CASE STUDY

# Extreme Weather App – United Arab Emirates

**SUMMARY**

The Extreme Weather App[14] is a freely accessible application that alerts citizens, especially ones with health problems, and government about current and future weather conditions at their current location using a smartphone or web browser. Launched in 2016 by the UAE's Masdar Institute of Science and Technology, the app is powered by a series of algorithms using real-time satellite data and weather forecasting models. It is one of the first to specialise in detecting and predicting sandstorms, which pose a major challenge in the Middle East, especially for those with medical conditions such as asthma.

14. See *https://atlas.masdar.ac.ae/forecast.*

⟳⟲ Dust storms in the Middle East.

### THE PROBLEM

Sandstorms can be a major disruptive force in this Middle East. In 2015, one storm alone was powerful enough to cause extremely low visibility, resulting in hundreds of car accidents and significant flight delays and school closures, causing damage to the economy (Solomon, 2016). The high levels of mineral dust and pollutants in the air can also trigger severe asthma attacks, respiratory diseases and infectious diseases. These storms can even render solar panels ineffective and have detrimental effects on agricultural crops. Recent research has found that severe dust storms are occurring more frequently in the UAE, accelerating the need for a reliable and accurate solution (Solomon, 2016).

### AN INNOVATIVE SOLUTION

Scientists and technologist at the Masdar Institute of Science and Technology sought a new solution to the longstanding problem of sandstorms, which are composed of dust mites, microbes, pollen and sand crystals. In 2016, they launched the Extreme Weather App to allow users to view current conditions through near-live maps, and to alert citizens, especially ones with health problems, when situations deteriorate or a storm event is imminent. Despite its advanced design and functionality, the app was developed and shipped in just over one year.

### NOVELTY

Although a few other dust models exist, the Extreme Weather App is able to provide a highly precise estimation of aerosols over the region, which allows both individuals and government organisations to better prepare for storms. This is possible due to the fact that the innovation team is the first in the Middle East to use the regionally adapted three dimensional chemistry transport model CHIMERE,[15] an open source model for dust and air quality forecasting and simulation that allows researchers to enter weather and land surface variables such as wind speed, humidity and soil composition, in order to produce forecasts of dust and other aerosol/gaseous pollutant species including ozone (Solomon, 2016).

The Masdar Institute's approach is also innovative in that it focuses on complex real-world problems with a multidisciplinary approach. The app pairs the regional expertise and practical knowledge developed at the research institute with sophisticated Earth-observation technologies and scientific modelling to obtain very specific climate characteristics of desert areas such as those found in the UAE.

15. See *www.lmd.polytechnique.fr/chimere*.
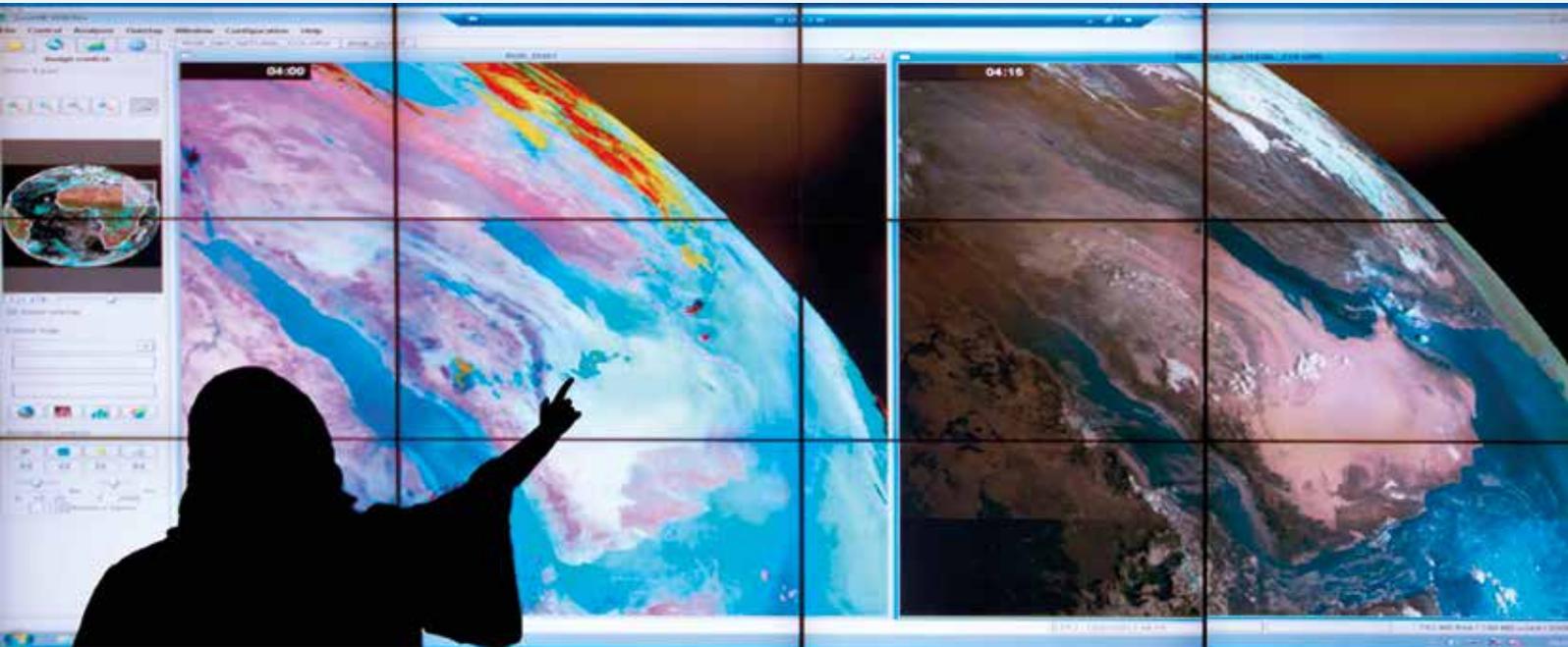
⊕ Extreme Weather App in browser (*Source:* The Masdar Institute).

### IMPACT AND RESULTS

The app represents a turning point in the region's ability to properly manage the impacts of dust storms. Its introduction enables the government and citizens to better predict and prepare for dust and sandstorms. This allows the UAE to more effectively and efficiently manage health, environment and climate policy – all key socioeconomic sectors affected by dust storms – and provide advanced warning ahead of extreme dust events in order to reduce the risk to human life.

The algorithms and models used in the app have been peer-reviewed and validated by top scientists in the atmospheric science field (Naseema Beegum et al. 2016).
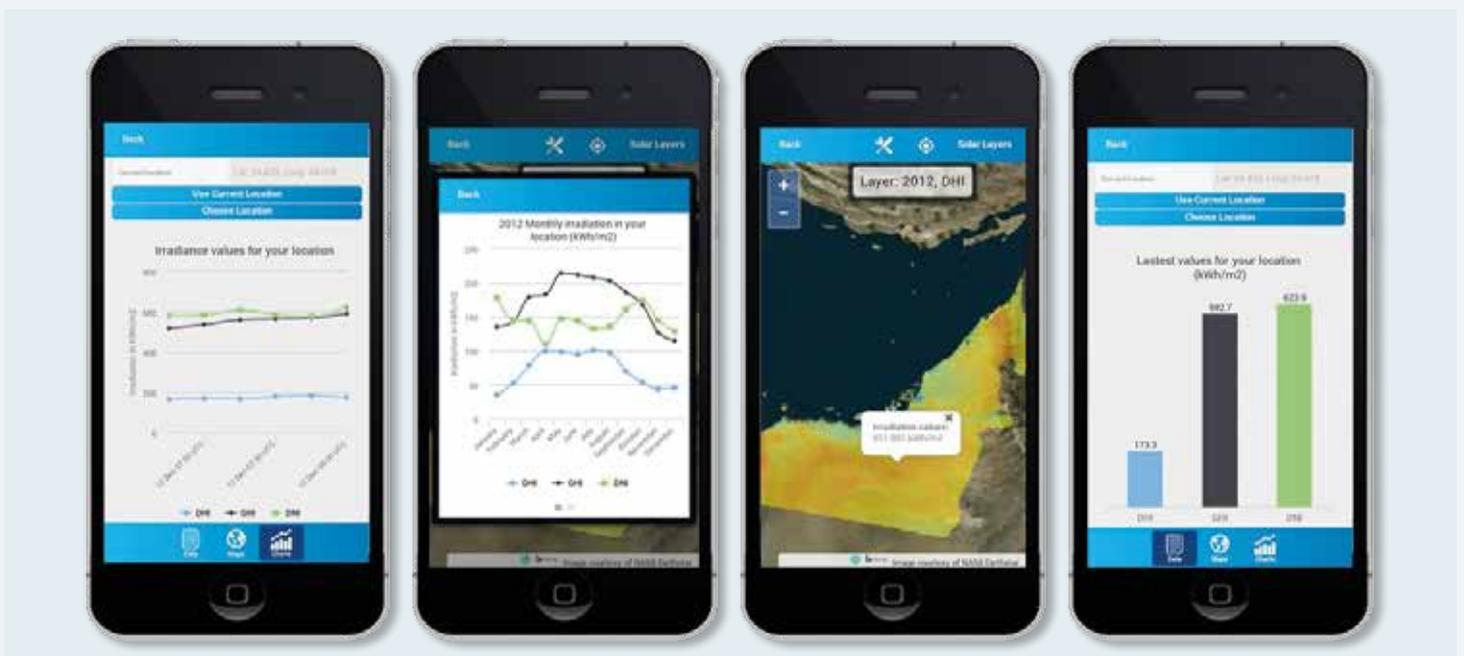


⊕ Extreme Weather App on smartphone (*Source:* The Masdar Institute).
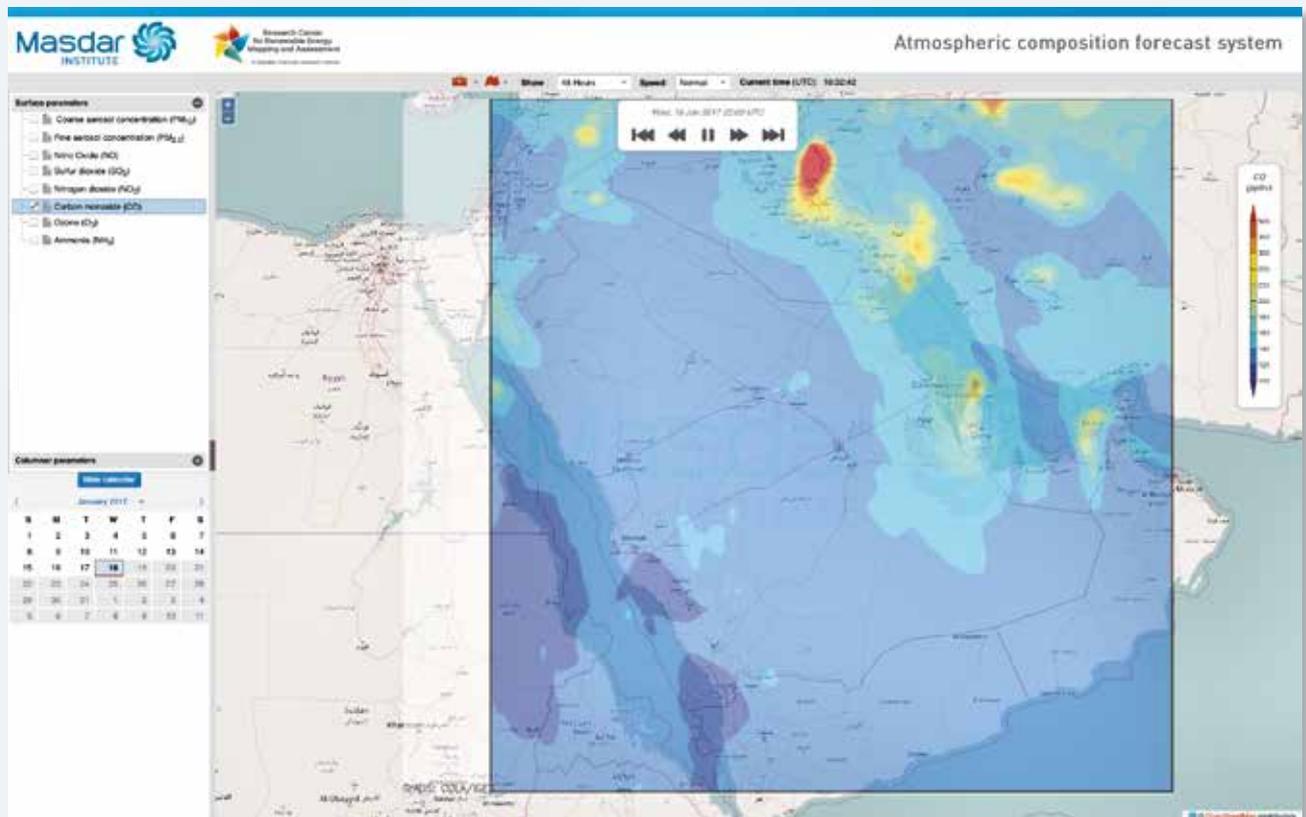
⊕ Extreme Weather App in browser (*Source:* The Masdar Institute).

## REPLICABILITY

Dust and sandstorms are a common problem in the Middle East, and the app can be replicated to address similar problems in other areas. The CHIMERE model is open source, enabling others to freely download the source code and apply it to their own work. However, the scientists at Masdar state that one of the keys to the app's success is knowledge of conditions specific to the regional area. Other countries seeking to develop similar technology should ensure that they rely on human insights based on experience as much as they do technology. The tool is useful not only for citizens and government policy makers, but also for other sectors as well. For example, transportation and traffic safety officials can benefit from the tool, as it can provide motorists, pilots and air traffic controllers with advanced warnings of dust, so they can take action to mitigate risk.

The tool is designed to be versatile and expandable, which opens the door to additional features able to track a variety of parameters. For example, air quality indices, road visibility, surface temperatures and water quality could all be added to the algorithms and maps to further enhance its utility for minimising storm casualties, adverse effects on human health, and economic damage.

## CHALLENGES AND LESSONS LEARNED

The main challenges with the app are technical in nature. The initiative has only recently become possible, as significant computing power is needed to bring together weather models and satellite data to produce weather information that updates every few minutes.