Agenda

- NASA Earth Science to Action & GLOBE alignment

- GLOBE's Strategic Plan

- New GLOBE Protocols

- New GIO high-level work plan for community input

Earth Science to Action Strategy

- NASA Earth Science Division's 2024-2034 strategic plan

- In response to 2017 Decadal Survey and other priorities

- **"Action" - accelerating the use of Earth science to support policy and decision making for society's well-being, by:**
  - Scaling up: Scale up existing efforts to get NASA science and data into hands of end users to solve real-world challenges
  - Building bridges: build structural and cultural bridges between research, technology, flight, data, and Earth action elements; identify and remove barriers to collaboration
  - Being user centered: prioritize info exchange with end users to allow their experiences to inform future programs

Earth Science to Action Strategy

NASA EARTH SCIENCE STRATEGIC GOAL:

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

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

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

Earth Science: who's included

When we refer to "Earth science" we're referring to our very large Earth science community, which represents a broad and diverse array of talent, disciplines and approaches, including but not limited to:

Disciplines

Agronomy
Atmospheric sciences
Biogeochemistry
Biology
Cryospheric sciences
Ecology
Geology
Geophysics
Human geography
Hydrology
Land use science
Meteorology
Oceanography
Physics
Radiation sciences

Approaches

In situ measurements
Airborne observations
Remote sensing
Research
Modeling
User engagement
Decision support
Capacity building

Earth Science to Action

Public Understanding & Exchange

We engage broader audiences and data users to:

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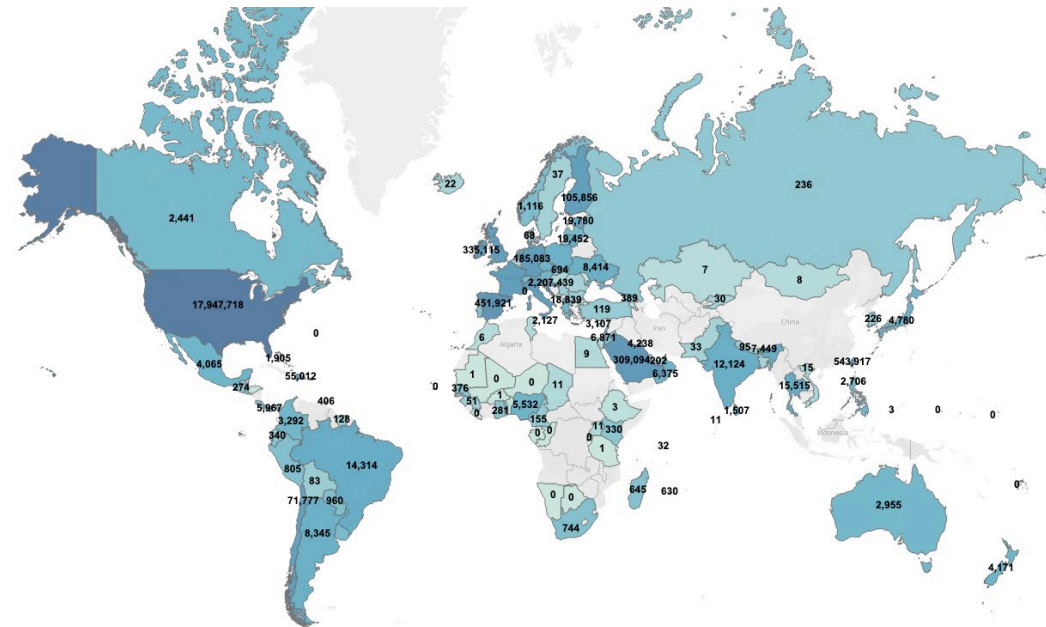- Use input to inform subsequent work

GLOBE and Earth Science to Action Alignment

Foundational Knowledge, Technology, Missions, & Data

Foundation of strategy built upon technology innovation, Earth observations missions, and data collected from space, air, and **ground**. (Knowing)

Data submitted to GLOBE in FY23 (10/1/2022 – 9/30/2023)

(There are >255 million measurements total in GLOBE database as of July 13, 2024)

GLOBE and Earth Science to Action Alignment

Earth System Science & Applied Research

- Grow scientific understanding of Earth's systems

2006

Validation of the MODIS snow product and cloud mask using student and NWS cooperative station observations in the Lower Great Lakes Region

Timothy W. Ault [a,*], Kevin P. Czajkowski [a], Teresa Benko [a], James Coss [a], Janet Struble [c], Alison Spongberg [b], Mark Templin [c], Christopher Gross [d]

GLOBE Program
(cloud and snow)
- 1447 observation
- 77 schools

SATELLITES Program
(clouds and snow)
- 1025 observations
- 52 schools

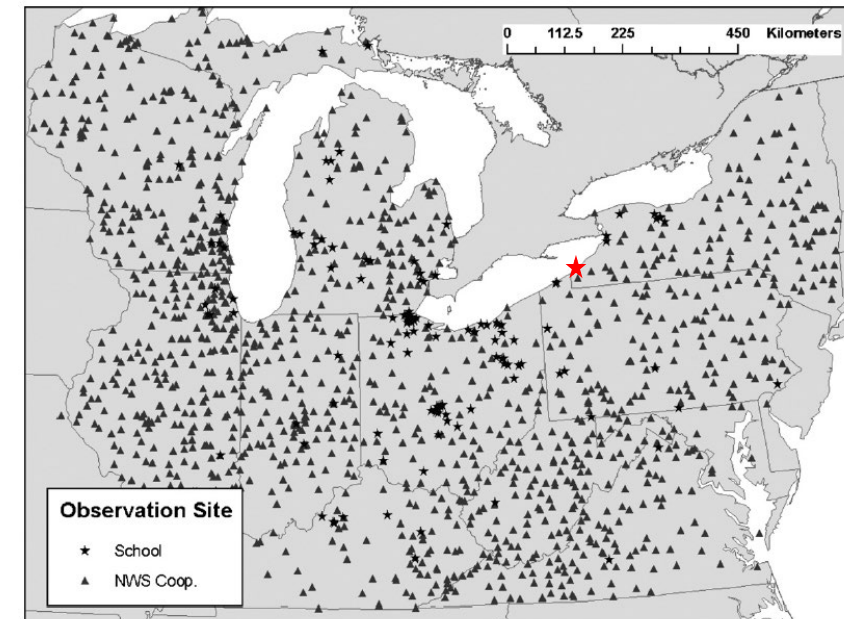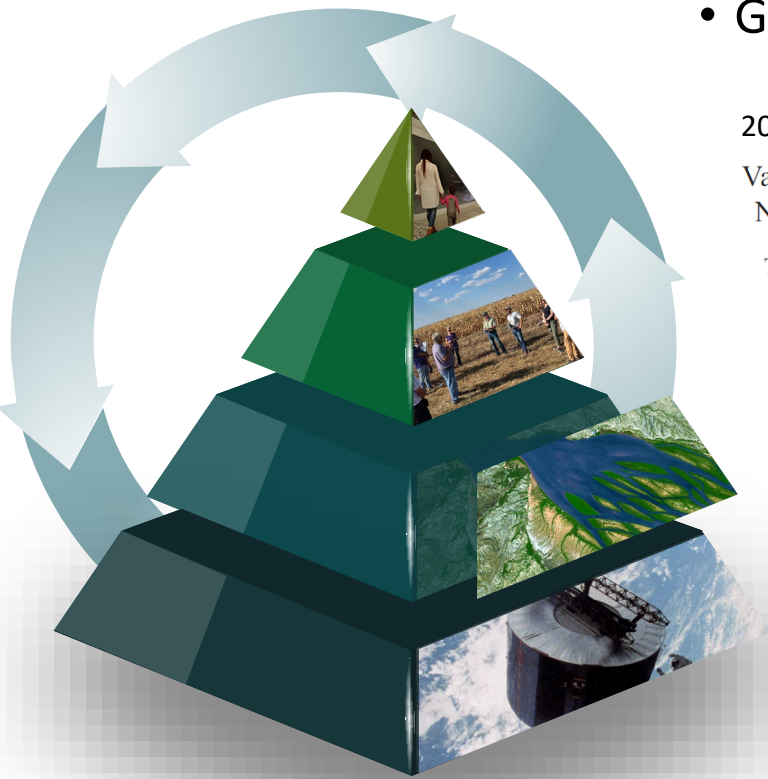NWS – Cooperative Program (snow)
- Daily snow depth

Fig. 1. SATELLITES, GLOBE and NWS cooperation extension observation sites used in this study.

Sponsored by: NASA   Supported by: NSF, NOAA, Department of State

GLOBE and Earth Science to Action Alignment

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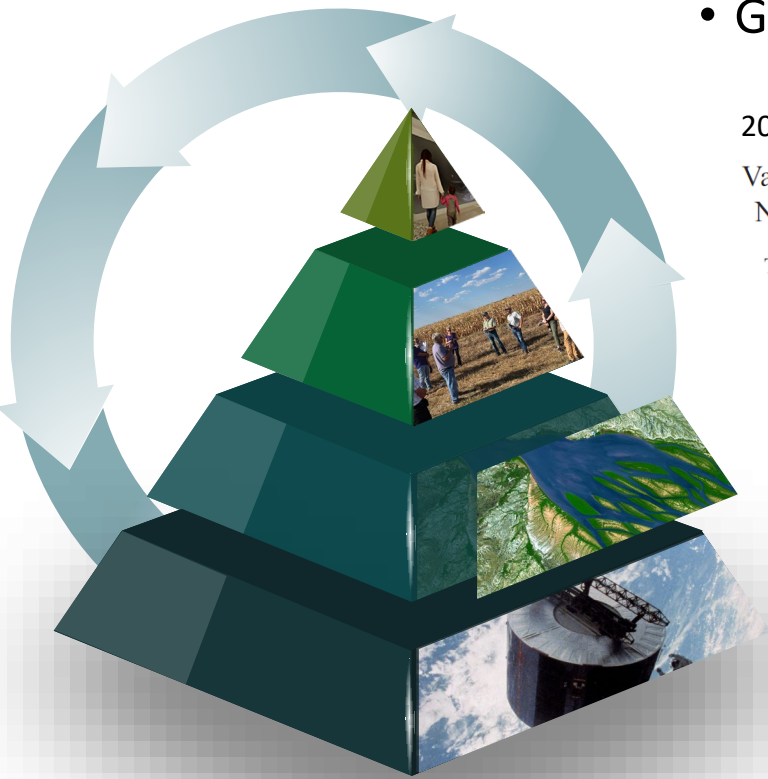
Table 4
MOD10_L2 snow product observations compared to student snow observations categorized by snow depth and year

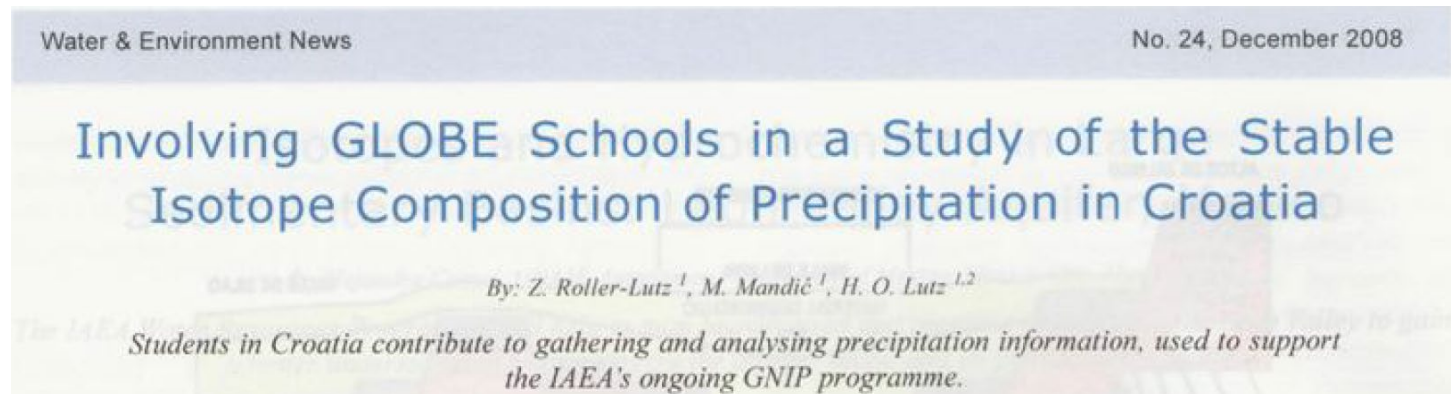| Student observations		MOD10_L2							Accuracy
		2000–2001		2001–2002		2002–2003		2000–2003	
		Land	Snow	Land	Snow	Land	Snow	Land	Snow	
Land	0 mm	52	7	371	7	26	4	449	19	96.1%
Snow	Trace (<10 mm)	6	3	2	2	2	2	10	7	41.2%
Snow	10–50 mm	2	12	0	3	6	16	8	31	79.5%
Snow	50–100 mm	1	7	1	23	2	15	4	45	91.8%
Snow	>100 mm	2	18	0	15	2	12	4	45	91.8%

The highest amount of error occurs in trace snow.

GLOBE and Earth Science to Action Alignment

Earth System Science & Applied Research

- Grow scientific understanding of Earth's systems

Water & Environment News — No. 24, December 2008

Involving GLOBE Schools in a Study of the Stable Isotope Composition of Precipitation in Croatia

By: Z. Roller-Lutz [1], M. Mandić [1], H. O. Lutz [1,2]

Students in Croatia contribute to gathering and analysing precipitation information, used to support the IAEA's ongoing GNIP programme.

2013

Stable isotope composition of the meteoric precipitation in Croatia

Tamara Hunjak, Hans O. Lutz & Zvjezdana Roller-Lutz
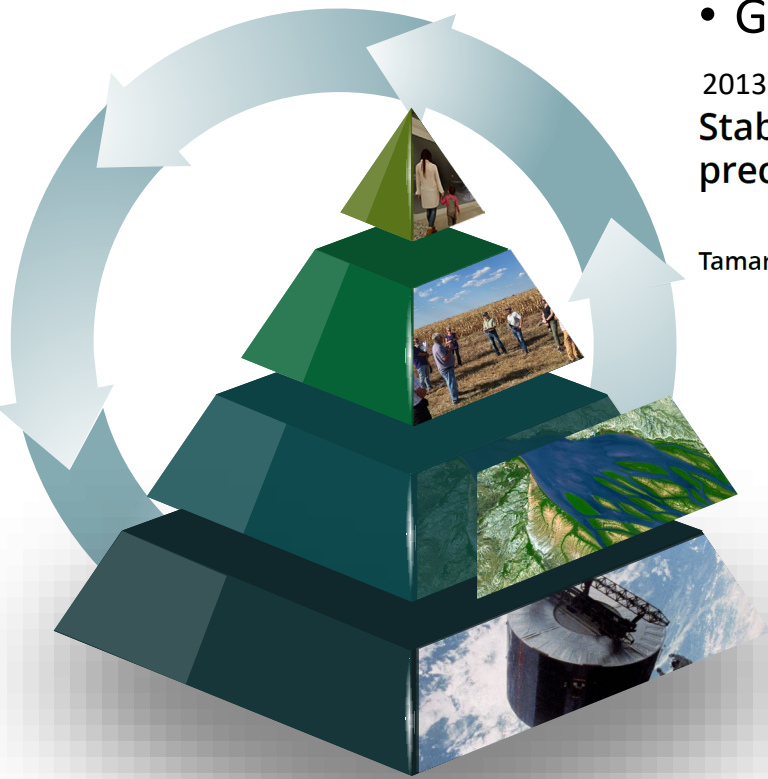
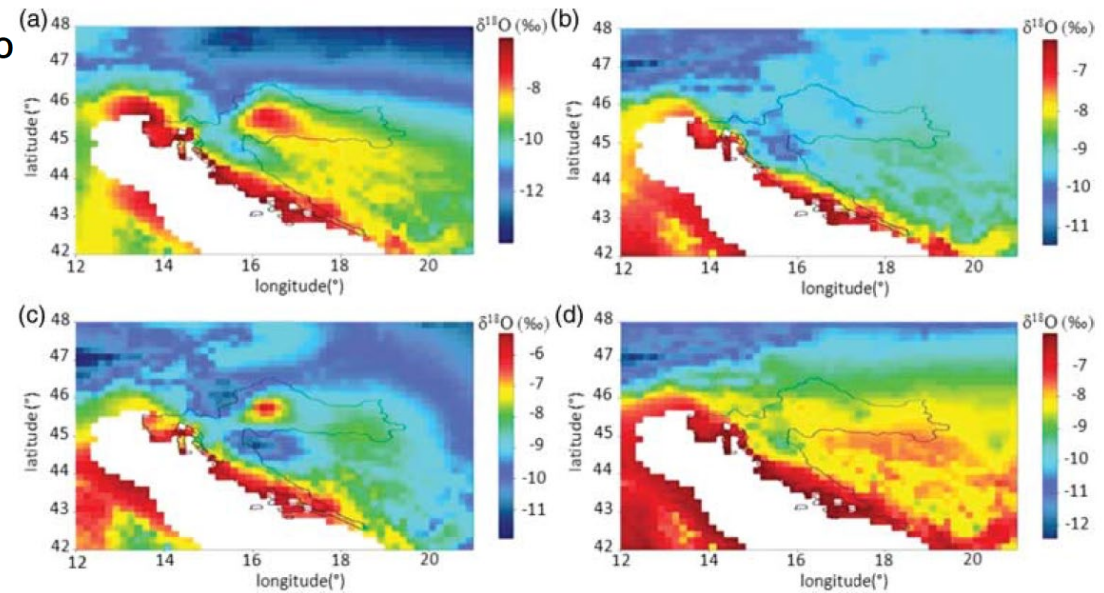## GLOBE and Earth Science to Action Alignment

Earth System Science & Applied Research

- Grow scientific understanding of Earth's systems

2013
Stable isotope composition of the meteo precipitation in Croatia

Tamara Hunjak, Hans O. Lutz & Zvjezdana Roller-Lutz

GLOBE and Earth Science to Action Alignment

Solutions & Societal Value

To benefit humanity we:

- Offer models, scientific findings and info through Open-Source Science principles
- Support operational climate services
- Provide science applications and tools to inform decision
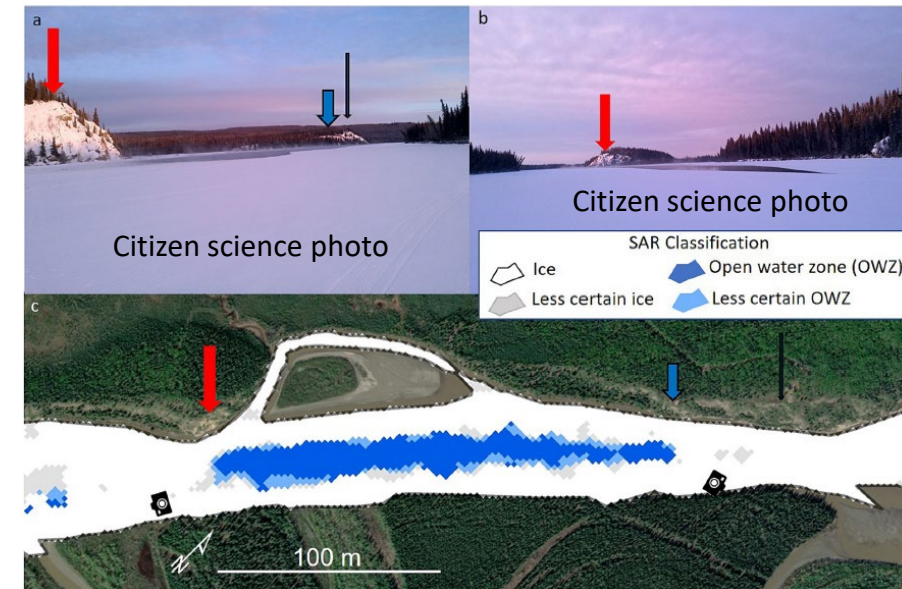
2024

Detecting early winter open-water zones on Alaska rivers using dual-polarized C-band Sentinel-1 synthetic aperture radar (SAR)

Melanie Engram [a,*], Franz J. Meyer [b], Dana R.N. Brown [c], Sarah Clement [c], Allen C. Bondurant [a], Katie V. Spellman [c], Laura E. Oxtoby [a], Christopher D. Arp [a]

[a] Water and Environmental Research Center, Institute of Northern Engineering, University of Alaska Fairbanks, USA
[b] Geophysical Institute, University of Alaska Fairbanks, USA
[c] International Arctic Research Center, University of Alaska Fairbanks, USA

Citizen science photo

Citizen science photo

SAR Classification
Ice — Open water zone (OWZ)
Less certain ice — Less certain OWZ

100 m

GLOBE and Earth Science to Action Alignment

Data retrieved from GLOBE in FY23 (10/1/2022 – 9/30/2023)

	Atmosphere	Biosphere	Hydrosphere	Pedosphere	**Total**
VIS	49,062	11,156	11,570	7,916	79,704
ADAT	12,779	5,297	7,149	6,310	31,535
API	58,602	23,071	6,570	179	88,422

Please help us understand your data usage!

GLOBE and Earth Science to Action Alignment

Which best describes you?

K-12 student, formal/informal educator	81
Interested public, end user/other user	66
Scientist/researcher, government or ministry personnel	36
College or graduate student	28
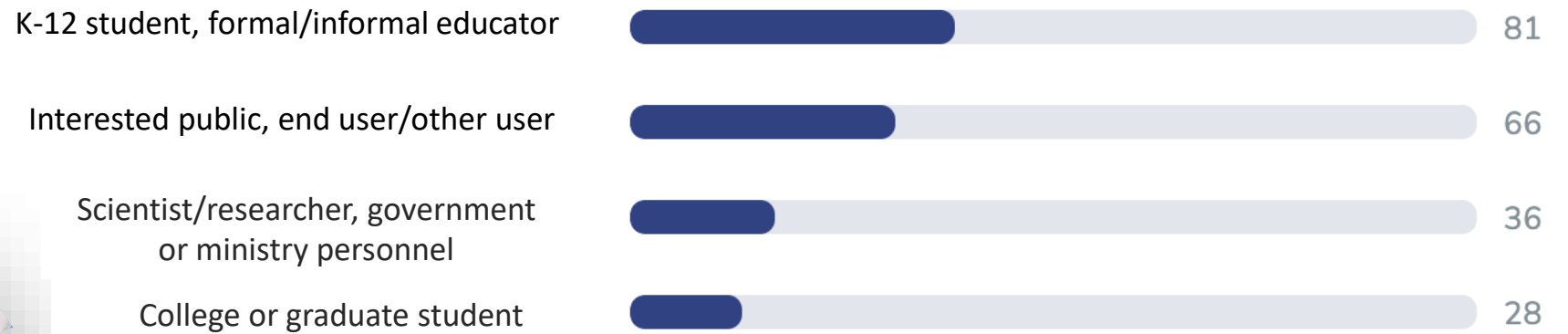
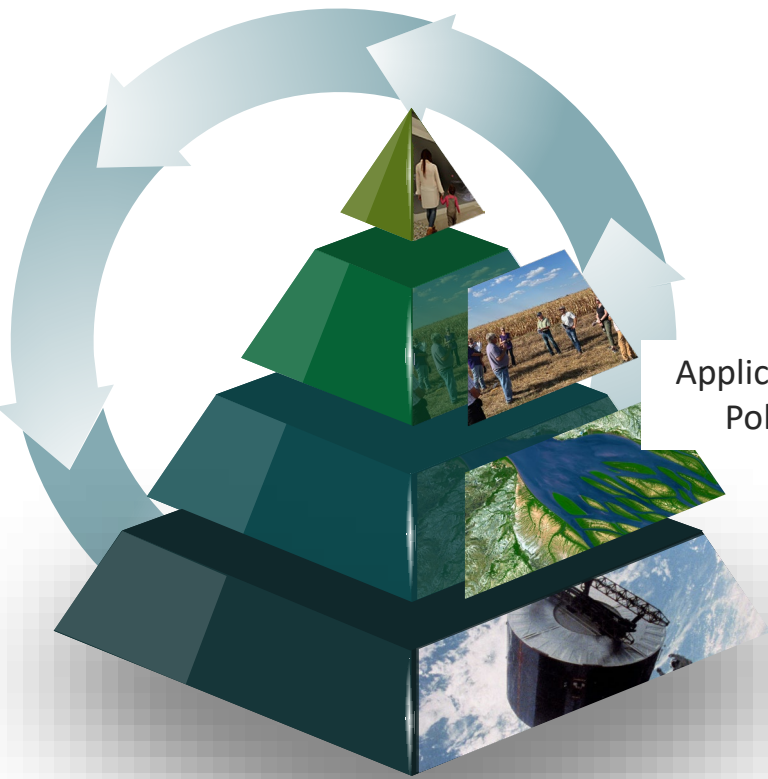**One month of data**

GLOBE and Earth Science to Action Alignment

How do you intend to use GLOBE data (select all that apply)

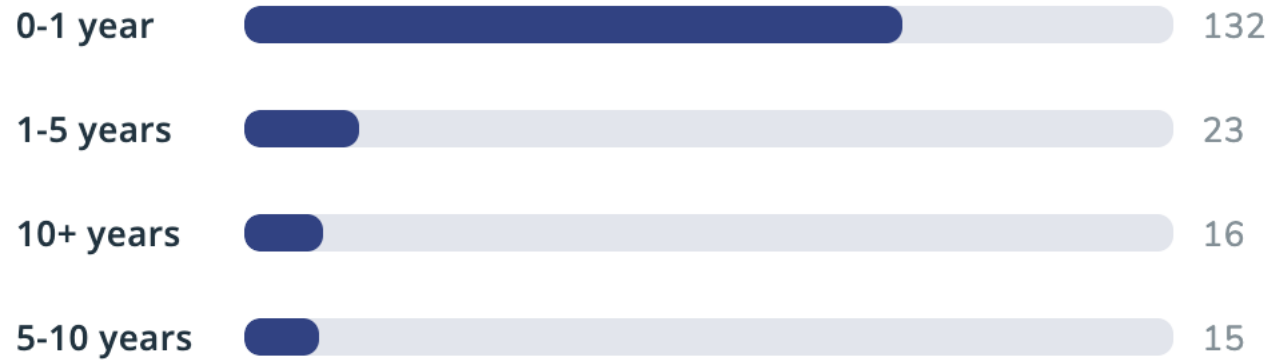|	
Education and Outreach	128
Other	49
Application (Environmental Conservation, Land Use Planning, Policy and Decision Support, Weather Forecasting etc.)	48
Educator Professional Development	36
Fundamental scientific research	36
Thesis (graduate or undergrad)	15

One month of data

GLOBE and Earth Science to Action Alignment

How do you use the data?

- For a heat waves project
- Showing Green School Educators this resource
- To prepare a book of tallest trees in Aragon
- My student data has been recorded almost every year for the past many years
- I plan to use this for calendar time at my morning meeting in class where we discuss weather and math concepts
- Organizational site monitoring, local youth and community education
- Hello from Chernivtsi, Ukraine. Me and my students are continuing our observings. This autumn we choose limes, birches, cherry, and oak (7 trees)
- …

One month of data

GLOBE and Earth Science to Action Alignment

Public Understanding & Exchange

We engage broader audiences and data users to:

- Put more scientific understanding into public sphere

Implementation Guiding Principles:

- Amplify impact and augment capabilities through **enhanced partnership**
- Engage a diverse workforce and the wider Earth science community
  - Amplify the value of Earth science through **global-reaching training, education, outreach, and capacity building**
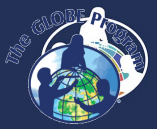
GLOBE and Earth Science to Action Alignment

1550 university students surveyed
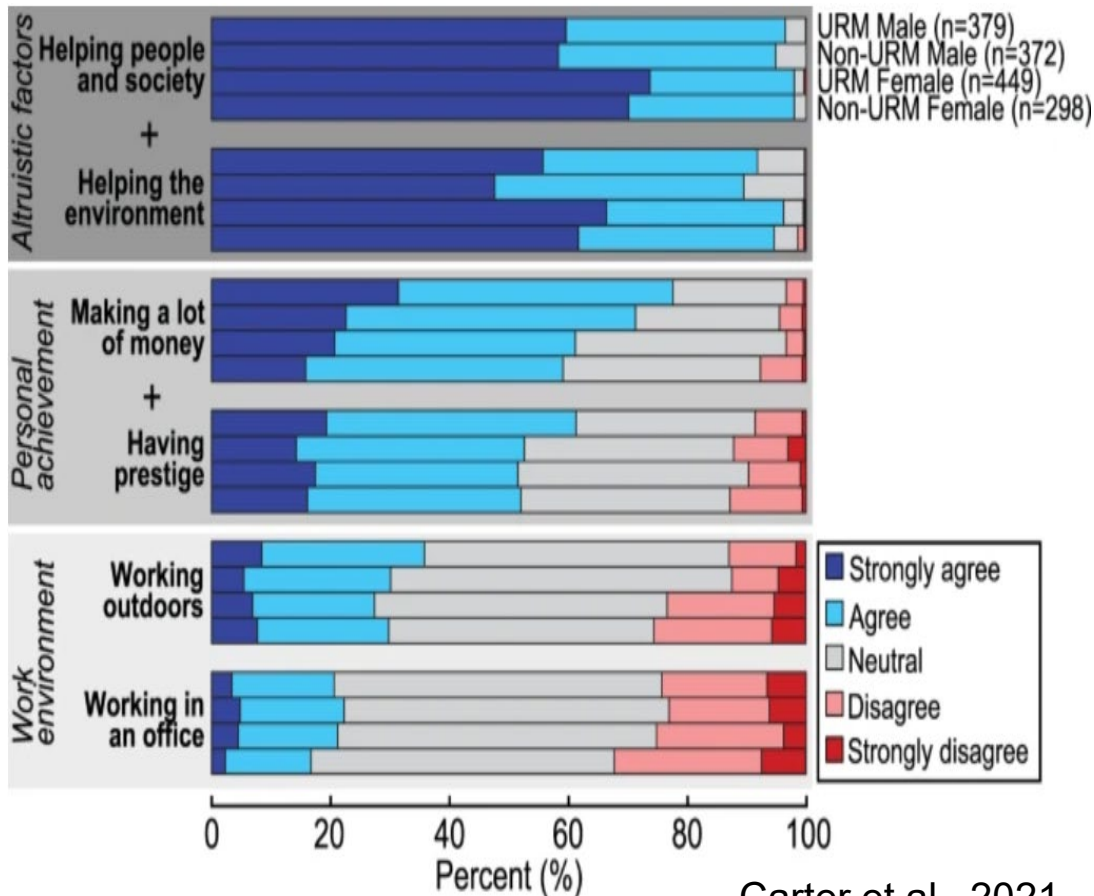
Carter et al., 2021

What do we mean by "action"?

Our definition of action is accelerating the use of Earth science to support policy and decision-making for society's well-being

Characterization of the larval habitat of mosquitoes in Northern Patagonia, Argentina (2021)

- Investigated puddles using GLOBE protocols to determine factors affecting habitat selection.
- Knowing the breeding habitats allows to design prevention and control systems.
- 2021 winners of the Argentine Junior Water Prize.

Monitoring and protecting Marmont alley, Croatia (2024)
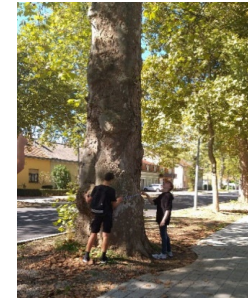
- Students measured tree heights, age, and mass of carbon absorption for 102 trees in Marmont Alley (Karlovac, Croatia)
- They recorded environmental parameters from a weather station and created a program to monitor traffic rates.
- Students demonstrated the significance of the trees and beneficial impacts on their local environment.

Comparing Select Atmospheric Parameters Between Disparate Geographic Locations USA and Qatar (2023)

- Crestwood High School in Dearborn, Michigan, USA compared atmospheric parameters with ACS International School in Doha, Qatar using GLOBE protocols.

- Michigan students also compared their findings with a local WeatherBug Station and determined the Vernier Go Direct measurements offered an inexpensive alternative with similar data accuracy.

Contribution of GLOBE students' research to the issue of water and agriculture in Ferlo, Senegal (2024)

- With support of the SERVIR-AO Program, teachers and students from 3 project schools assessed the temperature and pH variation of two local water sources.
- Vegetable markets established inside the school allowed for a hands-on experience of market gardening.
- Students dug a drainage canal to link Lake Guiers to the school garden to investigate the utility of the water to grow crops.

Developing equipment to help anchor seagrass seedlings to increase seagrass survival rates – Thailand (2024)
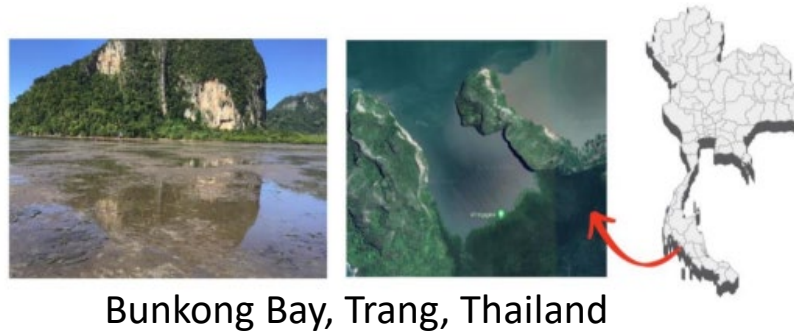
Bunkong Bay, Trang, Thailand

- Students collected water and soil samples. Planting area included 5 plots (1m x 1m) with 9 seagrass plants in each plot.
- Each plot adopted a different equipment type.
- After 1-month students assessed any changes in water quality and seagrass survival.

Northern Redbelly Dace Conservation Data Science Project (Colorado, USA 2022)

- In partnership with the Innovation Center, high school students from St. Vrain Valley Schools have been involved water quality assessments and release requirements for an indicator fish species.
- Students have been involved in water quality sampling, land use assessment, fish hatchery and release of fish in local rivers.

Sponsored by: NASA   Supported by: NSF NOAA

GLOBE's next strategic plan - updates

- Current plan, valid 2018 – 2023, extended until 2025

- Developments of the previous plans (2012-2017 and 2018-2023) were led by GIO

- Development of the next strategic plan is led by GLOBE Program Office (GPO)

  - Two new limited-term GPO staff: Dr. Tara Strang (30% rotation from NASA OSTEM), Dr. Herb Fynewever (AAAS Fellow)

  - Will be developed with input from federal co-sponsors, GIO, WGs, USPF, GECP, RCOs, USCC, GISN, wider GLOBE communities, etc. and aligned with NASA ESD and sponsoring agency priorities.

  - Be in place in calendar year 2025

New GLOBE protocols - updates

• Last Annual Meeting: history of GLOBE protocols, new protocol requirements

• New solicitation on new/modified GLOBE protocols – draft will be out soon for community comments

   • First step: organize a workshop to engage with relevant Earth system science and application communities, community groups, and related citizen science/education efforts

   • Workshop goals:

      • inventory of similar citizen science projects

      • state of knowledge and gaps, for both science and education/outreach

      • discussions of opportunities to collaborate between citizen science projects, scientific/application communities, and community groups on project design, data collection and analysis.

New GLOBE protocols - updates

First upcoming protocol workshop, most likely PM2.5, with the following objectives:

- Understand how PM2.5 LCS are used by the broader scientific community to monitor air quality, possibility for filling in remotely sensed data gaps, QA/QC and data harmonization requirements

- Discuss how PM2.5 LCS can help address environmental justice, increase STEM/atmospheric science/community science literacy according to the guiding considerations in the National Academy of Sciences, Engineering and Medicine (NASEM) Learning through Citizen Science: Enhancing Opportunities by Design (2018)

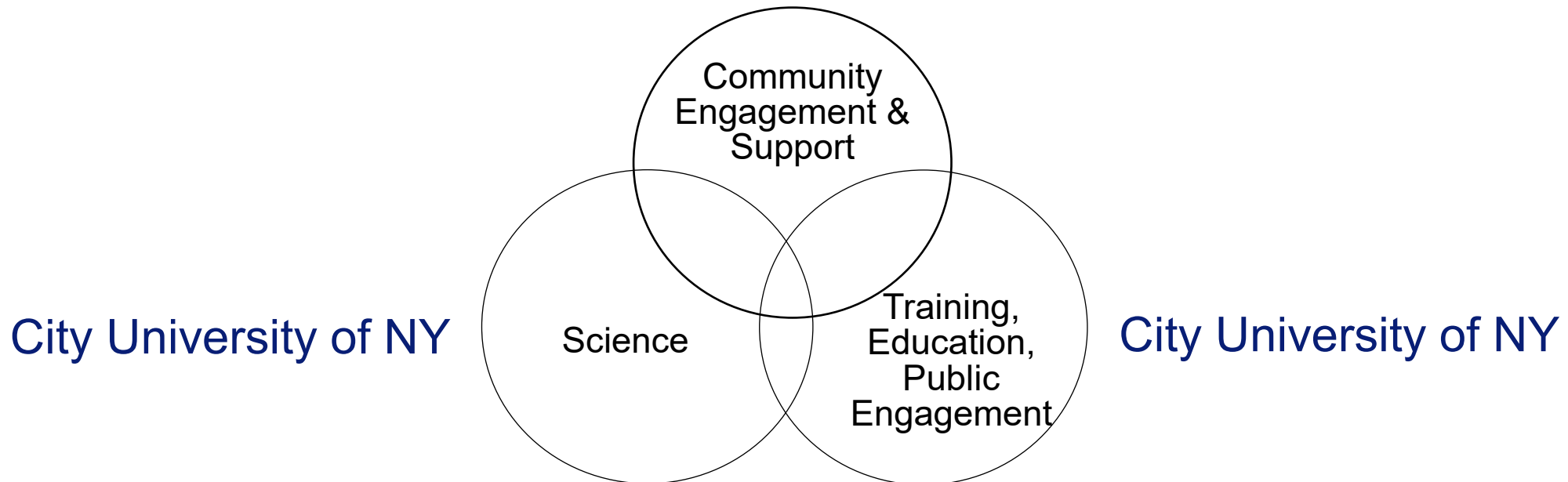Questions? See Kevin Czajkowski, Margaret Pippin, Amy P. Chen

GIO high-level work plan for community input

- GIO's objective: strengthen the programmatic support for GLOBE and enhancing the value of GLOBE to its worldwide community of students, educators, scientists, citizen scientists, and partners

Education Development Center

City University of NY   City University of NY

Community Engagement & Support

Science

Training, Education, Public Engagement