Plenary Panel

Geospatial Caravan: Embracing One & All
Insurance

Dr Kelvin Wong | 02 May 2023

Geospatial World Forum 2023, Rotterdam

Gallagher Re

1.1 Introduction: Why Does GIS Matter?

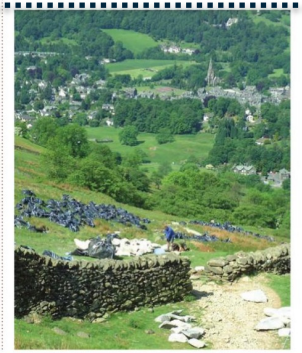
Almost everything that happens, happens somewhere. We humans confine our activities largely to the surface and near surface of the Earth. We travel over it and in the lower levels of the atmosphere, and we go through tunnels dug just below the surface. We dig ditches and bury pipelines and cables, construct mines to get at mineral deposits, and drill wells to access oil and gas. Keeping track of all of this activity is important, and knowing where it occurs can be the most convenient basis for tracking. Knowing where something happens is of critical importance if we want to go there ourselves or send someone there, to find other information about the same place, or to inform people who live nearby. In addition, decisions have geographical consequences. For example, adopting a particular funding formula creates geographical winners and losers, most obviously when the outcome is a "zero-sum game." Therefore geographic location is an important attribute of activities, policies, strategies, and plans. Geographic information systems (GIS) are a special class of information systems that keep track not only of events, activities, and things, but also of where these events, activities, and things happen or exist.

Almost everything that happens, happens somewhere. Knowing where something happens can be critically important.

Because location is so important, it is an issue in many of the problems society must solve. Some of these problems are so routine that we almost fail to notice them—the daily question of which route to take to and from work, for example. Others are quite extraordinary occurrences and require rapid, concerted, and coordinated responses by a wide range of individuals and organizations—such as the events of August 29, 2005 in New Orleans (Box 1.1). Problems that involve an aspect of location, either in the information used to solve them or in the solutions themselves, are termed geographic problems. Here are some more examples:

- Health care managers solve geographic problems (and may create others) when they decide where to locate new clinics and hospitals.
- Delivery companies solve geographic problems when they decide the routes and schedules of their vehicles, often on a daily basis.
- Transportation authorities solve geographic problems when they select routes for new highways.
- Geodemographics consultants solve geographic problems when they assess the performance of retail outlets and recommend where to expand or rationalize store networks.
- Forestry companies solve geographic problems when they determine how best to manage forests, where to cut, where to locate roads, and where to plant new trees.
- National park authorities solve geographic problems when they schedule recreational path maintenance and improvement (Figure 1.1).
- Governments solve geographic problems when they decide how to allocate funds for building sea defenses.
- Travelers and tourists solve geographic problems when they give and receive driving directions, select hotels in unfamiliar cities, and find their way around theme parks (Figure 1.2).
- Farmers solve geographic problems when they employ new information technology to make better decisions about the amounts of fertilizer and pesticide to apply to different parts of their fields.

Figure 1.1 Maintaining and improving footpaths in national parks is a geographic problem.

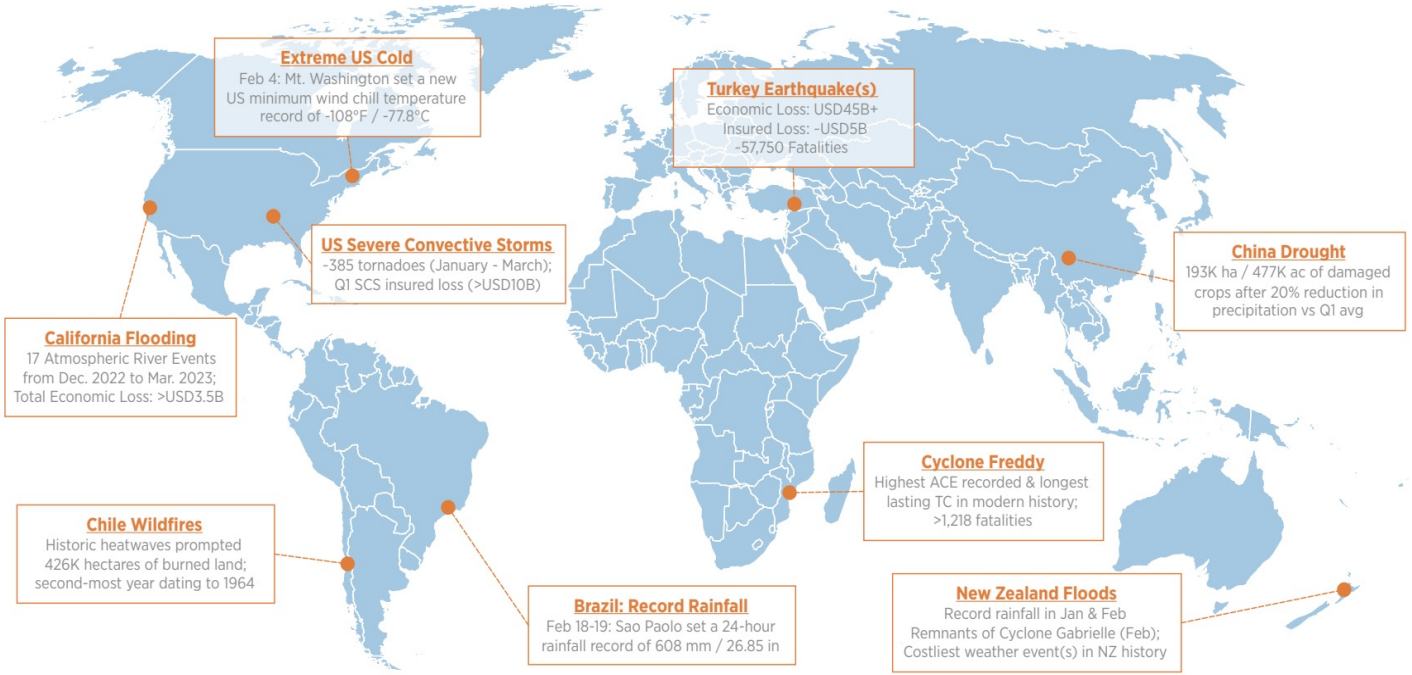


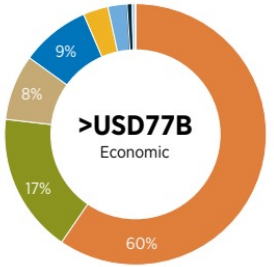
Almost everything that happens, happens somewhere. Knowing where something happens can be critically important.

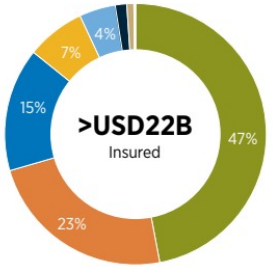
Source: Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W., 2011. *Geographic information systems and science*. Wiley.

Geospatial and location underpins almost everything in insurance.

Natural Catastrophe Losses—Q1 2023







TC: Tropical Cyclone | FL: Flooding | WW: Winter Weather
SCS: Severe Convective Storm | DR: Drought | EW: European Windstorm
EQ: Earthquake | WF: Wildfire | Other

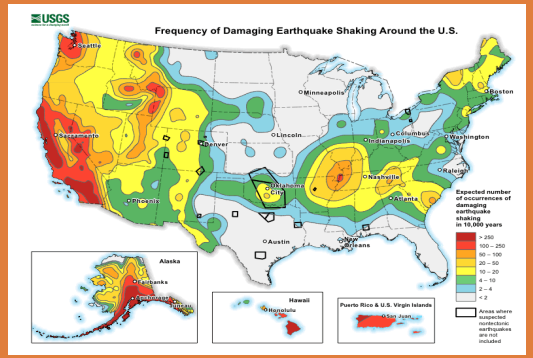
Source: [Q1 2023 Natural Catastrophe Report Preliminary Overview, Gallagher Re, April 2023]

What is the role of geospatial in Insurance?

Risk = Hazard x Exposure x Vulnerability

Hazard

What's the probability of a certain intensity of event at a specific location? e.g., likelihood of an X magnitude earthquake happening



Source: https://www.usgs.gov/programs/earthquake-hazards/science/introduction-national-seismic-hazard-maps

Exposure

What is exposed to a hazard? e.g. Is the property in a flood zone? Built near the coast? In a seismically active area?

Vulnerability

What the likelihood of damage from the hazard? e.g., modern steel-frame building v.s. wooden building or single-story v.s. multi-story.

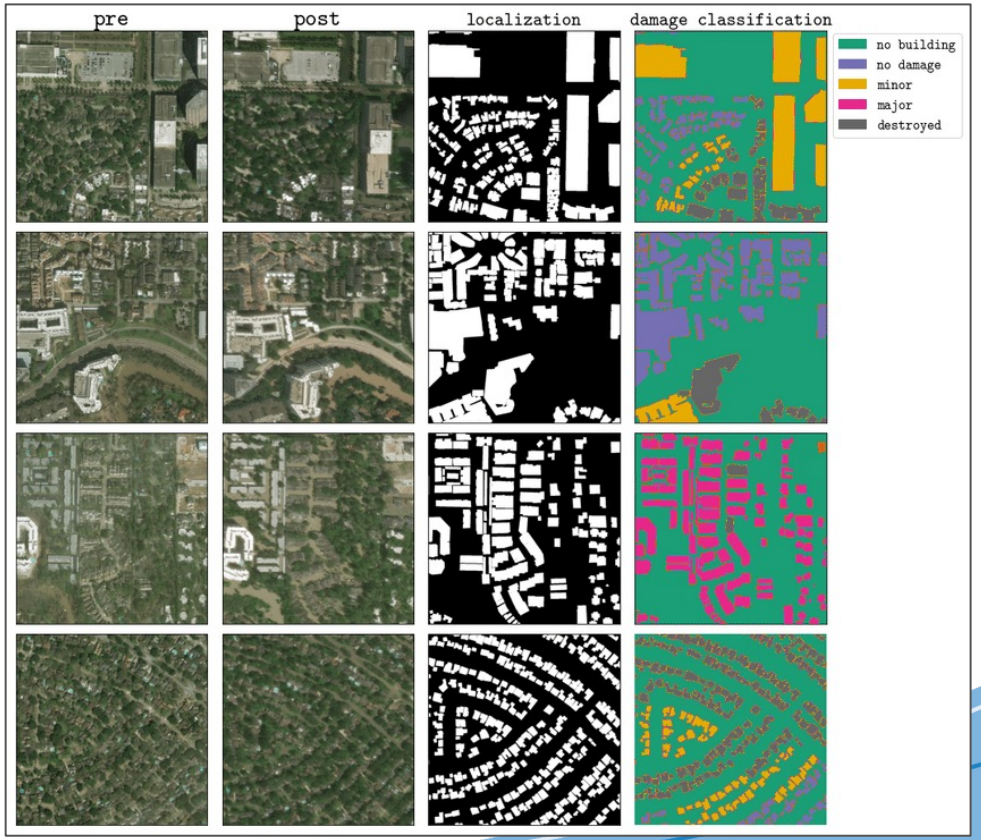
Location

AI Building Damage Assessment

Evaluating damage level using pre- and post-event imagery

- Damage estimation can be a difficult and dangerous task after a disaster as it requires people on the ground.
- Computer vision algorithms can perform damage assessment in a quicker and safer way using remotely-sensed imagery.
- xBD (Gupta et al. 2019) is an annotated large-scale dataset with 850k buildings, covering six types of natural disasters, over 15 countries and 45k square kilometres.

Disaster Level	Structure Description
0 (No Damage)	Undisturbed. No sign of water, structural or shingle damage, or burn marks.
1 (Minor Damage)	Building partially burnt, water surrounding structure, volcanic flow nearby, roof elements missing, or visible cracks.
2 (Major Damage)	Partial wall or roof collapse, encroaching volcanic flow, or surrounded by water/mud.
3 (Destroyed)	Scorched, completely collapsed, partially/ completely covered with water/mud, or otherwise no longer present.



Source: Xia et al. (2022) 'Self-Supervised Learning for Building Damage Assessment from Large-scale xBD Satellite Imagery Benchmark Datasets'

Challenges in Geocoding

Having an exact location is the foundation of catastrophe analytics.

Beursplein 37, Meent 110, 3011 AA Rotterdam, Netherlands

[detailed sections] [city/municipality/locality] {province} {country}

Japanese format

〒155-0031 東京都世田谷区北沢2丁目19-10

[postcode] [prefecture] [city/municipality/ward] [location in city/municipality/ward] [detailed sections]

Western format

2 Chome-19-10 Kitazawa, Setagaya City, Tokyo 155-0031, Japan

[detailed sections] [location in city/municipal/ward] [city/municipal/ward] [prefecture] [postcode] {country}

Impact of Climate Change

- Climate change is **increasing the frequency or severity of many natural perils**, but the science is complex and there's not always consensus.
- Climate change will also impact each peril differently—it can even have a different impact on the same peril, **depending on where it occurs in the world**.
- **Confidence in our understanding also varies by peril** because sometimes there are competing 'drivers' of change and we do not know which will become dominant
- As such, we are less able to **use the past to inform the present**.

With the uncertainty around climate change, knowing where something happens is just as critically important as ever

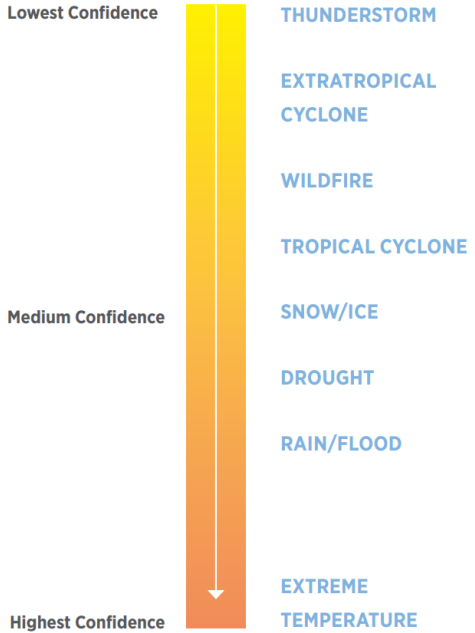
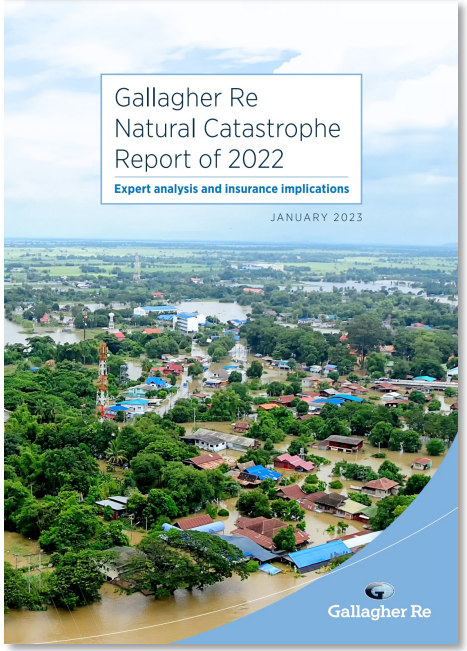


Figure 1: Current confidence in climate change attribution to individual perils
Source: Attribution of Extreme Weather Events in the Context of Climate Change

Learn More

Gallagher Re Natural Catastrophe Report 2022

https://www.ajg.com/gallagherre/news-and-insights/2023/january/nat-cat-report-2022/



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Royal Geographical Society Disaster Risk Management Professional Practice Group

https://www.rgs.org/professionals/professional-practice-groups/disaster-risk-management-ppg/

https://www.linkedin.com/groups/12470011/