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Preparing the Geoscience Workforce for a Resilient Future: Skills, Perspectives, and Emerging Opportunities

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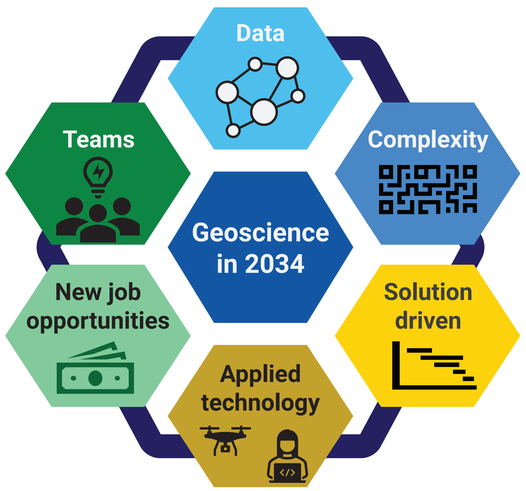
The geoscience workforce plays a critical role in developing solutions to address the challenges resulting from climate change impacts. Early-career and emerging geoscientists will be in the unique position to understand the drivers, opportunities, and mitigation options needed to overcome these challenges. However, are they aware of and actively engaged in developing the skills they need to become effective solution providers?

In this presentation, we will draw on results from our NSF-funded Geoscience Program Adaptation to Natural Disruptive Events (GRANDE) project (#2223004) to explore the perspectives of early-career and mid-to-late career geoscientists about how the geosciences will change over the next decade, including the skills that will be needed to develop solutions for societal issues related to hazards, resource limitations, and climate change impacts. We will discuss the expected transformations in work, research, and higher education that will be driven by integration of new technologies and the research and application spaces that are expected to emerge. We will also examine the expected changes in the demand for geoscience expertise across employment sectors over the coming decade and discuss opportunity spaces for developing the skills and competencies needed for building a resilient future.

What will geoscience jobs look like in 2034?



The main drivers of employment change in the next 10 years
from the US Bureau of Labor Statistics, Employment Projections

AI technologies
- replacement of automation-prone jobs and substitution for missing labor
- increased productivity and efficiency
- increased connectivity and discovery of knowledge and data
- integration of AI and expert knowledge to address complex problems

Climate impacts & sustainability
- job growth in occupations focused on solutions for impacts and sustainability
- hazard adaptation, mitigation & preparedness
- transition to renewable and electrified energy sources
- adaptations to sustainability-focused regulations and policies

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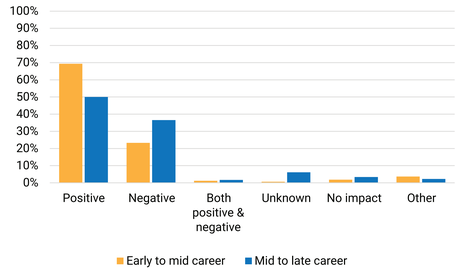
The results and interpretations are the views of the American Geosciences Institute and not those of the National Science Foundation.

How will work, research, and education change?

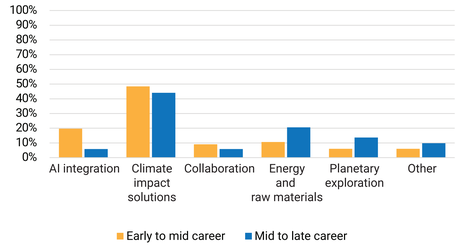
The impact of artificial intelligence on earth science research
Percentage of cohort



Positive perspectives
- Broadening research opportunities and increasing impact
- Automation & efficiency
- Data management & analysis
- Modeling & visualization
- Reliability & reproducibility
- Application to earth systems, hazards, decision-making, climate impacts
- Improved communication and knowledge discovery
- Education & training
- Job growth

Negative perspectives
- Encourages cheating and plagiarism
- Decrease in critical thinking
- Lack of regulation and ethical usage
- Dangerous, fraudulent, scary, bad, untrustworthy, flawed, invasive
- "I don't know anything about AI, nor do I care to learn."

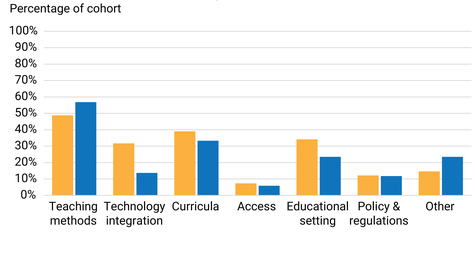
What will be the new horizons for earth science research?
Percentage of cohort



Early to mid career cohorts...
...focus on AI and technology as tools to collaboratively solve climate and environmental issues.

Mid to late career cohorts...
...look to resource management and theoretical research involving water, raw materials, earth processes, exoplanets for harvesting and habitation.

How will earth science be taught in the next decade?
Percentage of cohort



Teaching methods
- Interactive techniques, traditional classroom teaching, online learning

Technology integration
- AI, VR/AR, large datasets, remote sensing, computers, software, apps

Curricula
- Data science & analysis
- Focus on climate change impacts and sustainability
- Multidisciplinary approaches, integration with other sciences, arts, humanities

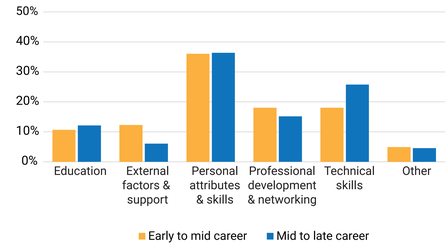
Access
- Global reach and connectivity, especially with developing regions
- Tailored to various learning styles and capabilities

Educational setting
- Emphasis on learning through real-world exploration and data collection
- Specialized programs, including workshops and specialized courses

Policy & regulations
- Changes in educational standards, curriculum requirements
- Policy changes, funding, and support for earth science education

What skills will students need to prepare for these jobs?

Factors that are needed for a successful career in the earth sciences
Percentage of cohort



Personal attributes
- adaptability, attention, curiosity, creativity, self-motivated, thinking outside the box

Professional development
- communication, collaboration, teamwork

Technical skills
- analysis, critical thinking, math, programming, writing, spatial thinking

Opportunities & Cautionary Tales

AI as a toolbase
- Streamlining of workflows empowers geoscientists to do geoscience.
- AI as an 80% solution to accelerate solutions

Geoscience job growth
- Expected 5.6% growth in geoscience occupations over next 10 years
- Strong growth in professional services with focus on environmental services
- Geoscience jobs are focused on application of knowledge to problems

Emerging models for hiring and upskilling of geoscience talent
- High school to industry apprenticeships - training and support for college degree
- Brazilian Residency Model - two years of employment at Geological Survey working in different divisions to develop a strong skills portfolio and Master's degree.

Lack of integration of hazards into personal decision making
- Climate impacts, such as hazards, serve as inspiration for research and study
- Limited perspectives due to lack of experience, understanding of outcomes

Incentives for hazard research still low
- 4% of NSF awards (2000-2019) were related to hazards research.

Technology integration into curricula is lacking
- Aversion to AI technologies
- Lack of instruction within / outside of geoscience departments

Natural Hazards & Job Choice
https://hazardgame.americangeosciences.org

Do climate impacts factor into your decision making?