The University of Texas at Austin
Jackson School of Geosciences

SIP 1 Business Plan:
Earth Hazards From Physics To Risk

Science for Hazards, Impact Evaluation, and Long-term aDaptation (SHIELD)

Leads: Yuko M Okumura (UTIG) and James Thompson (BEG)

November 2025

Table of Contents

SIP 1 Business Plan:
"Science for Hazards, Impact Evaluation, and Long-term aDaptation (SHIELD)"

Call to Action

Earth hazards, such as floods, heatwaves, wildfires, hurricanes, earthquakes, landslides, and volcanic eruptions, have profound impacts on human life and infrastructure. These extreme events sometimes occur together or in sequence (e.g., landslides triggered by earthquakes), exacerbating and prolonging the socio-economic impacts. Some Earth hazards can result from chronic conditions or gradual changes rather than extreme events (e.g., persistent periods of hot and dry weather or slow sea level rise), cumulating damage over a long period of time. It is therefore crucial to understand, monitor, predict, and mitigate these Earth hazards and the associated risks. The Jackson School of Geosciences (JSG) is home to many world-leading experts on various aspects of Earth hazards. The impact of our research, however, could be significantly enhanced by 1) taking more integrative approaches from physics to risk and 2) aligning our research more closely with societal needs. For example, we can apply a new physical understanding of extreme rainfall events to the monitoring and mitigation strategies of hydroclimate hazards and water resource management. On the other hand, the operational need for the knowledge of certain weather events can promote research on the physical mechanisms and predictability of these events. Such integrative approaches are desperately needed, given the increasing cost of Earth hazards in our growing society. Furthermore, societally relevant research would open more possibilities for securing nontraditional research funding during a period of federal funding uncertainty.

The primary goal of the SIP 1 leadership team is to develop lasting mechanisms and platforms for a societally relevant, interdisciplinary Earth hazard research program. JSG is uniquely positioned to advance this initiative. First, the JSG unit structure, comprising the Department of Earth and Planetary Sciences, the Institute for Geophysics, and the Bureau of Economic Geology, enables cross-disciplinary collaboration across geophysics, geology, hydrology, climate, and environmental sciences, offering a depth and breadth unmatched by most institutions. Second, JSG has an outstanding opportunity to integrate the physical science of Earth hazards with engineering and social sciences, in which UT Austin plays a leadership role (e.g., a recent NSF-funded DesignSafe project). While several Earth hazard research centers exist around the United States and beyond, most focus on engineering and social sciences, with limited engagement with physical science communities. By building on the academic excellence in physical science, which is critical for advancing the predictive capacity of hazards, JSG has the potential to distinguish itself as a hub for a comprehensive Earth hazard research program.

We will name the SIP 1 initiative **SHIELD**, **S**cience for **H**azard, **I**mpact **E**valuation, and **L**ong-term a**D**aptation, to reflect our goal better and attract more external attention. The name will be used in our planned activities, such as workshops and newsletters. In the remainder of this proposal, we will outline the strategy and plan to achieve our goal.

Plan of Action

1. Establishing the SIP 1 Team and Stakeholder Engagement

We will start by forming a SIP 1 leadership team, composed of five sub-teams focused on different types of Earth hazards, and an advisory board, comprising various stakeholders, researchers from other relevant UT academic departments, and staff from the UT Foundation Relations. We will hold regular online meetings to explore interdisciplinary collaboration and funding opportunities and discuss plans for annual workshops (see action plan #3 below).

a. Focus areas and sub-teams

We will focus on the following five types of Earth hazards, for which we have sufficient JSG expertise, and will create sub-teams for these hazard types. The SIP 1 leaders and sub-team leaders listed below will identify other contributing experts across JSG and the wider UT research community and discuss ways to connect our research to maximize societal impact. We will also explore collaboration between sub-teams to address the risk of compound and cascading hazards.

- Hydroclimate extremes (floods, droughts, water resources)
  Lead: Bridget Scanlon (BEG)
- Heatwaves (extreme temperature and humidity, human health impact)
  Lead: Geeta Persad (DEPS)
- Wildfires (fire weather, post-fire landslides and environmental pollution)
  Lead: Danielle Touma (UTIG)
- Coastal hazards (hurricanes, storm surges, and sea level)
  Lead: Chris Lowery (UTIG)
- Earthquakes, volcanic eruptions, and landslides
  Lead: Alexandros Savvaidis (BEG)

b. Advisory board

To understand the broad societal research needs related to Earth hazards and explore funding opportunities, we will form an advisory board consisting of various stakeholders (e.g., insurance and other industries, municipal offices, utilities, and healthcare), researchers from other relevant UT academic departments (e.g., engineering, business, and medicine), and staff from the UT Foundation Relations. We will hold monthly/bimonthly online meetings between the SIP 1 leadership team and the advisory board. The initial meetings will focus on understanding the most urgent issues among stakeholders and how these issues map to the existing or emerging JSG research. Subsequent meetings will aim to identify the most promising areas of collaboration for pilot research projects and to reassess the projects as they progress (see action plan #4). We will also use these meetings to plan for annual workshops (see action plan #3).

2. Enhancing Collaboration at JSG

One of the frequently raised issues during the recent JSG town hall meetings and SIP survey is the challenge of discovering a wide range of research within JSG, which leads to missed opportunities for

interdisciplinary collaboration. We propose establishing a few mechanisms to enhance communication and collaboration within JSG.

a. *Seminar series reorganization*

Attending seminars given by colleagues is a great way to learn about their latest research and foster discussions and collaborations within JSG. However, there are currently nine official seminar series across JSG (Deford Lectures, UTIG Seminars and Discussion Hours, BEG Seminars, WCE Seminars, Geophysics Seminars, Soft Rock Seminars, Paleontology Seminars, and LDE Seminars), which is too many to keep up with. Additionally, most departmental/institutional seminars (Deford Lectures and UTIG/BEG seminars) feature researchers from external institutions. Although non-departmental/institutional seminars are often given by JSG researchers, postdocs, and students, attendance is generally low and limited to members within a specific discipline.

In collaboration with SIPs 2 and 3, we propose reorganizing/modifying the JSG seminar series to enhance cross-disciplinary communication. There are a few possible ways: 1) consolidating six non-departmental/institutional seminar series into three along SIP themes and alternating locations between the main and Pickle campuses; 2) increasing the number of slots for cross-departmental speakers in departmental/institutional seminars and highlighting SIP-relevant seminar presentations; 3) converting a few departmental/institutional seminar slots per semester into SIP sessions each featuring 3-4 short AGU style presentations by JSG researchers with a focus on ongoing research and new directions to spur collaborative ideas. Option #3 is motivated by the success of the first annual UTIG research symposium in February 2025. We will conduct a JSG-wide survey to explore the best option. We will also discuss strategies to increase cross-campus seminar attendance (e.g., live streaming in a remote seminar room).

b. Co-working space

The lack of secure and comfortable working spaces away from home institutions, as well as the physical distance between the main and Pickle campuses, is another barrier to enhancing communication and collaboration within JSG. For example, some UTIG researchers work and hold meetings in the Holland Family Student Center, which can be noisy and unsafe to leave laptops and other valuables unattended when going to a bathroom. We will discuss potential solutions to this problem with the JSG leadership (e.g., converting available rooms into co-working space and making them accessible to JSG researchers).

3. Workshops and Newsletters

The Earth Hazard SIP will host a 2-day workshop near the end of each project year to foster collaborations across researchers in the JSG and increase engagement with the advisory board and other stakeholders, with a focus on operational needs and bridging barriers to adoption. The 2-day event will include plenary sessions, lightning talks, breakout sessions, tutorials, workshops, poster sessions, as well as unstructured time for engagement. The SIP leads will invite guest speakers from academia, government, and industry that run similar hazard and risk programs, including institutions outside the US. Each year a new overall theme of the workshop will be developed to achieve certain goals that will advance the impact and strength of the SIP:

- **YEAR 1: Identifying gaps:** the first year will focus on evaluating the current research and initiatives ongoing within the JSG and highlight areas of focus over the following 2 years. The first

year will also focus on learning about best practices from other institutes that have similar earth hazard programs, as well as needs from stakeholders, to help guide our focus over the next few years.

- **YEAR 2: Progress:** the theme of the second year will be to assess the progress made towards the overall outcomes (see Expected Outcomes and Deliverables section for details) of the SIP and gauge any shortcoming. Strong engagement and feedback from stakeholders will be prioritized.
- **YEAR 3: Future and Cascading Hazards:** year 3 will focus on building the SIP for the future and discussing approaches for continued success and funding in perpetuity. Outcomes will be shared with stakeholders for feedback. Finally, as we move the SIP from a development stage to a more operational stage, we will start to develop themes for the workshop and year ahead to focus our priorities. This year we will propose a cascading hazards theme.

At the conclusion of each workshop the SIP leads and focus area leads will provide whitepapers on the discussions, outcomes, and future directions.

The quarterly newsletter will provide highlights on the status and progress of the Earth Hazards SIP to the JSG community, UT leadership, advisory board, stakeholders, and prospective individuals. These newsletters will be an easily digestible, synergistic summary of the SIP over the last few months, as well as providing a list of publications and grants inspired by SIP, upcoming events, and ways to get involved.

4. Pilot Research Projects

Each sub-team will leverage the unique and existing Earth hazard science and technological capabilities at the Jackson School to support operational agencies in meeting the challenges of Earth hazard management across the United States and beyond. We will initially focus on five use-cases. These focus areas will be co-developed with management agency stakeholders to support decision-making before, during, and after Earth hazards.

The aim of the projects is to provide an avenue in which stakeholders and practitioners are directly linked with like-minded developers at JSG, fostering a unique method of co-development that focuses on operational needs. Fundamental research is well developed at JSG across Earth hazard disciplines, however the ability to transition to operations is sometimes limited and barriers of adoption remain. Therefore, the projects will lead in the creation of an end-to-end engagement and co-design plan (Figure 1). The project teams, in coordination with the SIP leads, Dean's office, and Advisory board, seeks to assist operational end-users and decision-makers in a variety of settings to define gaps in their operational workflow, match research products with end-users, create product training, conduct user assessments to provide feedback to developers, and assist in the successful transition of research products into operations. By leveraging relationships across federal, state, local, and tribal governments, as well as non-governmental entities, the SIP seeks to develop new partnerships for co-development and assessment/testing of products, which are critical components to the Earth Hazard SIP objective of having a measurable improvement in U.S. Earth hazard management.

One example of what a pilot project may involve and how engagement is achieved, is outlined below:

1. SIP Leadership and Advisory Board pose a topic of investigation based on known existing knowledge in the JSG. For example, improve data integration for fire impacts [e.g., how can improved data integration and scaling from point measurements to landscapes and across data types (moisture, terrestrial laser scanning, airborne, and satellite) capture heterogenous impacts of fire to vegetation and soils?]

2. SIP identifies a stakeholder to be involved in the co-development, in this example Texas A&M Forest Service. The stakeholder then provides a “Call to Action” statement or presentation that highlights their needs related to this topic for operations. In this example, perhaps some limitations with SPoRT or FIRMS products and their ability to provide accurate fire forecasts.
3. The JSG members ask clarification questions to get a better sense of needs and current operational limitations.
4. In small group or as a group, spend some time generating some “How might we...” questions based on the call to action. Consider what challenges and opportunities most excite you and what do you wonder about? For example, how might we develop AI/ML algorithms to improve data synergy and analysis for predicting fire season forecasts.
5. In small group or as a group, spend some time discussing prompts related to the topic that were provided by the stakeholder previously. From these discussions, everyone develops “Wouldn’t it be great if... by...” statements based on these discussions. For example, a prompt could be “in your option what do you think is missing from the current fire operational model”, which could be used to create a “Wouldn’t it be great if all fire related data and models were collated into a single location by the creation of a repository with an interactive interface to provide the most relevant data and model based on the fire domain.
6. Next, everyone votes on the statements that they are most interested in developing further.
7. Continue to develop the top voted statement ideas in small groups through answering questions. For example, what are the challenges, why is it important, what are the needs to make it a reality. Report out to whole group and group provides pluses, potentials, and concerns.
8. From these, small groups are formed to start working on the developing ideas, with strong collaboration with the stakeholder. Each group develop an implementation plan to present to SIP leadership
9. SIP leadership help to develop the projects. There could be one or many project developed from each focus area.

To train the next generation of Earth hazard researchers, we will involve graduate students and postdoctoral researchers in the development and execution of pilot research projects. For students, we will offer both 1-year fellowships to recruit new students and semester-long fellowships to support existing students. For new students, we will solicit nominations from JSG researchers interested in exploring a new direction in Earth hazard research. We will select the awardees based on the quality of proposed research and the potential to foster new collaborations at JSG and beyond (as well as aligning with the SIP goals). For postdocs, we will provide postdoctoral fellowships to recruit outstanding researchers who can ideally fill the gaps in the existing Earth hazard research at JSG. All fellowship awardees will be invited to attend the advisory board meetings and present their research at the annual workshops. We will aim to distribute the student and postdoc awardees across all five focus areas of Earth hazards.

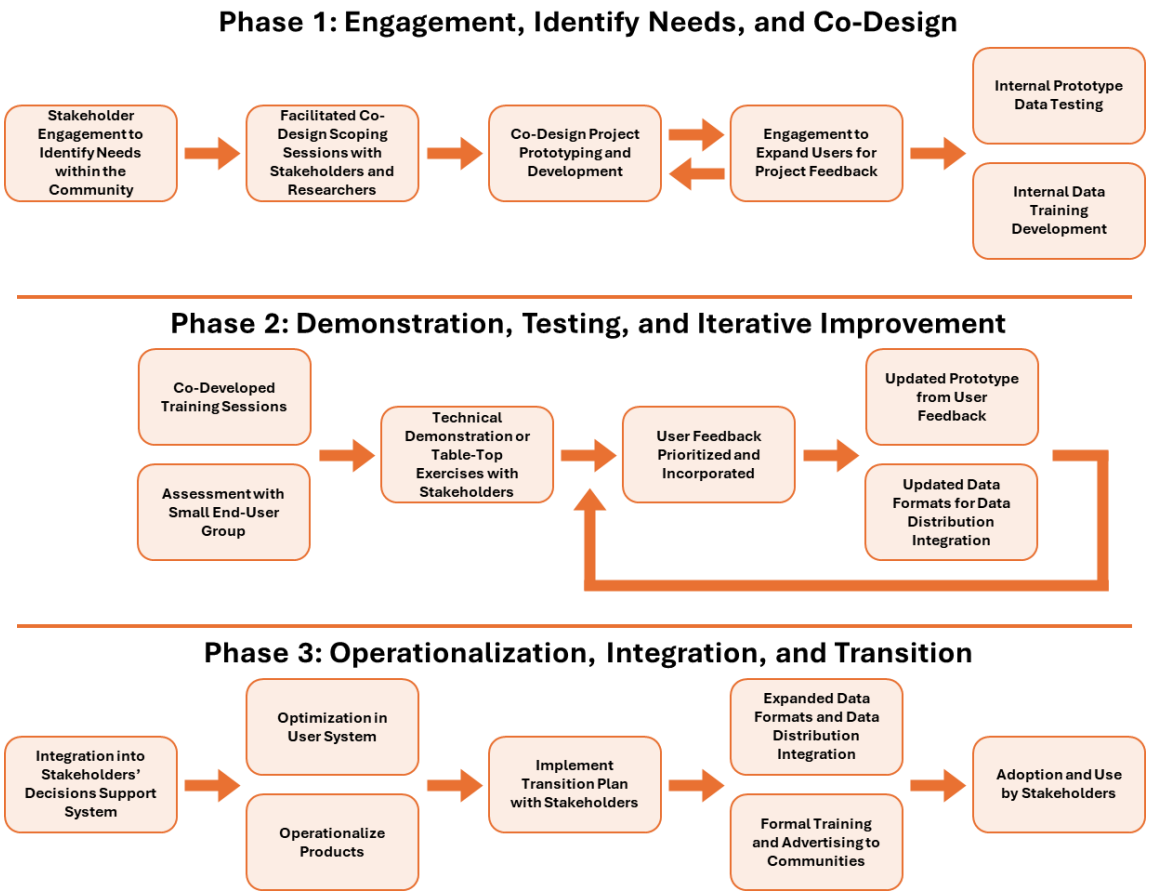
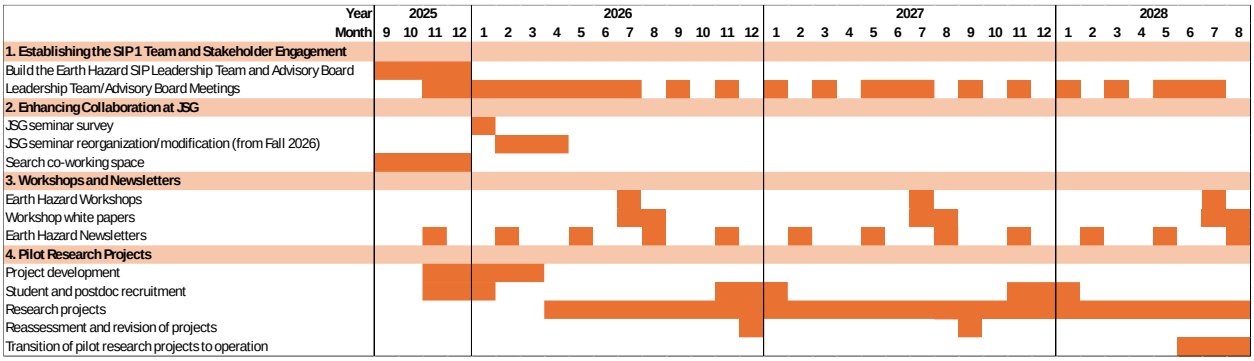


Figure 1:The expected process for the development of projects within the SIP that fosters a unique method of co-development that focuses on stakeholder needs and engagement.

Timeline



Expected Outcomes and Deliverables

- More holistic, interdisciplinary Earth hazard research that integrates the existing research strengths at JSG and UT Austin.
- Strengthened engagement with stakeholders and research applications to societally relevant Earth hazard problems, bridging the barriers to operations.
- Training of the next generation of Earth hazard researchers.
- Improve the reputation of the JSG as a leader in Earth hazard research and operational support.
- Increased communication and collaboration within JSG.
- Quarterly newsletters highlighting progress, successes, and initiatives.
- An engaging productive annual workshop that fosters research development for operational needs.
- Annual whitepapers that highlight progress and outcomes from the annual workshops.
- Become a financially self-sustainable initiative that continues to develop new Earth hazard research projects that are adopted by operational stakeholders.

Success Criteria

- ✓ Become an internationally recognized organization that is at the forefront of innovation in Earth hazard science and technology that is directly linked to operations across at all levels (e.g., local-international, government-NGO-industry).
    - Independent funding
    - Expanding graduate student population
    - Strong post-doctoral program
    - Connecting research initiatives
- ✓ Publish findings and outcomes from SIP initiatives and workshops in peer-reviewed articles including AGU Earth Future. Additionally, the SIP provided content to the Climate and Catastrophe Insight report.
- ✓ List of research publications and grants inspired by SIP
- ✓ The workshops attract over 50 individuals from outside UT.