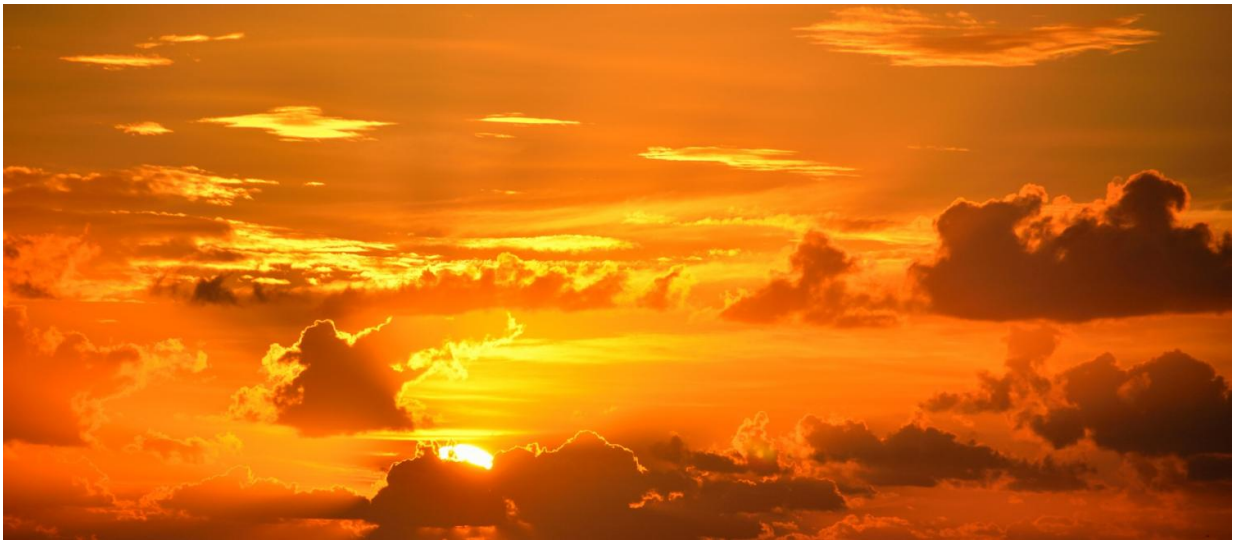
Improving climate observations offers major return on investment

November 8 2017



Credit: CC0 Public Domain

A well-designed climate observing system could help scientists answer knotty questions about climate while delivering trillions of dollars in benefits by providing decision makers information they need to protect public health and the economy in the coming decades, according to a new paper published today.

The flip side is also true, said lead author Elizabeth Weatherhead, a scientist with CIRES at the University of Colorado Boulder. The cost of failing to invest in improving our ability to predict and plan for droughts,

floods, extreme heat events, famine, sea level rise and changes in freshwater availability could reach hundreds of billions of dollars each year, she and her colleagues wrote. Their paper is published in the current edition of *Earth's Future*, an online journal of the American Geophysical Union.

"Improving our understanding of climate not only offers large societal benefits but also significant economic returns," Weatherhead said. "We're not specifying which measurement (or observing) systems to target, we're simply saying it's a smart investment to address the most pressing societal needs."

Data generated by the current assemblage of observing systems, including NOAA's satellite and ground-based observing systems, have yielded significant insights into important climate questions. However, coordinated development and expansion of climate observing systems are required to advance weather and climate prediction to address the scale of risks likely in the future.

For instance, the current observing system cannot monitor precipitation extremes throughout much of the world, and cannot forecast the likelihood of extreme flooding well enough to sufficiently guide rebuilding efforts. "The current decline of our Earth observing systems is likely to continue into the foreseeable future," said Liz Moyer, a climate researcher at the University of Chicago who was not involved in the new assessment. "Unless action is taken—such as suggested in this paper—our ability to plan for and respond to some of the most important aspects of climate, including extreme events and water availability, will be significantly limited."

Weatherhead and a team that included four NOAA laboratory directors and many other prominent climate scientists urge that investments focus on tackling seven "grand challenges," such as predicting extreme weather

and climate shifts, the role of clouds and circulation in regulating climate, the regional sea level change and coastal impacts, understanding the consequences melting ice, and feedback loops involving carbon cycling. In each category, observations are needed to inform process studies, to build long-term datasets against which to evaluate changing conditions,and ultimately to improve modeling and forecasting capabilities.

"We are on the threshold of a new era in prediction, drawing on our knowledge of the entire Earth system to strengthen societal resilience to potential climate and weather disasters," said co-author Antonio Busalacchi, president of the University Corporation for Atmospheric Research. "Strategic investments in observing technologies will pay for themselves many times over by protecting life and property, promoting economic growth, and providing needed intelligence to decision makers."

"Well planned observations are important to more than just understanding climate," agreed Deon Terblanche, director of research at the World Meteorological Organization. "Predicting the weather and extreme events, and managing water availability and energy demand will all benefit,"

"Developing observation systems focused on the major scientific questions with a rigorous evaluation process to ensure the measurement quality is fit-for-purpose—as the authors propose—will more than pay off in the long run," said Tom Gardiner, a principal research scientist at the UK's National Physical Laboratory.

Objective evaluations of proposed observing systems, including satellites, ground-based or in-situ observations as well as new, currently unidentified observational approaches, will be needed to prioritize investments and maximize societal benefits, the authors propose.

"We need to take a critical look at what's needed to address the most important climate questions," said NASA scientist and co-author Bruce Wielicki.

Not all new observing strategies would necessarily require expensive new systems like satellites, the authors pointed out. For example, after a devastating flood hit Fort Collins, Colo. in 1998, the state climatologist developed a network of trained volunteers to supplement official National Weather Service precipitation measurements using low-cost measuring tools and a dedicated web portal. The Community Collaborative Rain, Hail and Snow now counts thousands of volunteers nationwide who provide the data directly to the National Weather Service.

Using a rigorous evaluation process to develop a robust network of observation systems focused on the major scientific questions will more than pay off in the long run, the authors concluded.

"The economic risks from climate change are measured in trillions of dollars," agreed Rich Sorkin, CEO of Jupiter, a Silicon Valley-based company that provides intelligence on weather and climate risks around the globe. "So an improved, properly designed observing system, with commensurate investments in science and understanding, has the potential to be of tremendous value to society."

More information: Betsy Weatherhead et al, Designing the Climate Observing System of the Future, *Earth's Future* (2017). DOI: 10.1002/2017EF000627

Provided by University of Colorado at Boulder