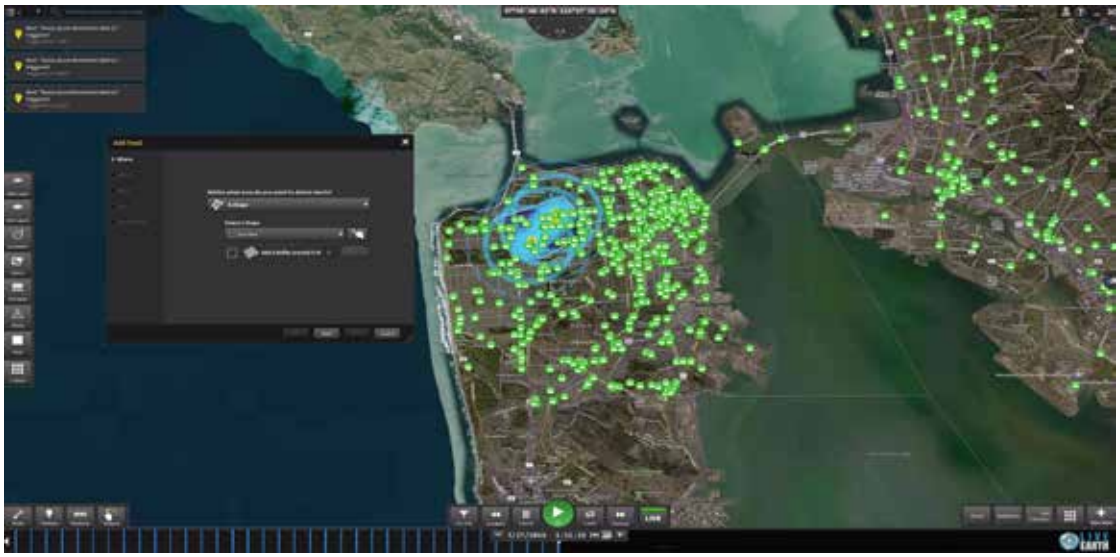

With the help of Live Earth, event operations and security staff can access a wealth of critical information that will help them prepare for games and large events. The capability now exists to ingest and render over six million events per hour in real-time through Live Earth's cutting-edge mapping platform. The extensible platform makes it easy for any system to be integrated, eliminating the issue of disparate, siloed data feeds. Decision-makers can consider all relevant data in one platform, reducing the possibility of missing a critical event.

Operators adopting a consolidated view of their current systems can be more proactive in resolving issues before they spiral out of control. While teams may monitor for different problems, the ability to go to the same view on Live Earth helps them communicate effectively with one another and gives insight into the best solution. Live Earth provides access to data feeds, including Fathym's surface weather forecasts, traffic flow and incidents, traffic cameras, buses and parking garages. These live layers can be viewed alongside existing systems for a combined view that adds rich and valuable context to every situation.

For example, in the above image, New York's Citi Field integrates and visualizes their security cameras, door access points, internal and external facial recognition and drone detection systems on Live Earth alongside weather and traffic. By seeing their integrations in a consolidated view, Citi Field operators are able to share information with relevant staff and quickly deploy resources to necessary areas. They can also drill down on weather stations for real-time observational data.

## Configurable Alerts for Safety

Live Earth's configurable alerting feature generates alerts, which are based off of rules using combinations of data feeds and can be customized to notify event staff about situations of interest. Notifications can be sent by text, email or in-platform, making it easy for staff to move about the venue while still being aware of potential safety issues.

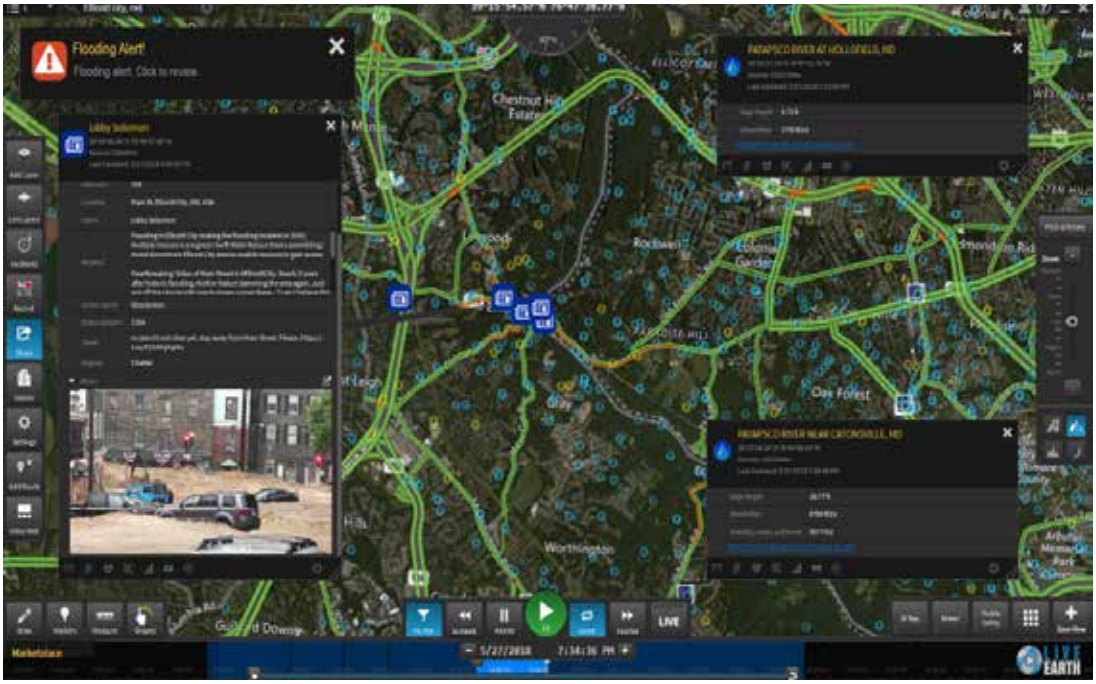


For example, operations teams can be instantly notified about changes in the weather that may affect traffic, such as incoming precipitation and freezing temps, which could lead to icy roads. Tracking and being alerted to these components in real-time can help staff accommodate sudden changes or respond to serious problems as soon as they happen.

For example, when lightning is in the area, stadium staff can receive configured alerts that indicate the proximity of the strike, allowing for better tactical information for delaying the event and clearing the stands. Thirty minute lightning forecasts are also available, which allows for better management of crowds and stadium closures even before the lightning is within a few miles of the stadium.  The automated alert and communication system gives stadium decision-makers

# Rapidly Communicate Critical Information

Live Earth provides an array of fast options for stadium operations teams to communicate on-screen information to their teams. **Screenshots** capture the information visible on the screen and save a high-quality image. **Live links** allow the user to set the parameters of visible live layers, as well as date and time. By sending the link, the user can instantly share the data they want demonstrated to their team. **Screen recordings** capture all movement and information visible on the screen, making it ideal to record scenes for review or training purposes.



Additionally, users can send and receive important information with regards to weather delays due to incoming severe weather in real-time through Live Earth's integration with radio communication systems, WebEx, online team platform or e-blasts. These publishing and communication options enable teams to relay important information to other security personnel or relevant stakeholders. Stadiums can save time and money by making the appropriate adjustments to daily operations.

## Better Situational Awareness for Safer Stadiums

Fathym's weather forecasts and sensor observations from fixed weather stations, along with lightning and weather radar feeds, give actionable insight into oncoming weather, allowing for the stadium staff to closely monitor for situational awareness around weather issues that could directly impact the event. Alerts can be set in the Live Earth platform that are based on impactful weather parameters and send notifications about pertinent changes.

The combination of localized real-time and forecasted weather conditions with other data feeds, gives operators the information needed to keep their stadiums safe and running efficiently.  Knowing when to delay or cancel games based on weather conditions, keeping spectators safe in the event of evacuations, monitoring changing road conditions in and out of a stadium, and keeping sidewalks and stairways clear are all critical to stadium safety.  Whether the situation is major or minor, visualizing all available data in a single place can help decision-makers relay critical information to relevant stakeholders efficiently, ensuring swift action.


Fathym and Live Earth empower security operators and facility managers to be proactive to potential environmental risks. With all data available in a single place, stadium operators can assess threats, acknowledge alerts and visualize all systems in context without missing critical moments, helping them to streamline daily operations to mitigate extraneous costs, improve the overall fan experience and keep their stadiums secure.

For more information, or answers to any questions, please contact Live Earth at www.LiveEarth.com and Fathym at www.Fathym.com.

Live Earth is the world's most advanced real-time IoT Visualization Platform. Built to converge multiple live data streams and time series data into one platform, the interactive system provides real-time alerts to critical situations allowing organizations to respond quickly and increase safety. The platform seamlessly fuses data from multiple sources, sensors and systems that include weather, traffic, IoT, transportation, video management, shot detection systems and more. Live Earth supports multiple markets that include Defense, First Responders, Law Enforcement, Logistics, Energy and Transportation in order to improve efficiency and the organization's understanding of critical scenarios.

Fathym is a low-code rapid innovation framework that empowers developers of all skill levels to rapidly and collaboratively build data applications that optimize businesses and fuel the Internet of Things. By lowering the barrier for entry in developing data and IoT solutions, Fathym minimizes risk by shortening development cycles and reducing reliance on limited expert resources while maximizing flexibility. In giving a larger population of users the power to quickly, easily and economically bring ideas to life, Fathym seeds diverse innovation in the connected world. Fathym harnesses the proliferation of IoT devices and sensor data to accelerate enterprise digital transformation. Fathym simplifies cloud service provisioning and the development of flexible, scalable distributed applications, data visualization dashboards and app-building tools. Our road weather solution combines environmental monitoring sensors with a state of the art, on-demand surface weather forecast model to improve both road and ground condition awareness for many industries including transportation, smart cities and agriculture.

**For more information, or answers to any questions, please contact Live Earth at www.liveearth.com and Fathym at www.fathym.com.**

LIVE EARTH

Phone: (888) 813-4551

Email: info@liveearth.com

Learn More: www.liveearth.com

fathym®

Phone: (855) 532-8496

Email: communications@fathym.com

Learn More: www.fathym.com

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11044 Research Blvd. Austin, TX 78759

www.liveearth.com

1920 13th St. Ste A, Boulder, CO 80302

www.fathym.com