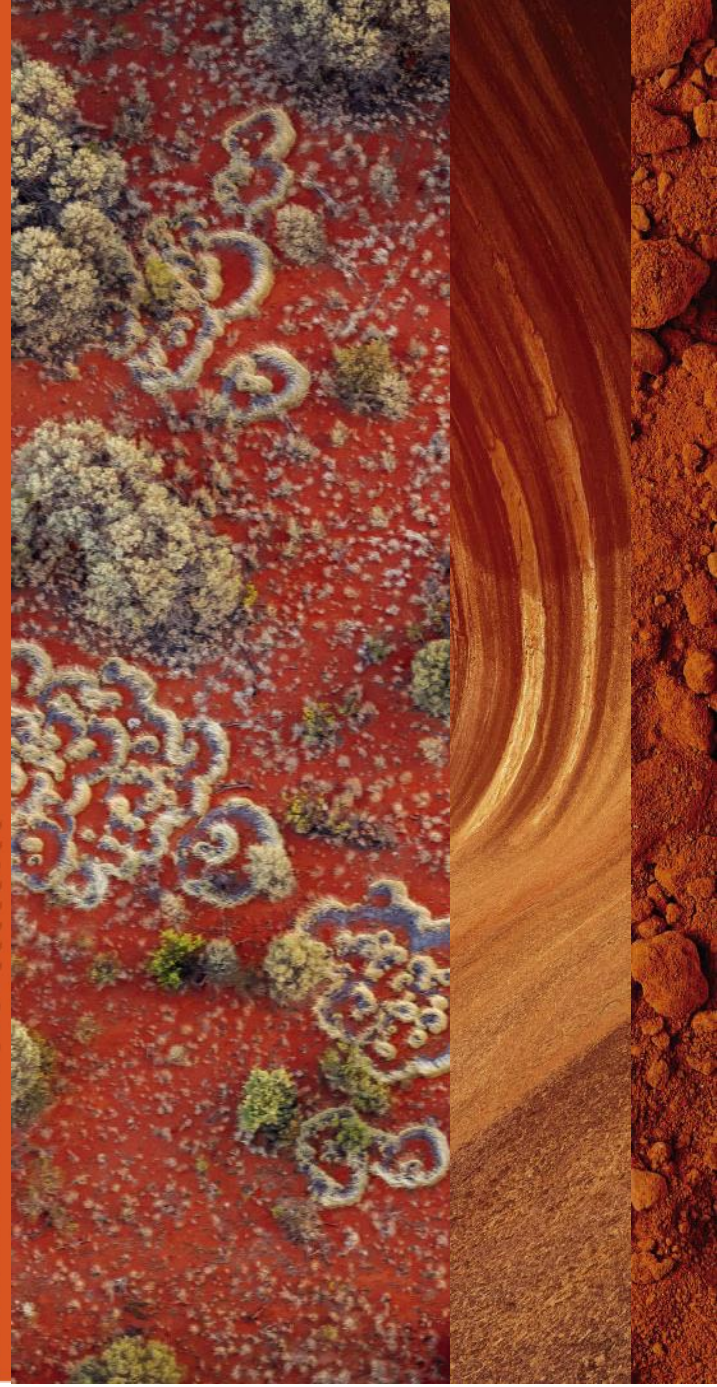
Australian Government
Geoscience Australia

POSITIONING AUSTRALIA

Geodetic Contributions to Disaster Risk Reduction

Dr John Dawson, Director of Positioning



Ensuring Australia's Community Safety

We cannot prevent natural hazards, such as tsunamis, earthquakes and cyclones, from occurring. However, we can work to prevent these natural hazards becoming disasters. This can be achieved by improving community resilience through effective preparation, monitoring and response. Geoscience Australia provides crucial information during each of these stages to ensure Australia's community safety.

Scientific instruments on the earth's surface and on satellites can monitor the processes that lead to natural disasters. By providing this information to emergency managers and other decision makers, communities can be given time to prepare or evacuate before the hazard occurs.

Monitoring and warnings are only one aspect. Governments, land-use planners, emergency managers and communities also need to be aware of the disaster's potential severity and impact.

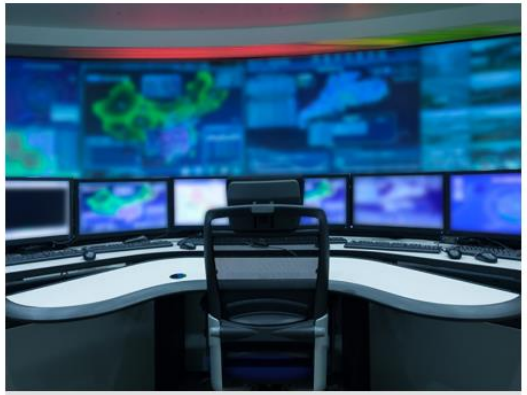
Historically, bushfires, floods, earthquakes and cyclones have caused loss of life and significant damage to property and infrastructure.

Bushfire

Coastal Erosion

Earthquake

Flood



Nuclear Monitoring

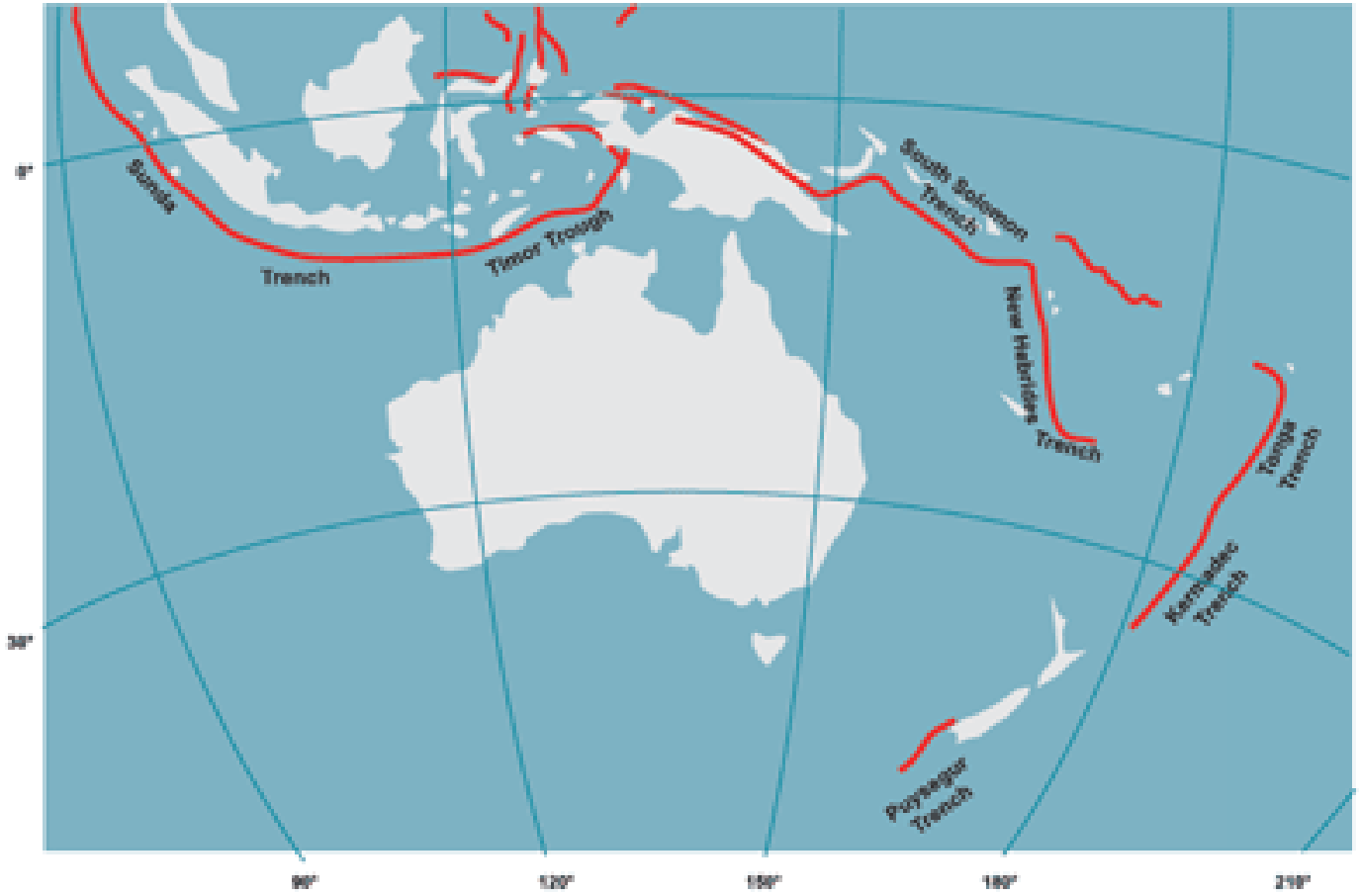
Risk and Impact

Severe Wind

Tsunami

Australian Government and Tsunami Warning

- Bounded by 8,000 km of active tectonic plate boundary capable of generating a tsunami (impacts 2-4 hours, 90 minute requirement for warning)
- Vulnerable low-lying areas significant
- After the December 2004 Tsunami, the need to be able to warn the Australian population was identified



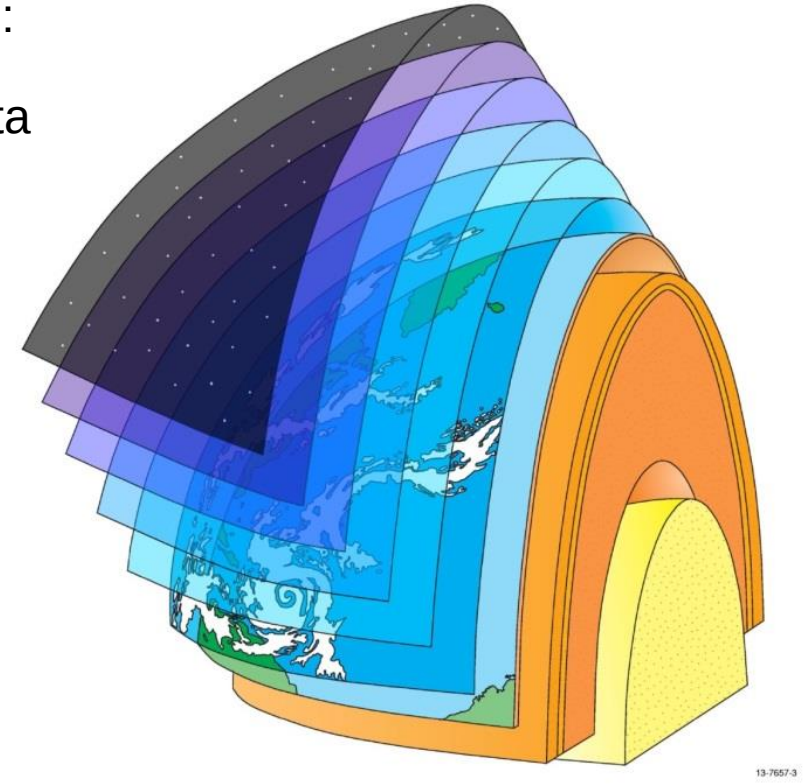
Australian Government and Tsunami Warning

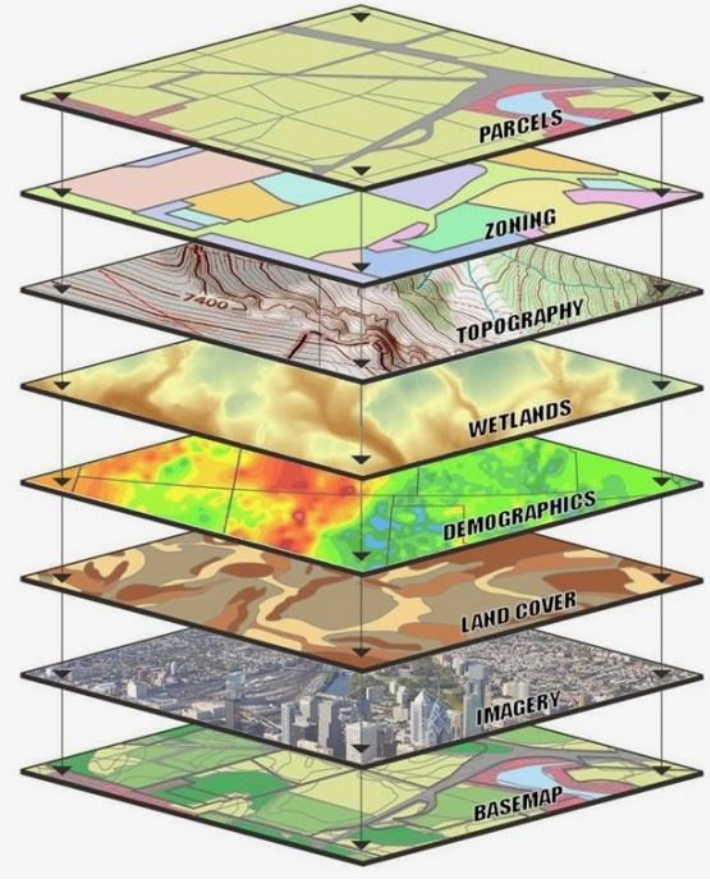
- The Joint Australian Tsunami Warning Centre (JATWC) is operated by the Bureau of Meteorology (Bureau) and Geoscience Australia (GA)
- Capability to detect, monitor, verify and warn the community of tsunamis in our region and possible threats to Australian coastal locations and offshore territories
- We rely on seismic and tide gauge data but GNSS data and analysis offers new tools that have the potential of greatly improving our capability

Geodesy and Disasters

Some things Geodesy provides:

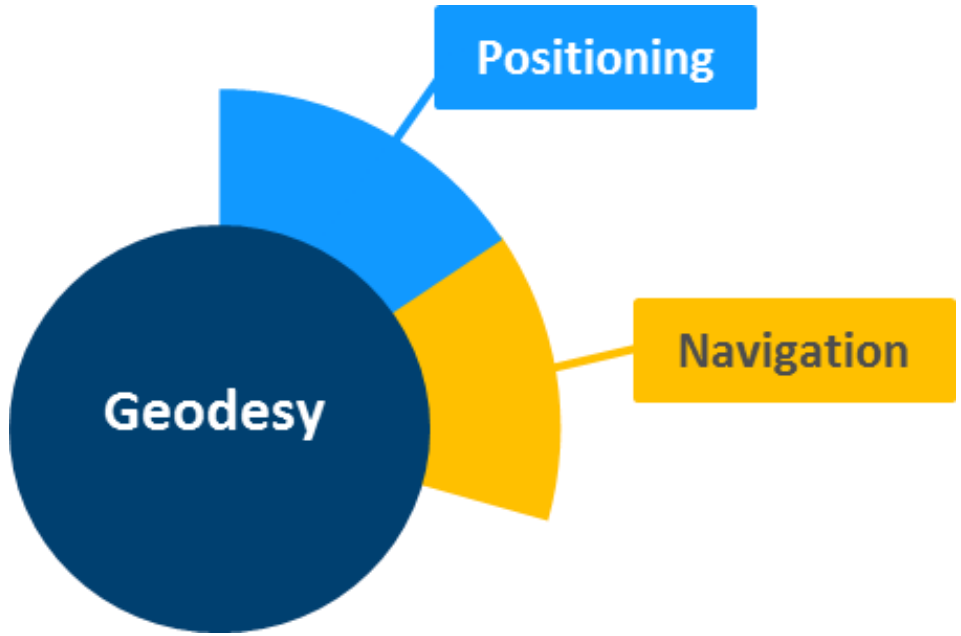
- Underpinning geospatial data
- Space weather
- Atmospheric state
- Surface motion
- Observations of sea level including observations in an absolute reference frame





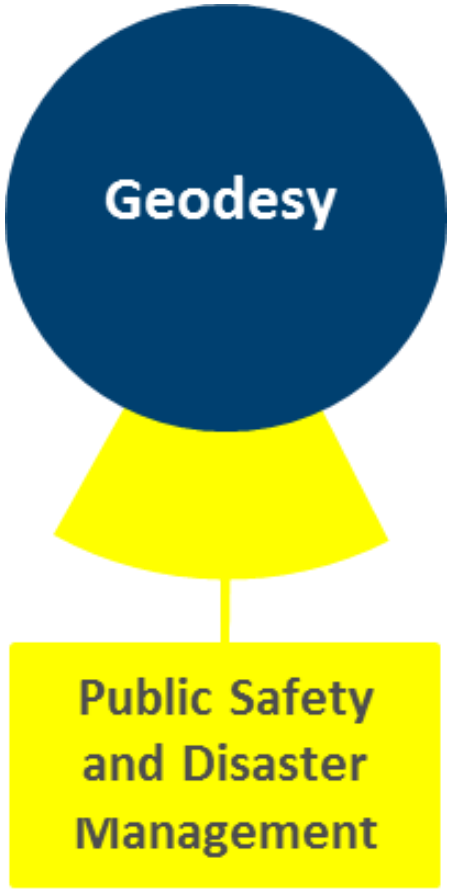
Geodesy and DRR

- How can I monitor and model groundwater in the lens?
- How can I be sure to build the hospital above the flood warning level?
- How can I define the flood warning level accurately across a whole country at locations / islands that don't have a tide gauge?



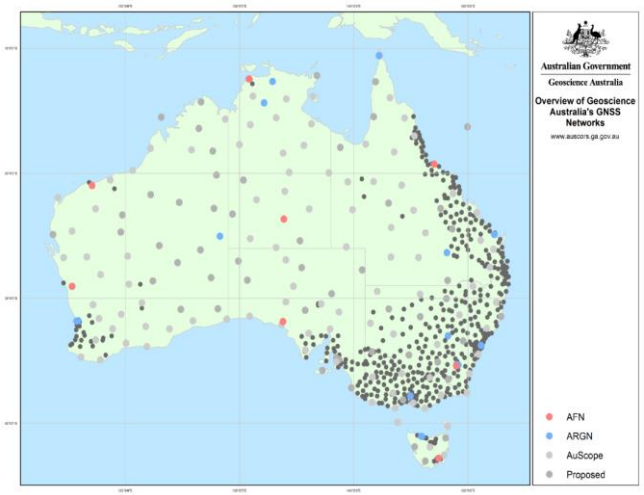
Geodesy and DRR

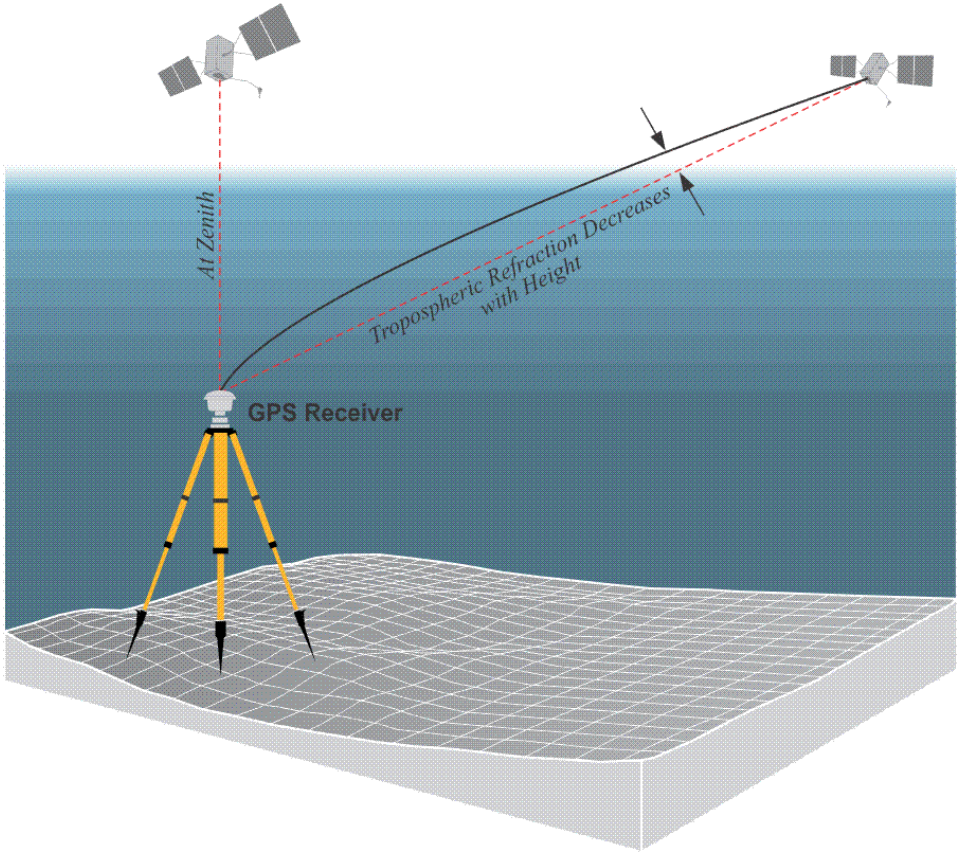
- Earthquakes: detect strain build up in tectonically active regions
- Tsunami: observe environmental hazards to better understand them (e.g. Fukushima)
- Volcano: observations help detect the build up and release phase

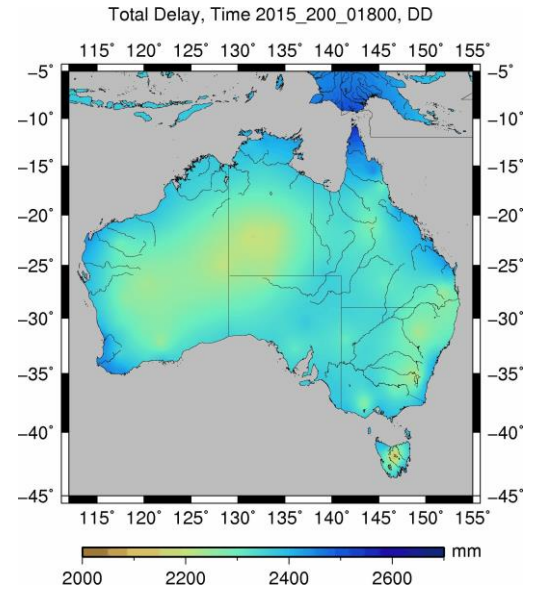


GNSS for Weather Forecasting

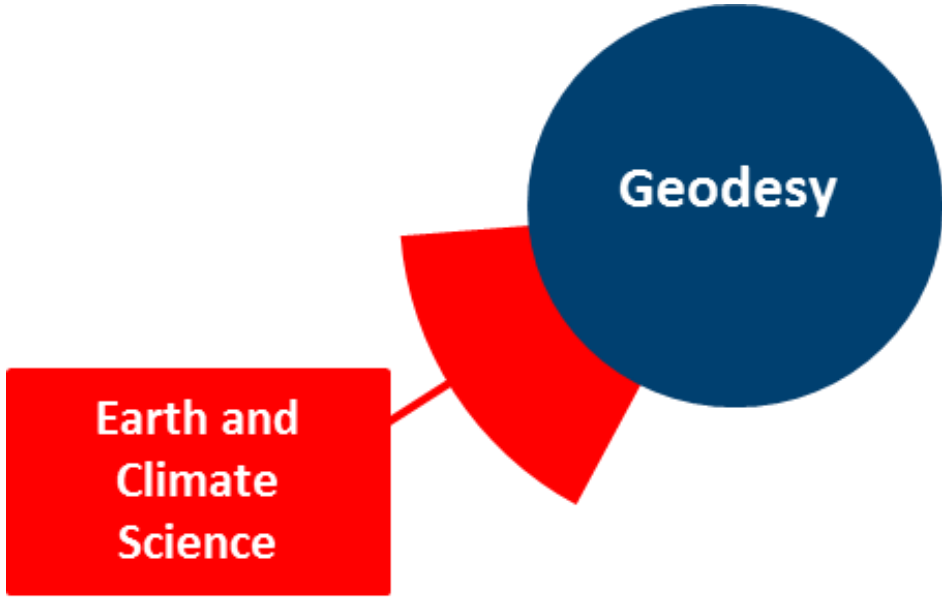
In 1999, the biggest single insurance loss in Australian history of A$1.7 billion caused by the Sydney hailstorm







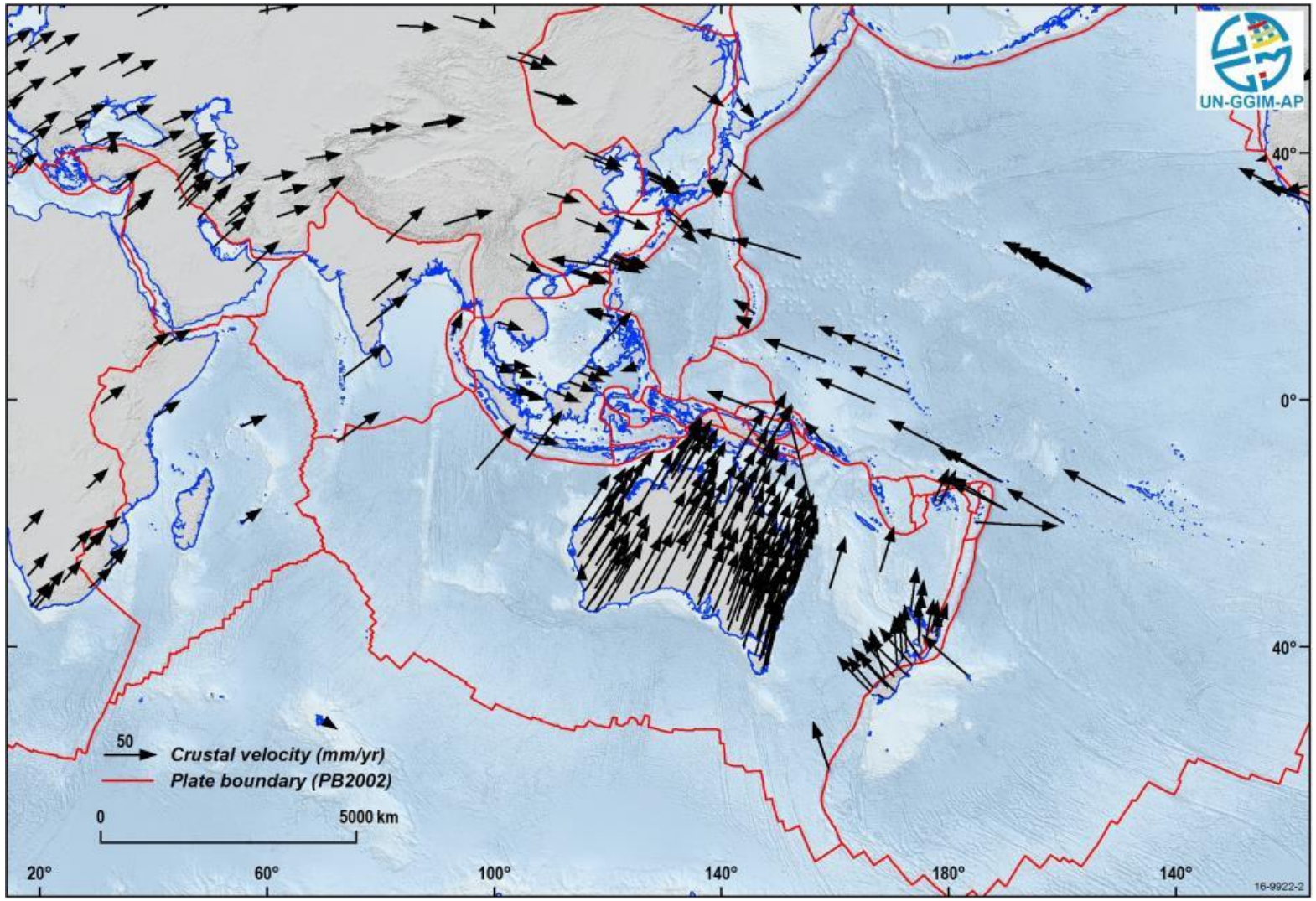
Geodesy and DRR



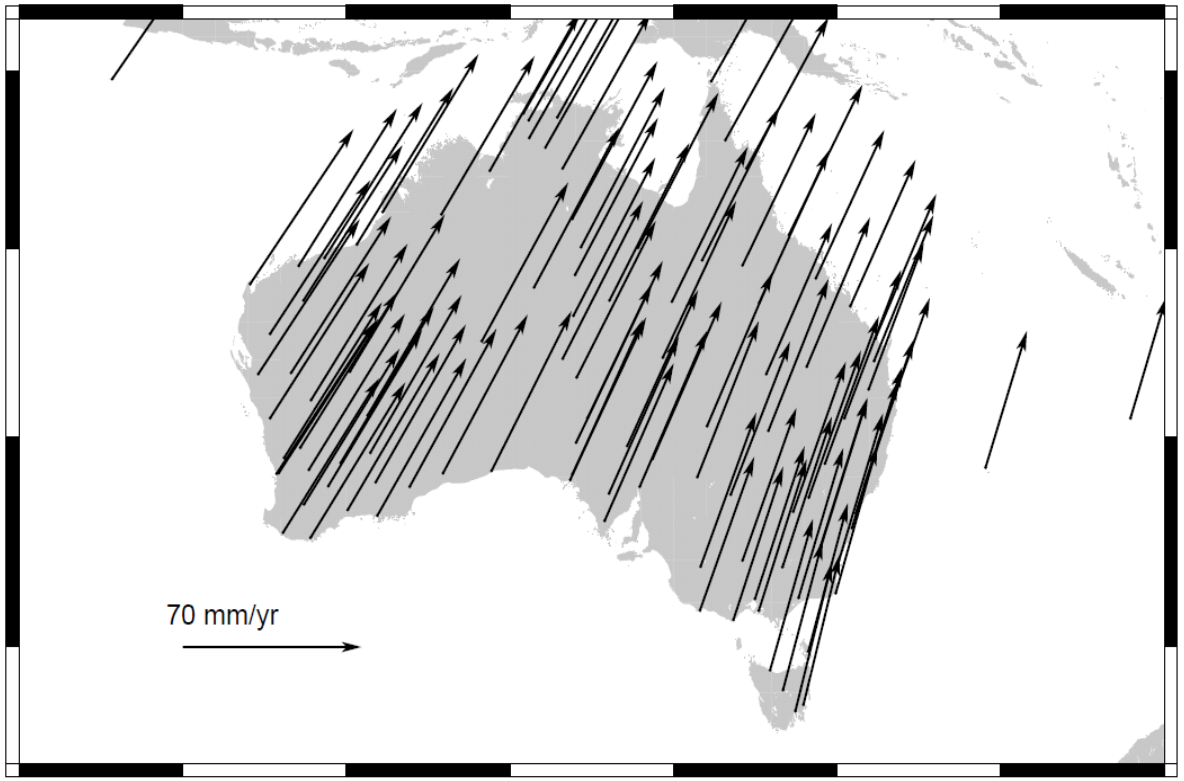
Satellites observations are able to detect millimetre scale trends in ocean and land height:

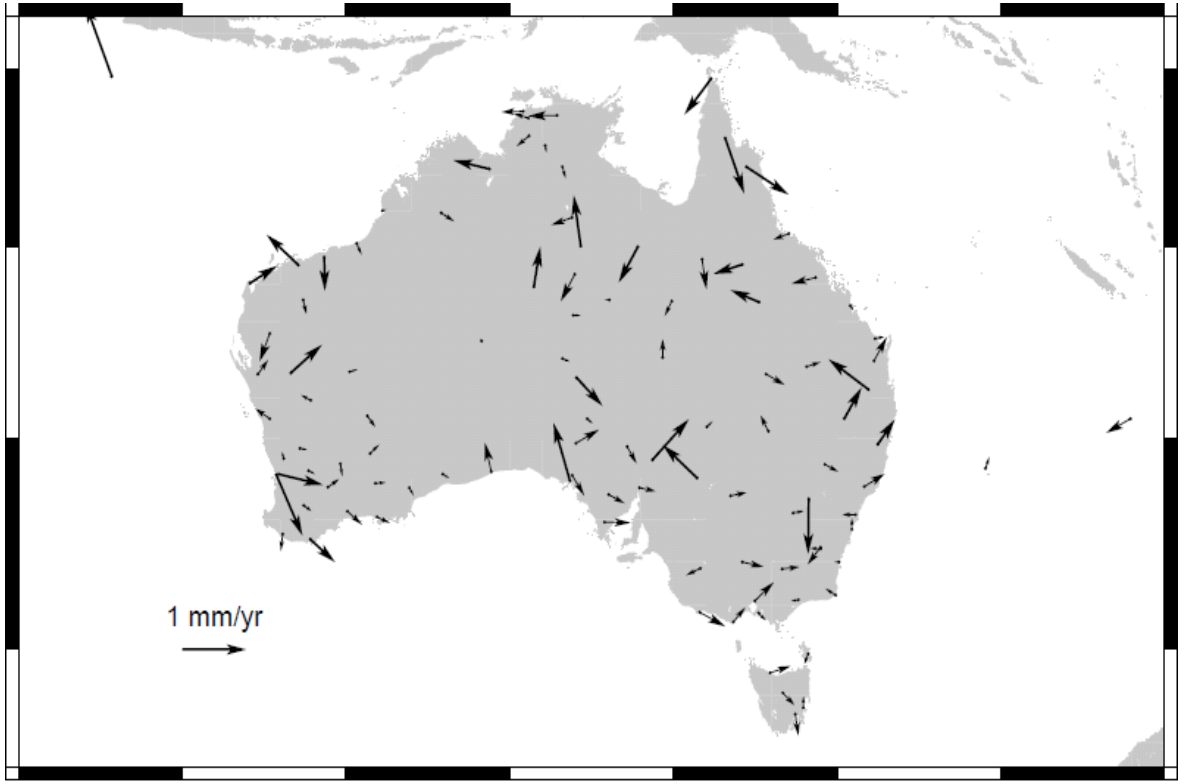
- Oceanography: changes in sea level from satellite altimetry and tide gauges
- Atmospheric: GNSS can detect changes in the atmosphere for extreme events; GA data used for weather forecasting by BoM
- Groundwater changes: changes in gravity to map seasonal groundwater movement

Global Tectonics

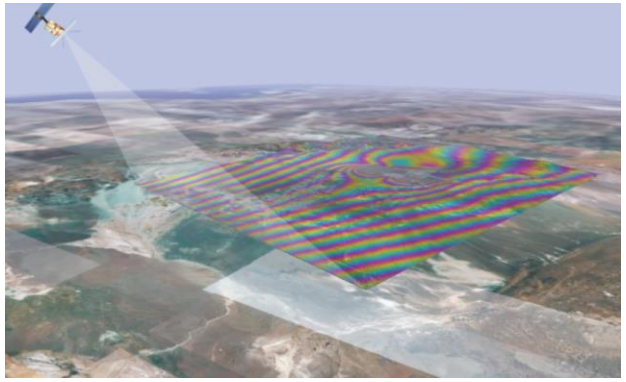


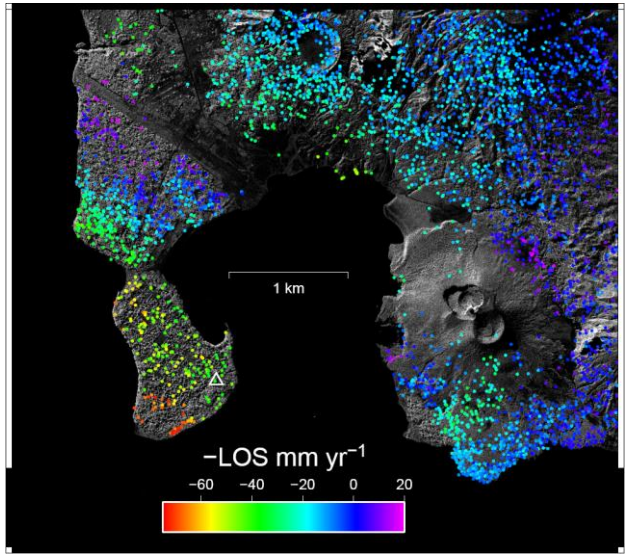
Intra-plate deformation

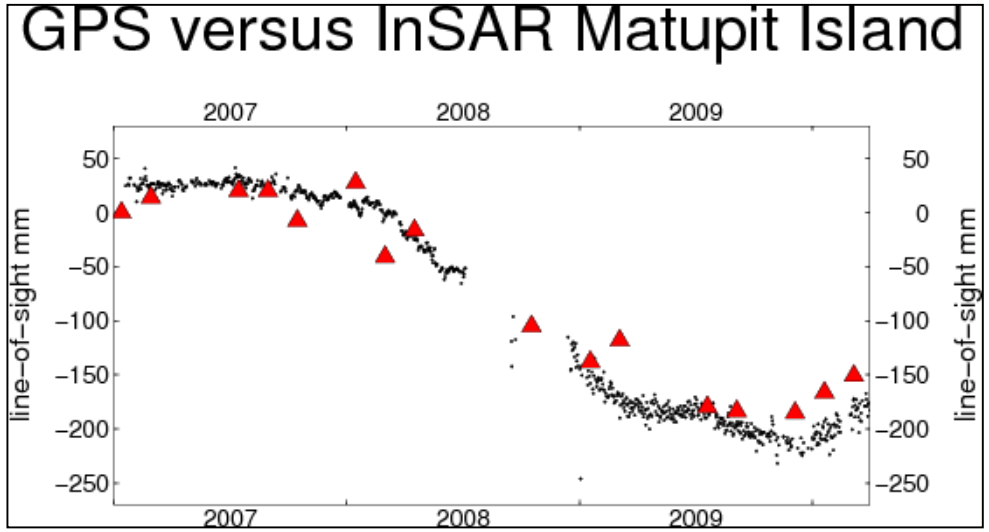




Geodesy for DRR

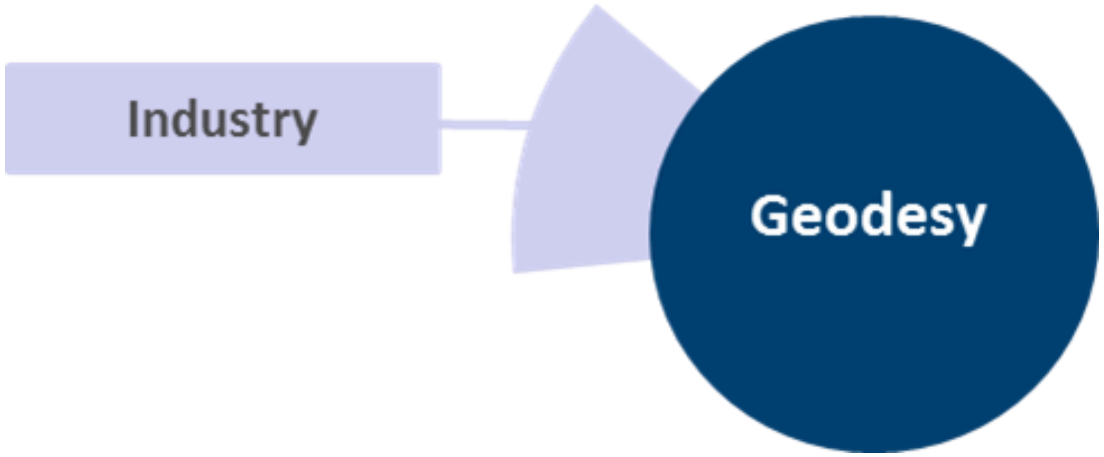






Dawson and Saunders, 2011

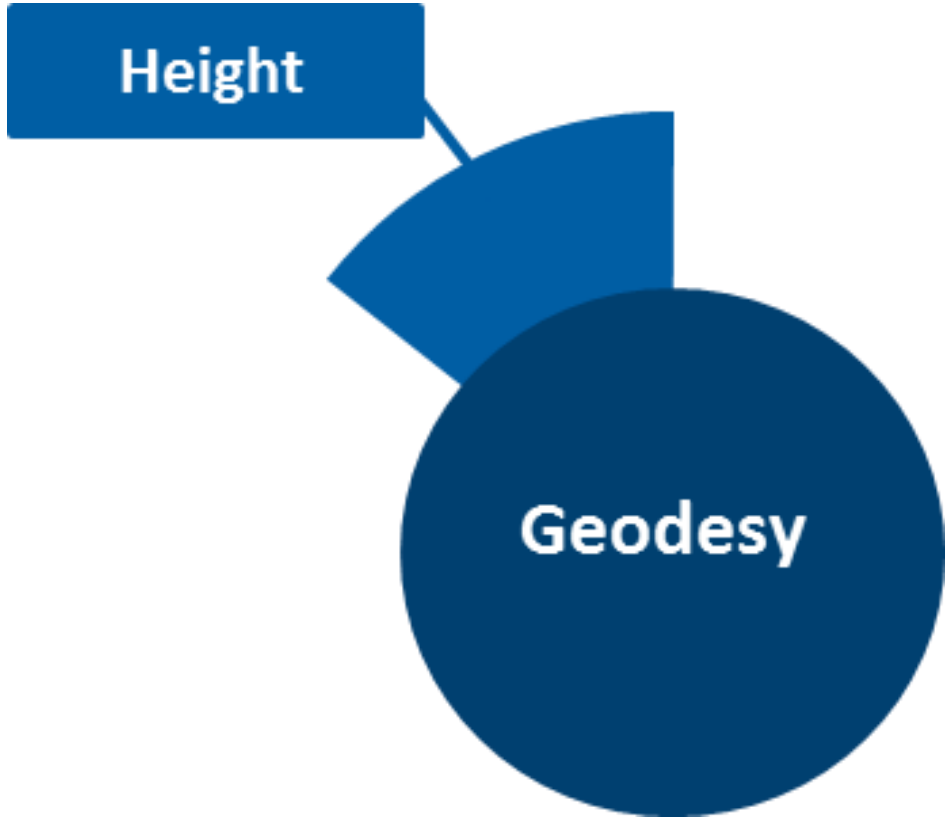
Geodesy and DRR



<u>Construction and Engineering</u>

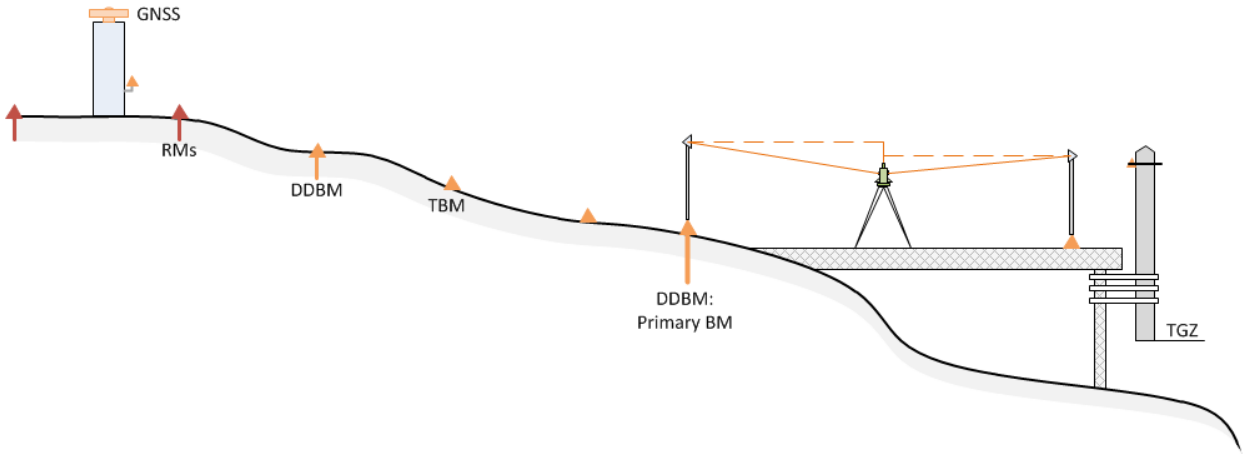
- Installing and managing water, sewerage and telecommunication assets
- Bridges that meet in the middle
- Construction of houses and buildings in safe regions
- Monitoring information can help inform building codes
- Precise, efficient and increasingly cheap positioning capability.

Geodesy and DRR

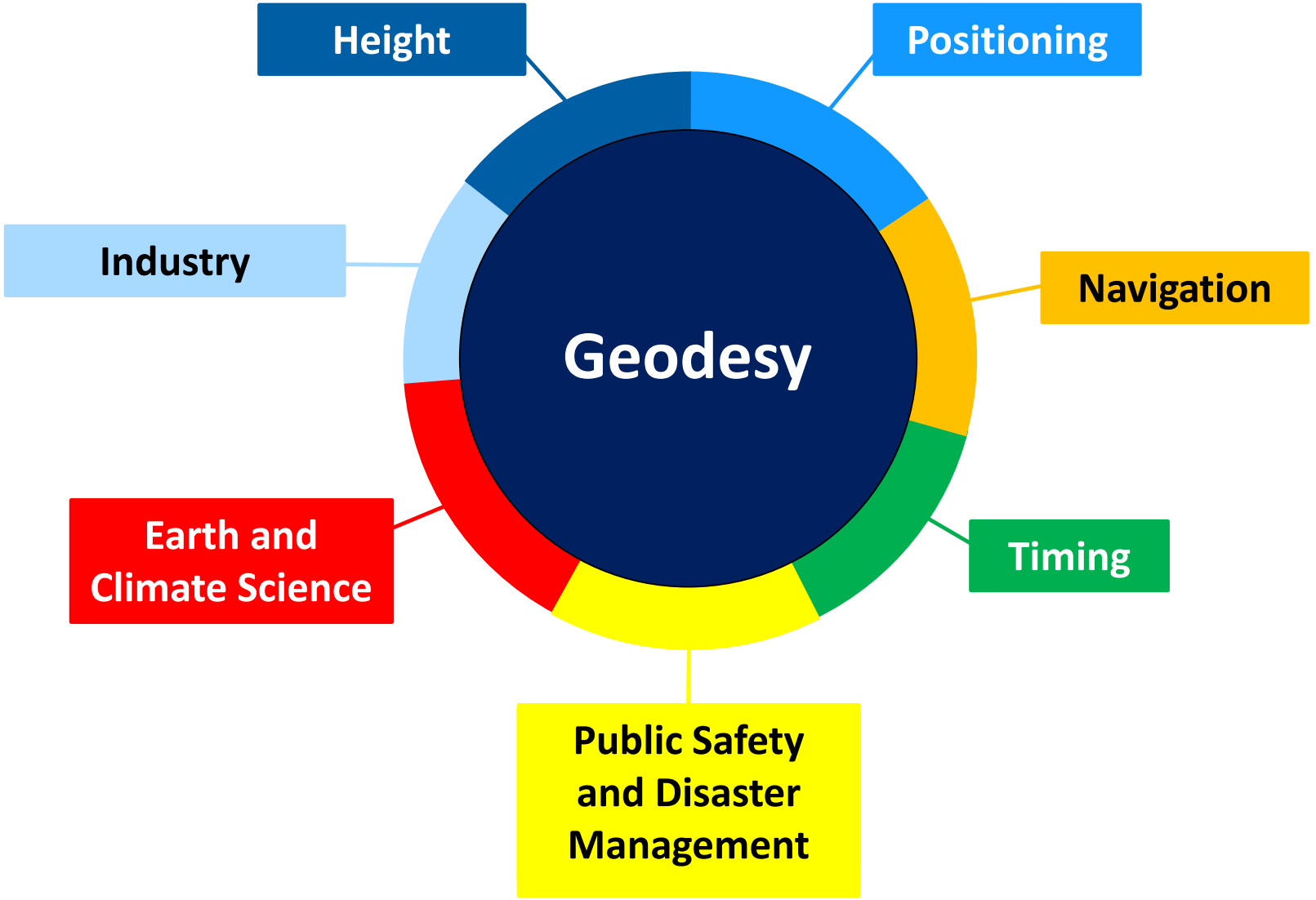


- Where should I build my house?
- Where should I go in case of a flood or tsunami?
- How can I mitigate the impacts of sea level rise?

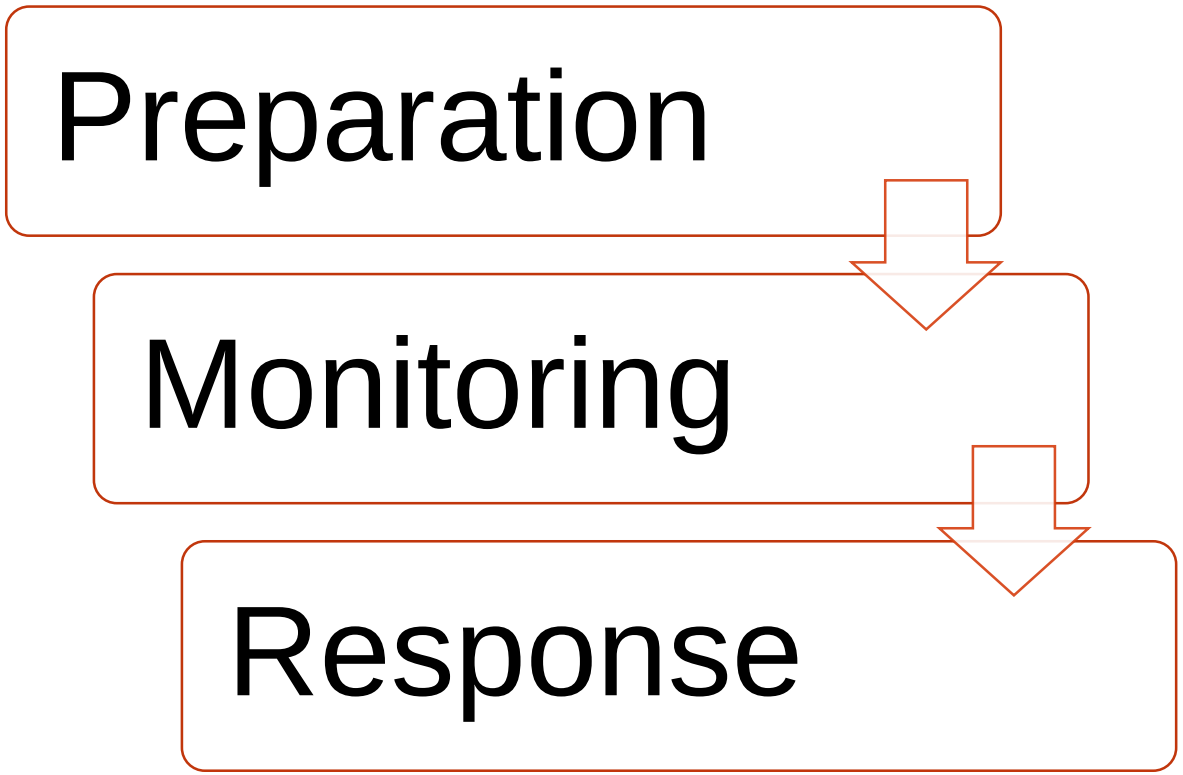
Observation of Sea Level Change



Geodesy and DRR



Disaster



Examples of how Geodesy can help

- Geospatial mapping of community exposure
- Tectonic mapping
- Hazard susceptibility mapping

- Sea level observation and prediction
- Volcanic eruption warning
- Earthquake characterisation
- Weather forecasting (rainfall events)

- Tsunami tracking
- Damage assessment
- Decision making aided by geospatial data

Final Thoughts

- Importance of data sharing
- Capacity building requirements are evident
- Government GNSS networks in the Asia Pacific continue to be developed. To support RTK they also generally aspire for real-time capabilities
- There is no easy solution to improving data sharing practices of governments
- Need to acknowledge the multi-use nature of GNSS networks in the region because this ensures its sustainability whilst emphasising the importance of sharing
- The costs and risks from sharing real-time data not insignificant for national agencies
- How will real-time data distribution work (e.g. casters)