NASA & ESA “Earth Science to Action” and “Earth Action”

Florian Schwandner

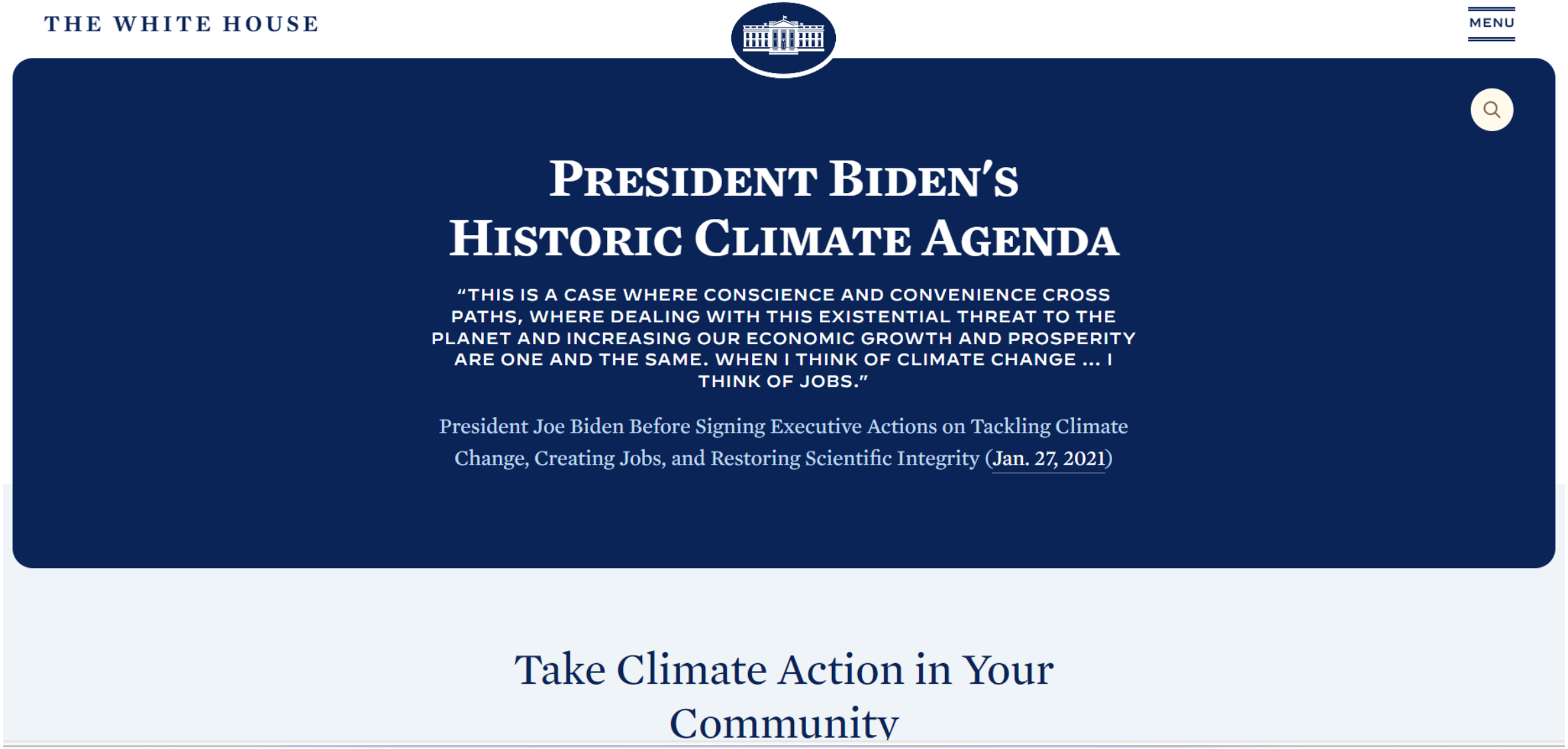
Chief, Earth Science Division

NASA Ames Research Center

1. 2021 US President’s call to action on climate change
2. NASA’s Earth Action Program Area
3. NASA’s Earth Science to Action 10-year strategy
4. ESA’s Earth Action Earth Observation Science Strategy

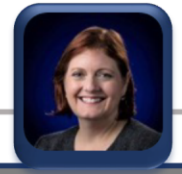
2021 US President's call to action on climate change

https://www.whitehouse.gov/climate/



NASA HQ Earth Science Division Leadership

Karen St. Germain
DIVISION DIRECTOR



Julie Robinson
DEPUTY DIRECTOR

Sid Boukabara
Senior Program Scientist, Strategy

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Communications Lead

ELEMENTS

Michael Seablom
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EARTH SCIENCE TECHNOLOGY OFFICE (GSFC)

Deputy Associate Director
Vacant

Scott Schwinger
Associate Director (Acting)

FLIGHT PROGRAMS

Deputy Associate Director
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RESEARCH & ANALYSIS

David Considine
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Deputy Associate Director
Emily Sylak-Glassman

Current as of 10-10-2023

NASA's Earth Science to Action (ES2A) 10-year strategy

https://science.nasa.gov/earth-science/earth-science-to-action/

The gap:
There is more data and information available to us than ever before – so much so that decision makers cannot access or act on it fast enough, creating a gap between what's available and what people can do with it

NASA's new ES2A strategy is designed to bridge that gap and accelerate and advance the impact of NASA's Earth science to meet this moment for the benefit of all humankind.

Vision
A thriving world, driven by trusted, actionable Earth science.

Our Mission
Compelled by our planet's rapid change, we innovate and collaborate to explore and understand the Earth system, make new discoveries, and enable solutions for the benefit of all.

ESD's ES2A Rollout Roadshow started at Ames on March 13, 2024
Photo: Sid Boukabara (HQ)

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Strategic Goal

Within a decade, we will advance and integrate Earth science knowledge to empower humanity to create a more resilient world.

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ES2A Objectives

Holistically Observe, Monitor, and Understand the Earth System

Using the power of science, cutting edge technology, engineering, modern tools and infrastructure, partnerships, and space-based observations, NASA will build a global framework that will allow constructing a comprehensive digital description of the Earth system. This approach will include the Earth environment's physical and geological systems, including surface and interior, biologic, and chemical components, as well as human and other relevant systems. The outcome will help answer challenging science questions posed by the community and allow a thorough understanding and monitoring of the Earth system and its interconnected nature. It will also allow the emergence of new applications and discoveries to benefit society.

Deliver Trusted Information to Drive Earth Resilience Activities

Based on our history of understanding Earth as a system and its various applications, we will coalesce and cultivate the diverse communities of Earth science, including working across sectors and across agencies, to generate the science-based decision support information needed by users. When appropriate, we will build efficient and interactive end-to-end tools, models, and assessment systems with the needed latencies, at the appropriate temporal and spatial scales, and with the appropriate uncertainty quantification to serve people, communities, decision- and policy-makers, enabling them to take science-based actions. These activities will support efforts to build Earth resilience, including the development of strategies for mitigation, adaptation, and the assessment of various risks and contingencies associated with global change and its impacts. This approach will also include the investigation of potential risks due to crossing thresholds for climate tipping points and the possibilities for cascading environmental and societal impacts.

Our Approach

We will tap into the NASA Earth science community's end-to-end capability as an open enterprise to incorporate innovation, scientific discovery, and emerging user needs to accelerate the use of Earth science and inform the next iteration of programs, missions, and initiatives.

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Virtuous Cycle
- User needs inform next iteration of programs, missions and initiatives

Public Understanding & Exchange
- Put more scientific understanding into public sphere
- Deliver applied science to users
- Participate in multi-way info exchange
- Use input to inform subsequent work

Solutions & Societal Value
- Offer models, scientific findings and info through Open-Source Science principles
- Support climate services
- Provide science applications and tools to inform decisions

Earth System Science & Applied Research
- Grow scientific understanding of Earth's systems
- Develop predictive modeling for science applications and tools to mitigate, adapt and respond to climate change

Foundational Knowledge, Technology, Missions & Data
- Technology innovation
- Earth observations missions
- Data collected from space, air and ground

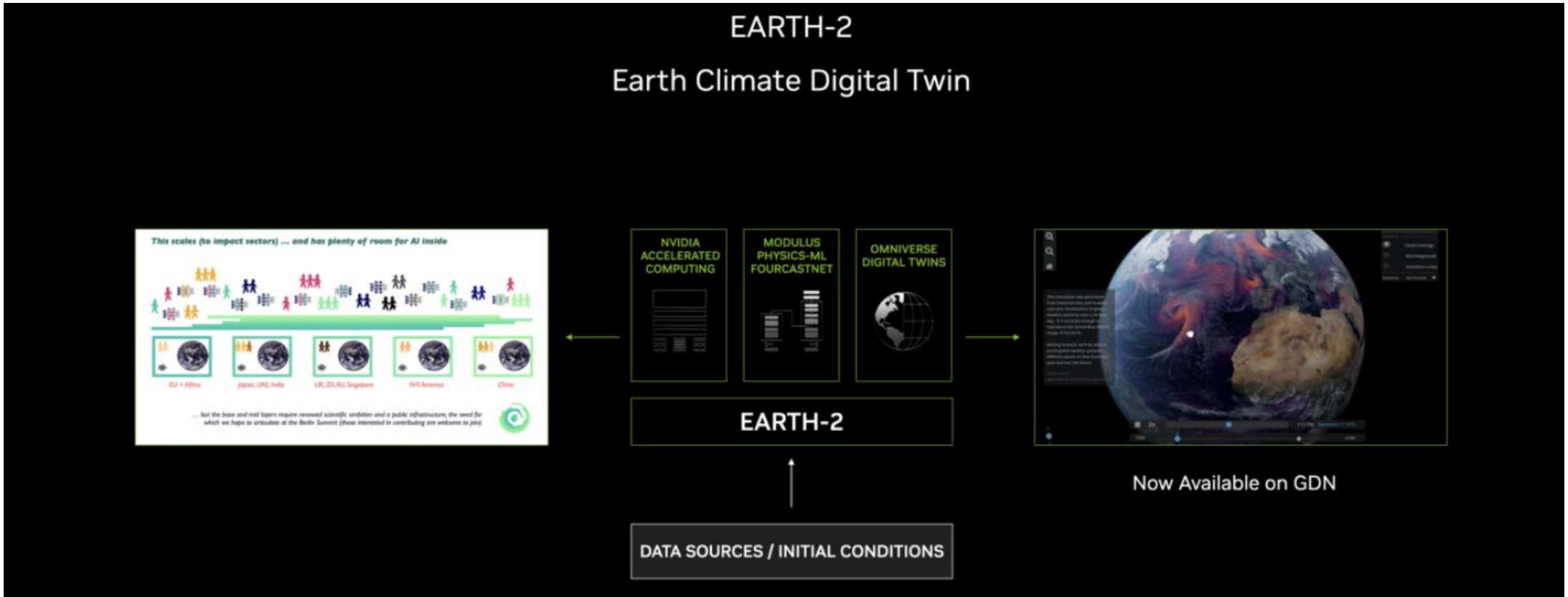
Digital Twins and ES2A

“NASA will build a global framework that will allow constructing a comprehensive digital description of the Earth system.”

Meet Earth-2!

https://www.nvidia.com/en-us/high-performance-computing/earth-2/

NVIDIA Earth-2 is a full-stack, open platform that accelerates climate and weather predictions with interactive, AI-augmented, high-resolution simulation. It includes physical simulation of numerical models like ICON; machine learning models such as FourCastNet, GraphCast, and Deep Learning Weather Prediction (DLWP) through NVIDIA Modulus; and data federation and visualization with NVIDIA Omniverse™. Running on NVIDIA DGX™ GH200, HGX™ H100, and OVX™ supercomputers, Earth-2 will provide a path to simulate and visualize the global atmosphere at unprecedented speed and scale.



ESA's *Earth Action* Earth Observation Science Strategy

- Current ("old" strategy from 2015 https://esamultimedia.esa.int/multimedia/publications/SP-1329_1/SP-1329-1.pdf
- New strategy announced 18 July 2023 https://www.esa.int/Applications/Observing_the_Earth/FutureEO/New_strategy_to_keep_pace_with_our_changing_world
- Revealed at IGARSS opening ceremony 8 July 2024
- Full final document expected "mid-2024".

Strategy's foundation:

- Science Strategy Foundation Study
  → 59 Key Earth Science Questions
- Examples:
  - CSQ2. How has the land biosphere responded to human activity and climate change?
  - CSQ11. How can we improve early warning of extreme events and climate hazards?
  - CSQ17. How is the resilience of key Earth System components changing under multiple anthropogenic pressures?
  - CS41. How does soil status control Earth system cycles and influence surface-air exchange processes?
  - CS54. How different drivers and threats effect the integrity of ecosystem?
  - CS56. Where and how are ecosystems undergoing critical transitions?