The vision of AI2ES is to create trustworthy Artificial Intelligence (AI) methods for diverse environmental science (ES) users that will revolutionize our understanding and prediction of high-impact atmospheric and ocean science phenomena and create new educational pathways to develop a more diverse AI and environmental science workforce.

AI2ES News

Edited by Jayne-Marie Linguist, Dr. Amy McGovern, Dr. Philippe Tissot, and Jennifer Warrillow

September 2023 Edition

AI2ES members posing for a group photo at the AMS 2023 Conference in Denver, CO.

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AI2ES Throughout the Years

Year 1

Year 1 kicked off AI2ES with new research projects, new teams, and new initiatives. Many conference, review, and journal papers were submitted to disseminate AI2ES' foundational research in AI, namely explainable AI for environmental science and AI and Machine Learning for severe weather. AI2ES publications in Year 1 also included developing two XAI models and XAI benchmarks. In addition to foundational AI research, AI2ES saw the growth of five use-inspired sets of research projects: convective weather, winter weather, tropical cyclones, subseasonal to seasonal (S2S) prediction for extreme weather, and coastal oceanography.

AI2ES aimed to broaden its impact across higher education and developed three programs geared towards educating students about AI, its applications for environmental science, and broadening the AI workforce. The first program of this kind was the Artificial Intelligence Community College Program to Develop and Broaden the AI Workforce. A pilot of this program was launched at Del Mar College (DMC) in Corpus Christi, Texas. Next, AI2ES partnered with other research groups, the Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University and the National Center for Atmospheric Research (NCAR) to develop the Short Course on XAI for Environmental Science and the Summer School on Trustworthy AI for Environmental Science, respectively.

Lastly, in Year 1 of AI2ES, researchers, postdoctoral fellows, and graduate students began foundational research in AI risk communication. The team has been an integral part of AI2ES to conduct convergent research and study comprehensively the trust dynamic involving the foundational methods underlying the AI models, the development of environmental models and the communication of AI predictions to a variety of stakeholders. The AI2ES risk communication team was featured in our August 2023 newsletter which highlights their work, achievements, and roles in AI2ES.

Year 2

Year 2 of AI2ES introduced new research projects, collaborations, and convergent science applications. In addition to the foundational and use-inspired research projects in Year 1, AI2ES began researching six new topics in Year 2. Foundational AI research published Year 1 XAI benchmarks, published a book chapter on XAI, and examined uncertainty qualification of XAI. New topics for foundation AI research also included robust AI and physics-based AI. The use-inspired research projects grew by four cases to conduct research on coastal fog predictions, coastal inundation predictions, sea turtle conservation, and ocean eddy prediction. AI2ES publications in Year 2 increased with benchmarks, conference papers, and even a book chapter on XAI to raise awareness of XAI applications in earth science for the computer science community.

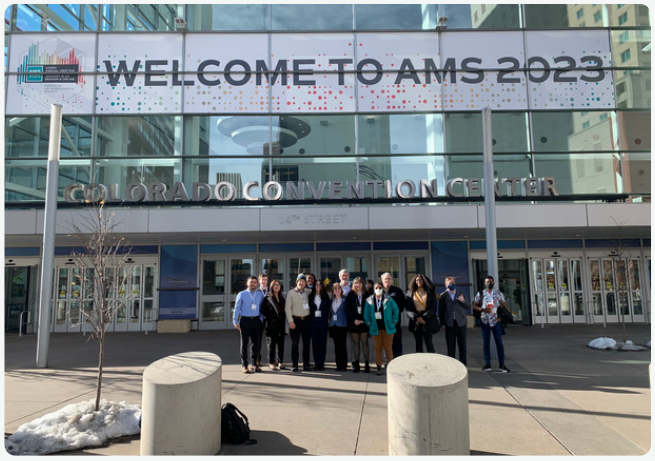
AI2ES also collaborated with more stakeholders and risk communicators to improve AI models. Interviews started to gauge very early in the development cycle future users' reaction and preferences as winter weather and fog predictions AI models are developed. Both the sea turtle conservation and ocean eddy prediction use-cases sought stakeholder and risk communicator input while developing new AI models. The sea turtle conservation team even guided stakeholders through a cold-stunning event in early February 2021 in the Laguna Madre in Texas.

Year 3

Year 3 was an eventful year for AI2ES. The use-inspired research projects continued from the previous two years and developed multiple new models and published more papers and benchmarks to increase AI2ES' intellectual outreach in the AI community. A major focus of AI2ES in Year 3 were the advances in nurturing the next generation of talent at all levels. AI2ES, along with the National Aeronautics and Space Administration (NASA) funded two middle school coding camps at DMC which reached 36 students in Corpus Christi, Texas and Texas A&M University-Corpus Christi (TAMU-CC) partnered with DMC to increase high school and middle school recruitment efforts. A partnership with the American Meteorological Society (AMS) formed to create Project Atmosphere that provided additional K-12 outreach for teachers across the nation. At the university and college education levels, DMC had two active cohorts participate in an education pipeline where several students have transferred to TAMU-CC to join the Computer Science, Physics and the Geographic Information Science (GIS) programs. Many new students and researchers joined AI2ES in Year 3 including 12 postdoctoral fellows, 19 graduate students, 9 Research Experiences for Undergraduate (REU) students, and 21 students in the DMC GeoAI program. The July 2023 newsletter featured AI2ES students who participated in REU and internship opportunities across the country.

Broadening participation and community building was another focus in Year 3. The AI2ES full cohort includes diversity of race, gender, LGBTQIA+, level of experience, first-generation students, and socioeconomic backgrounds; multiple Hispanic/Minority Serving Institution outreach efforts were successful with DMC, TAMU-CC, and CIRA. Additionally, two NSF ExpandAI grants were awarded to AI2ES which began at the beginning of this month. These grants are "PARTNER: Expand AI2ES for 4D space-time organization of precipitation processes and extremes, visualization tools, and workforce development" and "PARTNER: An AI/ML Collaborative for Southeast Florida Coastal Environmental Data and Modeling Center."

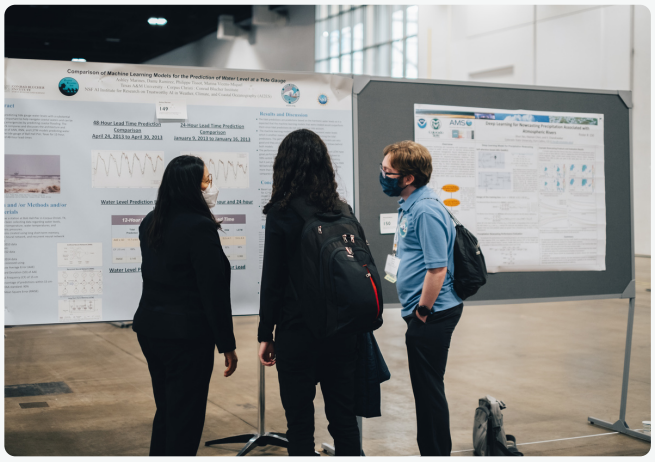
AI2ES now includes over 130 members and hosts bi-weekly site-wide meetings that are open to all. The AMS 2023 conference in Denver, Colorado brought together 70 members of AI2ES for the first time since the COVID-19 pandemic. At the AMS 2023 Conference, AI2ES members were authors or co-authors for 39 oral or poster presentations, one panel, and chaired and participated to many sessions. Some of the AI2ES highlights included our institute Director, Dr. Amy McGovern, being one of the speakers for the 2023 Presidential Forum kicking off this large conference and entitled "*Using Data to Drive Science, Inform Decisions, and Enrich Humanity*".

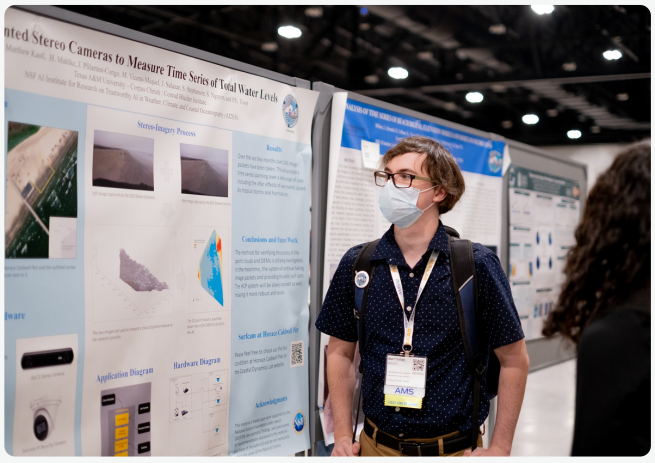


AI2ES members posing for a group photo in front of the AMS 2023 Conference in Denver, CO.

Along with the AMS AI Conference organizers, the AI2ES leadership also organized and animated a presidential session/panel entitled "How AI can Drive New Science and Improve Decision Making for all People" allowing a very engaged and most timely discussion on the role of AI in our field between OU's Kelvin Droegemeier, NOAA's Gina M. Eosco and The IMB/Weather Company's Peter Paul Neilley. The president panel was moderated by AI2ES leaders Amy McGovern, John Williams and Philippe Tissot. The AMS 2023 Conference was the highlight of the first AI2ES newsletter which featured the research presented at the conference and spotlighted fond memories of the team in Colorado. Since the conference, Raven Reese led efforts to create a monthly newsletter for AI2ES that includes working group updates, student spotlights, and featured research in AI2ES.

Going forward, AI2ES has many plans for Year 4 including more publications, improving predictive models, conducting interviews of users on AI predictions, and continuing collaborations and workforce development. Just as Year 4 has begun, Drs. Amy McGovern and Kara Sulia represented AI2ES in Washington DC (read below) and abstracts for the 2024 AMS Conference in Baltimore, Maryland have already been submitted. Year 4 will be an amazing year for AI2ES, full of research, programs, and fond memories. As this year unfolds, the AI2ES newsletter will continue to feature the accomplishments and research that are made along the way.





Photos of AI2ES members attending the AMS 2023 Conference in Denver, CO.

Some AI2ES Major Events Timeline

2020

August 26: NSF Announcement: "NSF advances artificial intelligence research with new nationwide institutes"

September 1: Start of AI2ES

2020 peer-reviewed publications by AI2ES: 1

2021

April 21: Kiiitv.com: Del Mar College offers first of its kind Artificial Intelligence certificate course

June 1: Year 1 NSF Annual Review

2021 peer-reviewed publications by AI2ES: 8

2022

January 23-27: AMS 2022 Conference in Houston, TX | 33 presentations, 1 panel

April 20: AAAS EurekAlert!: Can University of Oklahoma research team clear up biases in artificial intelligence?

August 22-24: Year 2 NSF Annual Review

2022 peer-reviewed publications by AI2ES: 18

2023

January 6: AI2ES @ AMS - first live meeting of AI2ES at NCAR

January 8-12: AMS 2023 Conference in Denver, CO | 40 presentations, 1 panel

February 3: First AI2ES Newsletter - AMS Conference Edition

May 10: AI Research conducted by Amy McGovern and Team Recognized in The New York Times and CBS News This Morning

September 11-12: Year 3 NSF Annual Review

September 18-19: Drs. Amy McGovern and Kara Sulia represent AI2ES in Washington DC

2023 peer-reviewed publications by AI2ES (so far): 10

AI2ES Takes on Capitol Hill

On Sep 18-19, Dr Amy McGovern (OU) and Dr Kara Sulia (UAlbany) traveled to DC to present AI2ES's work to both the National Science Foundation (NSF) and to members of congress. This event dubbed "AI on the hill" included directors and members of each of the 25 funded NSF AI institutes. The goal was to showcase the amazing breadth and depth of the work being done in AI across the nation.

Drs McGovern and Sulia represented AI2ES and highlighted our use-inspired AI for a wide variety of weather applications. We focused on impactful weather across the nation, with hands-on demos of severe weather, tropical cyclones, and winter weather. We had non-stop visitors from a variety of congressional offices, including staffers from both senators and representatives as well as people from other government agencies.

NSF has funded 25 separate AI institutes, cumulatively since 2020. AI2ES was one of the initial 7 institutes funded in 2020, and each year has added approximately 7-10 more. The impact of the institutes can be seen across all aspects of society, including agriculture, healthcare, privacy, education, and more. In total, NSF has invested a half of a billion dollars in the AI institutes nationwide and it was amazing to see the wide variety of applications and work being done in AI across all of the institutes.

Photos of Drs. McGovern and Sulia in Washington DC

AI2ES in the News

Over the last few months, AI2ES has been featured in news articles from Nature.com and on the Colorado State University website. These articles highlight the research being conducted by Drs. Imme Ebert-Uphoff, Elizabeth Barnes, Chuck Anderson, and Mr. Kyle Hillburn. Their research in these articles focuses on using AI in weather forecasting and climate change solutions. To read more about their research, visit:

nature.com, "The outlook for AI weather prediction" by Dr. Imme Ebert-Uphoff and Kyle Hillburn

Colorado State University, "AI helping to unravel complexity of climate, weather and land use, find solutions to climate change" by Jayme DeLoss

Colorado State University, "CSU researchers on the outlook for AI weather forecasting" by Matt Rogers, CIRA