CLIMFORMATICS

Forecasting Services for Business



WASHINGTON CORE

Floods, wildfires, and other severe weather conditions are becoming increasingly common, often with devastating consequences for society. Predicting upcoming severe climate events could help government planners and businesses to better prepare for the future, but until recently, most climate prediction tools have been focused on the long-term horizon rather than the next year or two. However, a California-based start-up is working to change the status quo through accurate near-term climate predictions. Washington CORE recently interviewed Dr. Subarna Bhattacharyya, Co-Founder & CEO of Climformatics LLC, a startup that develops and offers customized climate prediction services, about the impact of climate change on businesses as well as how climate forecasting can help businesses to make informed decisions and avoid loss due to natural disasters.

The following is a summary of Dr. Bhattacharyya's remarks to Washington CORE.

The Need for Climate Forecasting

s the impacts from climate change have accelerated, the demand for climate forecasting services has increased considerably. In 2013¹, I established Climformatics LLC along with Dr. Detelina Ivanova, one of my colleagues at Lawrence Livermore National Laboratory (LLNL).

While working at LLNL, Detelina and I worked on global climate modeling and performed sensitivity studies on a long-term scale, predicting and simulating possible scenarios for 500 to 1,000 years from now. However, we realized that most people and businesses do not need such long-term predictions. Instead, climate prediction time frames of one to five years could help people and businesses to understand potential climate risks such as floods or extreme heat events. For example, people may factor the climate risks into their decision to buy a home, while businesses could enhance their resilience by purchasing insurance and retrofitting their buildings and factories. This was the inspiration for our businesse.

LLNL is located in the Central Valley of California, which is the workhorse of California's wine industry. During our work there, friends often asked questions like "Will there be a drought this year?" or "Would the yield in this area be low this year?" Detelina and I were motivated to launch our business to answer those questions and help farmers and businesses to plan ahead for climate change.

Droughts in California have become a constant challenge, resulting in regulation and high prices for water. Almond farms in particular use a considerable amount of water. Without accurate climate predictions, almond farmers in California often experience a drought after planting, and suffer financial losses as a result. If farmers had access to accurate forecasting data such as expected temperatures, rainfall, wind, and soil moisture, they could make more informed decisions on whether to plant almonds or other plants that don't require as much water in a particular year.

In addition, advance climate predictions can help businesses to enhance their natural disaster preparedness. For instance, Walmart has nearly 5,000 stores throughout the U.S.² With a one-year heads-up on climate data, Walmart can not only prepare for potential climate risks, such as heat waves, wildfires, and floods, but can also more accurately plan its supply chain logistics, business operations and maximize its product promotions. In addition, Walmart can also identify ideal locations for new stores and place the right products in the right aisles at the right time in order to meet customer needs. We believe that customized climate predictions can help businesses and local governments to develop and implement better risk management.

Similarly, predictions can help municipal and local governments to assess their potential climate risks, and they can then coordinate with medical facilities to ensure the availability of medicines and other goods for disaster preparedness.

Modeling the Interactions of Air, Water and Land in Earth's climate

In the past, farmers used historical observation data to estimate their expected annual yields. However, the increasing frequency and intensity of extreme weather events such as wildfires, droughts, and floods have meant that longterm observation time history-based statistical prediction methods are no longer able to provide accurate climate forecasts. The UN Intergovernmental Panel on Climate Change (IPCC) has approved state-of-the-art global climate modeling technologies that are able to provide reasonable large scale and long-term future scenario projections. However, the IPCC approved technologies can have biased outputs, and do not necessarily match with the observed local climate.

Climformatics has therefore developed its own cloud-based Artificial Intelligenceenabled (AI-enabled) climate prediction platform to bridge the gaps between observation and climate and weather models.³⁴ The elements of the biosphere-air, ocean, and land -are all connected. Our platform incorporates climate models, weather models, and high-quality observation data to predict the climate at any customized location during a specific period.

To utilize the models and simulations appropriately, we need to understand the underlying physics of the Earth's climate. All of the variables in climate data, such as temperature, barometric pressure, and wind, are closely related to each other, and cannot be treated as independent variables. In order to develop our Al-enabled platform, it was essential to have a fundamental understanding of not only climate science and data science, but also mathematics, statistics, applied mathematics, applied mechanics, nonlinear dynamics, time series analysis, and signal processing.

Climate Forecasting for Diverse Industries

We believe that our climate forecasting services can be applied to a number of sectors beyond agriculture and local government. For example, insurance companies are very interested in the potential for this technology to fulfill the gap between existing insurance products and future insurance needs. I recently joined the spotlight panel of a Silicon Valley InsurTech meeting on Climate Risk, along with the California Insurance Commissioner.

The energy sector has also been seriously affected by climate change, particularly the renewable energy sector, which depends on the sun and wind. As global economies are making the transition to clean technology, the impacts of climate change on the energy sector will be deepened.

Other industries that have been affected by climate change include retail, shipping, supply chains, logistics, and aviation.

Female Scientists and Climate Change

Women's leadership is essential to understand and respond to climate change. I believe women care about natural resources, water, and energy, and are very concerned about using resources in a sustainable way. In my opinion, women often bring the same values that they use to address the needs of their family to their business and entrepreneurship, and are often driven by factors beyond the desire for fame or wealth.

There are already many female leaders who are active in this field. For example, Dr. Leslie Field⁵⁶ is the founder and CTO of the Arctic Ice Project⁷, formerly known as Ice911 Research.⁸ The Project aims to restore the Arctic sea ice by deploying a thin layer of very small hollow glass microspheres, which will reflect solar energy back to space and allow

young ice to build into multi year-old ice. The Arctic Ice Project has been leveraging the climate modeling offered by Climformatics, and has shown promising results, which have been presented at the United Nations (UN) and to the U.S. House of Representatives.

Pandemics and Climate Change

Last year, Climformatics presented at the American Geophysical Union (AGU) on how climate events such as El Nino and the Pacific Decadal Oscillation are affecting the Earth⁹ in many different ways. This year, we plan to present our research on how pandemics are related to climate change, based on tracking historical data on pandemics and climate events in history.

One of the reasons that I believe there is a relationship between climate change and pandemics is that there is a pattern of heat waves that appears to be correlated with the outbreak of illness. In addition to the outbreak of COVID-19, we have also seen colonies of some marine species that were affected by heat waves in the past. We are exploring and examining the causal relationship between climate change and pandemics based on statistical methods. This is still a work in progress and needs to be explored in more depth in the future.

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Interview by Chiyo Kobayashi, CEO, and Jessie Chen, Research Analyst

Endnote

- https://www.linkedin.com/in/subarna-bhattacharyya/
- ² https://www.statista.com/statistics/269425/total-number-of-walmart-stores-in-the-united-states-by-type/#:~:text=Walmart%20U.S.%20 had%20a%20total,which%2011%2C443%20were%20retail%20stores.
- ³ <u>https://www.weather.gov/about/observation-equipment</u>
- ⁴ <u>http://www.climformatics.com/</u>
- ⁵ https://www.linkedin.com/in/lesliefield/
- ⁶ <u>https://www.arcticiceproject.org/about/who-we-are/</u>
- ⁷ <u>https://www.arcticiceproject.org/</u>
- ⁸ https://www.arcticiceproject.org/
- ⁹ https://www.data.jma.go.jp/gmd/kaiyou/data/db/climate/knowledge/pac/pacific_decadal.html



Dr. Subarna Bhattacharyya, Co-Founder & CEO of Climformatics

Dr. Subarna Bhattacharyya is the Co-Founder and CEO of Climformatics. Climformatics is the winner of a 2014 CleanTech Open Western US Regional Finalist and is a semifinalist in the 2021 global Accelicity Leading Cities competition. Climformatics is now a member of UN's Disaster Risk Resilience ARISE-US. Dr. Bhattacharyya has a novel mission: to predict the climate in order to prepare for an environmentally sustainable future. Dr. Bhattacharyya's passion for climate data science led her to work with the Nobel winning International Panel for Climate Change (IPCC) group at Lawrence Livermore National Laboratory (LLNL) simulating abrupt climate change using global climate models. With two master's degrees in physics and in civil engineering and a PhD in engineering mechanics,

Dr. Bhattacharyya has 20 years of interdisciplinary experience in applying stochastic dynamics, statistical time series, wavelets and machine learning to understand and predict climate data. Dr. Bhattacharyya is also working on developing fire-weather prediction capabilities at Climformatics to improve wildfire risk assessment and mitigation. She has spoken at Cal Tech, Columbia University, the Institute of Electrical and Electronics Engineers (IEEE), the UN ARISE-US symposium for the Wildfire Risk Reduction and, most recently, at the Machine Learning for Industry meeting at LLNL. She has also published in leading journals and worked as a Catastrophe Risk Modeler.

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