

Australian Government
Geoscience Australia

Natural Hazard Impact Assessment at Geoscience Australia

Mark Edwards



COVERMAR Launch : Old Customs House
27th February 2014, Sydney

APPLYING GEOSCIENCE TO AUSTRALIA'S MOST IMPORTANT CHALLENGES

Queensland Floods - Jan 2011



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Tropical Cyclone Yasi - 3rd Feb 2011



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Structure

- Background to Geoscience Australia.
- Overview of agency capabilities in support of risk assessment and emergency management.
- Research activity areas:-
 - 1) Post Disaster Survey Activity
 - 2) Flood Vulnerability - DCCEE Co-funded Activity
 - 3) Alexandra Canal Study - City of Sydney Collaboration
 - 4) UN Global Assessment Report - COVERMAR Contr.
- Summary and future directions.

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Geoscience Australia

- Is a prescribed Australian Government agency within the Industry Portfolio and located in Canberra. Our Minister is Mr Ian Macfarlane MP.

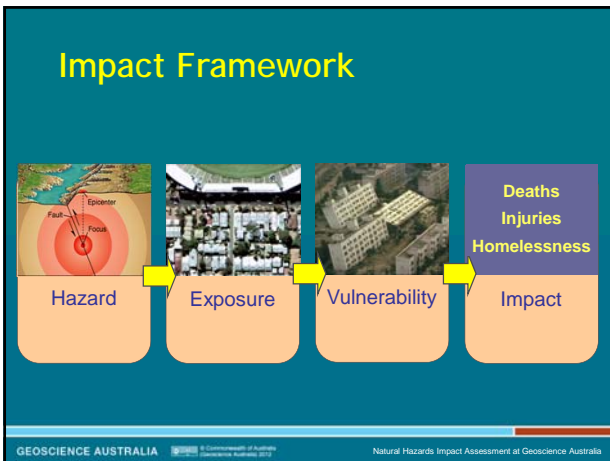


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Geoscience Australia

- Is a prescribed Australian Government agency within the Industry Portfolio and located in Canberra. Our Minister is Mr Ian Macfarlane MP
- Is Australia's national geoscience research agency with a mission is to use geoscientific information and knowledge for the economic, social and environmental benefit of Australia.
- Provides a range of information products (baseline and derived) to those involved in managing natural hazard risk.
- Collaborates with both state and local government, the insurance industry and broader research community.

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GA support for risk assessment and following natural disasters

Baseline geographic information

- Topographic and elevation data
- Aggregated exposure data

Hazard detection and alerting products

- Sentinel hotspots (bushfire alert)
- Earthquake and tsunami alerts

Disaster mapping

- Baseline imagery (pre-event imagery)
- Rapid imagery acquisition
- Derived hazard footprint

Impact analysis

- Event specific exposure data
- Impact modelling




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Baseline geographic information

Topographic and elevation data

Digital

- Map Connect (custom maps and data downloads)
- Topographic mapping data downloads
- Online ordering

Physical

- GA Sales Centre

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Baseline geographic information

Aggregated exposure data

GA compiles exposure data

- Database known as 'NEXIS'

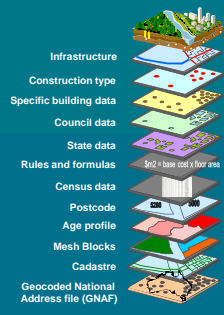
Off-the-shelf product

- Building level data aggregated to LGA or SLA

Updated annually

Digital only

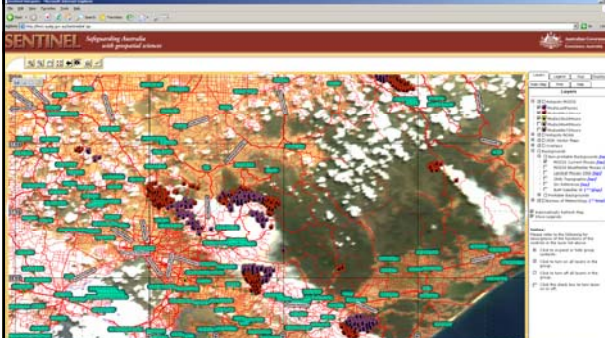
- Spreadsheet
- Map



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Hazard detection and alerting

Sentinel Hotspots Online



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Hazard detection and alerting

Joint Australian Tsunami Warning System



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Disaster mapping products

Rapid imagery acquisition

- Public-good imagery
 - Routine capture (MODIS, LANDSAT)
- Commercial imagery
 - Targeted capture (Radar, high-resolution)
- Catastrophic disasters
 - International support

Imagery analysis products

- Disaster footprints and example application

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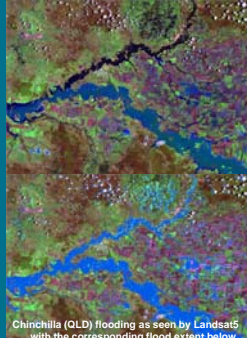
Imagery analysis products

Semi-automated to produce

- Flood extent
- Burn scar extent
- Cyclone impact extent
- Oil slick extent

Uncertainties

- Sensor quality
- Cloud cover



Chinchilla (QLD) flooding as seen by Landsat5 with the corresponding flood extent below.

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Impact Modelling

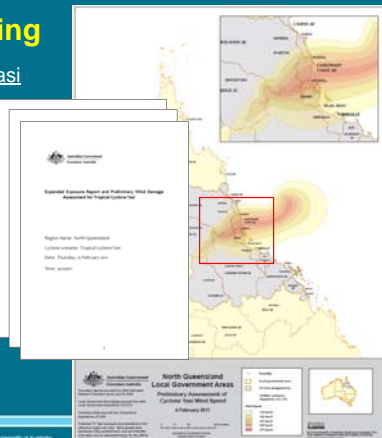
Tropical Cyclone Yasi

Date: 3 February 2011
Time: 4:30 pm

Scenario model using act...

Intensity and cyclone path provided by BOM

GA determined local wind considering local influence



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Tropical Cyclone Yasi


Date: 3 February 2011
Time: 4:30 pm

Residential exposure to Wind

Wind Zone	Buildings	Population	Building Value
Extensive	3,842	8,935	1,698 M
Moderate	8,650	3,239	2,518 M
Minor	11,438	32,574	3,315 M

Residential exposure to Storm Surge

Regional Councils	Storm Surge (m)	Buildings	Residences	Population	Building Value
Cassowary Coast	2.5 m	2,096	2,403	4,746	516M
Hinchinbrook	4.0 m	2,910	3520	7,157	760M

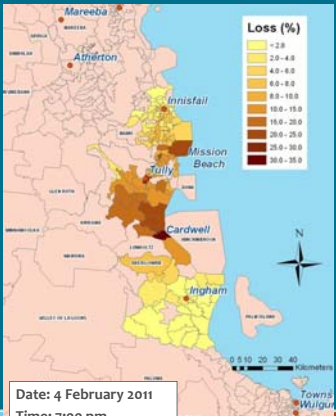


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Tropical Cyclone Yasi

GA capability to translate local wind speed for a residential buildings into damage (vulnerability).

Prioritise mitigation efforts before disaster.



Date: 4 February 2011
Time: 7:00 pm

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National Flood Risk Information Project (NFRIP)

NFRIP: 4 year project, 1 July 2012 – 30 June 2016

Aim: To improve the quality, availability and accessibility of flood information

Users:

- All levels of Government, public, insurers, land-use planners, emergency managers and consultants.

How?:

- Build and populate a portal
- Revise the Australian Rainfall and Runoff,
- Analyse Geoscience Australia's satellite imagery archive to derive historic flood extents.

Benefits:

- Discover existing authoritative information, view in a consistent way at a central location to manage flood risk.



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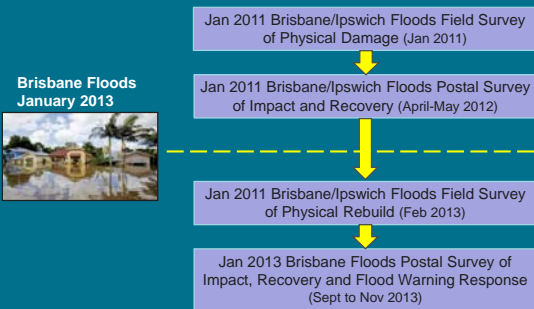
1) Post Disaster Activity



Geoscience Australia Survey Activity

- Dubbo Thundersform 2001
- Canberra Bushfires 2003
- Bendigo Tornado 2003
- South East Melbourne Flash Floods 2004
- Eyre Peninsula Bushfires 2005
- Lismore Floods 2005
- Tropical Cyclone Larry 2006
- Victorian Bushfires 2009
- Padang Earthquake, Indonesia 2009
- Kalgoorlie Earthquake 2010
- Darfield Earthquake, NZ 2010
- Brisbane/Ipswich Floods Jan 2011 (Indonesian and NZ assistance) 2011
- Tropical Cyclone Yasi (Philippines and NZ assistance) 2011
- Brisbane/Ipswich Jan 2011 Floods (postal survey of impact and recovery) 2012
- Tropical Cyclone Yasi (postal survey of impact and recovery) 2012
- Brisbane/Ipswich Jan 2011 Floods (mitigation in rebuild) 2013
- Brisbane Jan 2013 Floods (postal survey of impact and warning response) 2013
- Bundaberg Floods (residential postal survey of impact and recovery) 2014 - Underway

Longitudinal Studies



Survey Tools

Pre-programmed handheld computers with GPS and Camera.



Rapid Inventory Collection System (RICS)



Postal Survey Instruments



Common Platform for Survey Data Review (FiDAT)

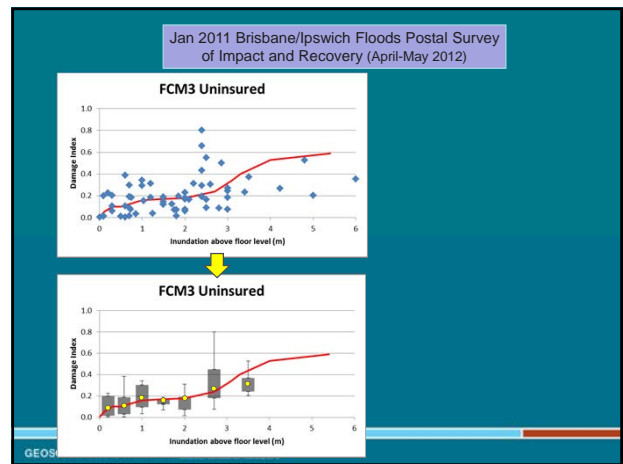
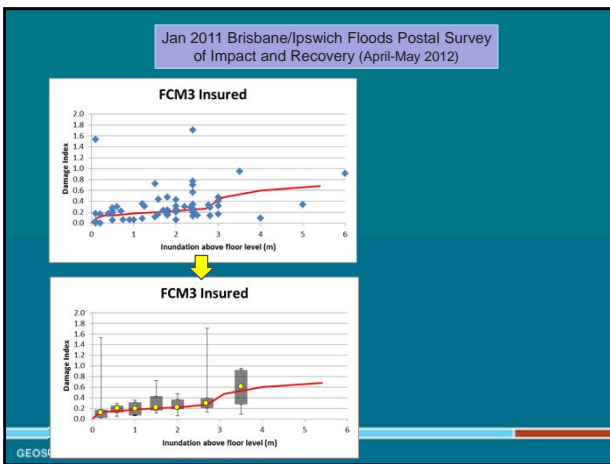
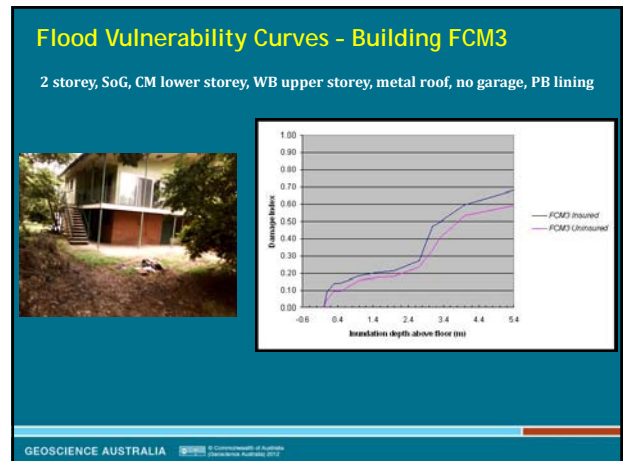


2) DCCEE Co-Funded Flood Vulnerability - Impacted Brisbane/Ipswich Building Stock Categorization

Generic House Type	Costing Module Code	Representative of House Types	Description
1	FCM1	ZA, N, D, F, E, L, M	1 storey, RF, WB or panel cladding, no garage, HB lining
2	FCM2	Q	1 storey, RF, WB or panel cladding, no garage, timber lining
3	FCM3	J, Z, ZF, V, ZD, I	2 storey, SoG, CM lower storey, WB upper storey, metal roof, no garage, PB lining
4	FCM4	K, T, Y, H, R, S, ZB	2 storey, SoG, CM lower storey, WB upper storey, metal roof, garage, PB lining
5	FCM5	G	2 storey, SoG, WB cladding, partial lower floor, PB lining
6	FCM6	ZE	2 storey, RF, WB cladding, no garage, PB lining
7	FCM7	A	1 storey, SoG, BV, garage, PB lining
8	FCM8	X, P, O, W	1 storey, SoG, BV, no garage, PB lining
9	FCM9	B	1 storey, RF, BV, no garage, PB lining
10	FCM10	U	1 storey, SoG, CM, no garage
11	FCM11	C	1 storey, RF, CM, no garage

Flood Vulnerability - Repair Strategy Costing

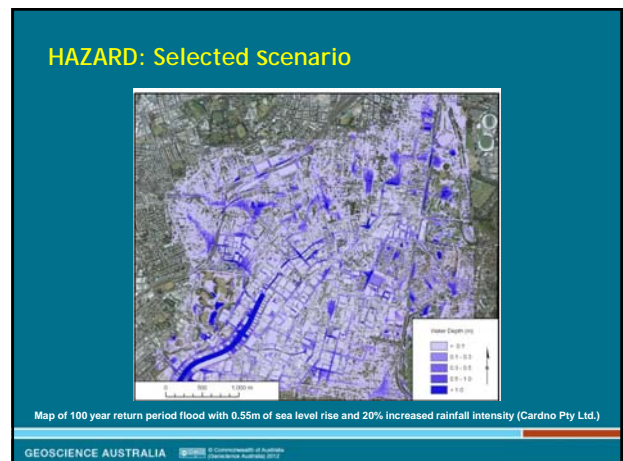
No	Component	Description	Required repairs for inundation depth relative to floor level (m)									
			-0.3	0	0.1	0.3	0.5	1	1.5	2	2.5	3
1	Substructure	Timber lattice enclosing underfloor space	Jet clean and allow to dry	Jet clean and allow to dry	Jet clean and allow to dry	Jet clean and allow to dry	Jet clean and allow to dry	Jet clean and allow to dry	Jet clean and allow to dry	Jet clean and allow to dry	Jet clean and allow to dry	Jet clean and allow to dry
2	Skirting boards	Moulded softwood skirting, paint finish	Nil	Nil	Remove and replace	Remove and replace	Remove and replace	Remove and replace	Remove and replace	Remove and replace	Remove and replace	Remove and replace
3	Ceiling	13mm plasterboard on timber battens	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Remove and replace. Allow to settle 25% of battens
4	Wall insulation	Fibreglass batts (thermal to exterior walls, sound to interior walls)	Nil	Nil	Remove and replace over bottom half of wall height	Remove and replace over bottom half of wall height	Remove and replace over bottom half of wall height	Remove and replace over bottom half of wall height	Remove and replace over full wall height	Remove and replace over full wall height	Remove and replace over full wall height	Remove and replace over full wall height
5	Wall finishes (general)	Undercoat + 2 top coats paint	Nil	Nil	Undercoat at lower half of walls and apply 2 top coats to whole wall	Undercoat at lower half of walls and apply 2 top coats to whole wall	Undercoat at lower half of walls and apply 2 top coats to whole wall	Undercoat at lower half of walls and apply 2 top coats to whole wall	Undercoat at and apply 2 top coats to whole wall	Undercoat at and apply 2 top coats to whole wall	Undercoat at and apply 2 top coats to whole wall	Undercoat at and apply 2 top coats to whole wall



3) Alexandra Canal Study

Aim and objectives

- Collaboration with the City of Sydney facilitated by the SCCG.
- The project aimed to better understand the future effects of climate change in the Alexandra Canal catchment area through improved risk assessment framework components.
- The objectives were to:
 - develop an exposure database with key attributes for each building.
 - develop a representative vulnerability models of the building stock.
 - assess the impact of an event in a scenario study to inform the development of mitigation measures.



EXPOSURE: Age distribution of surveyed buildings



Map of distribution of age of surveyed buildings (Maqsood et al., 2012)

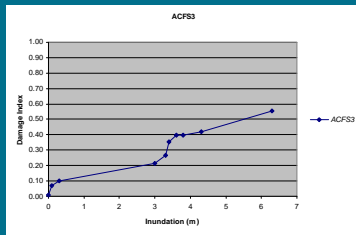
EXPOSURE: Floor height distribution of surveyed buildings



Map of distribution of building floor heights assessed by FIDAT (Maqsood et al., 2012)

VULNERABILITY: Supplementary Building Types

Two storey commercial/residential



IMPACT: Aggregated loss

Floor height Attribution Process	Total Damage Cost for Damage Functions Used	
	Simple Model Range (NSW Govt)	Broad Model Range (GA)
Assumed floor heights	\$93.9M	\$117.1M
FIDAT assessed floor heights	\$63.1M	\$83.1M



Uniform floor heights and NSW vulnerability model



Uniform floor heights and GA vulnerability model

4) UN International Strategy for Disaster Reduction (UNISDR) - GAR 2015

- The Global Assessment Report on Disaster Risk Reduction (GAR) is a biennial global assessment of disaster risk reduction. It includes a comprehensive review and analysis of the natural hazards that are affecting humanity.
- The GAR seeks to monitor risk patterns and trends, progress in disaster risk reduction and provides strategic policy guidance.
- Significantly it develops information using the risk assessment framework.
- Vulnerability knowledge has been a weakness of the GAR 2013 work reviewed by GA.
- Through UN and Australian AID funding a series of multi-hazard workshops were convened by GA to solicit expert opinion on regional vulnerability. COVERMAR researchers participated.

Regional Scope - Geographically

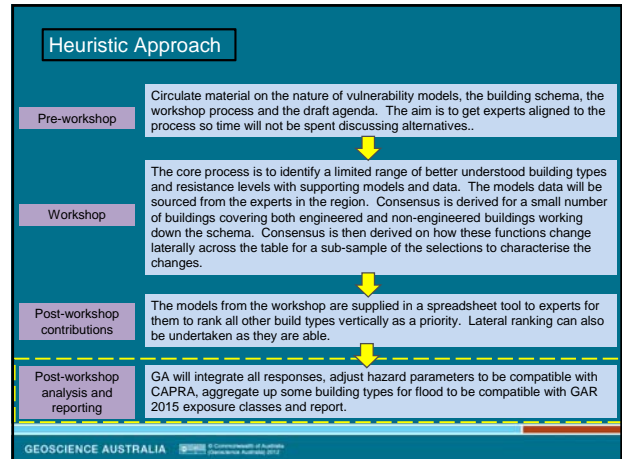


Regional Scope - Country List

24 in Total

Country	Hazard				
	Earthquake	Wind	Flood	Ash	Tsunami
Australia	Yes	Yes	Yes	No	Yes
New Zealand	Yes	Yes	Yes	Yes	Yes
Taiwan	No	No	No	Yes	No
Singapore	Yes	Yes	Yes	No	No
Japan	No	No	No	Yes	No
Korea, Rep.	No	No	No	Yes	No
Russia	No	No	No	Yes	No
New Caledonia	Yes	Yes	Yes	No	Yes
China	No	No	No?	Yes	No
Malaysia	Yes	Yes	No?	No	No
Tonga	Yes	Yes	Yes	Yes	Yes
Thailand	Yes	Yes	Yes	No	Yes
Fiji	Yes	Yes	Yes	Yes	Yes
India	Yes	Yes	Yes	No	Yes
Pakistan	Yes	Yes	Yes	No	Yes
Sri Lanka	Yes	Yes	Yes	No	Yes
Cook Islands	Yes	Yes	Yes	No	Yes
Bhutan	Yes	Yes	No?	No	No
Vietnam	Yes	Yes	No?	No	No
Solomon Islands	Yes	Yes	Yes	Yes	Yes
Vanuatu	Yes	Yes	Yes	Yes	Yes
Philippines	Yes	Yes	Yes	Yes	Yes
Mongolia	No	No	No?	Yes	No
Indonesia	Yes	Yes	Yes	Yes	Yes
Papua New Guinea	Yes	Yes	No?	Yes	No
Samoa	Yes	Yes	No?	Yes	Yes
Myanmar	Yes	Yes	No?	No	No
Cambodia	Yes	Yes	No?	No	No
Bangladesh	Yes	Yes	No?	No	No
Nepal	Yes	Yes	No?	No	No

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- ### Summary and Future Directions
- Geoscience Australia has a range of baseline and derived information for use by government, emergency management and the risk research community.
 - This is being shared and aligns with GA's strategic plan which has Community Safety as one of the six high level strategies .
 - Key directions:-
 - Greater discoverability of NEXIS through creative commons and tools.
 - Drive to obtain an improved understanding of vulnerability and mitigation options, informed by survey capture (BNHCRC).
 - Ongoing program to better understand community resilience and recovery.
 - Move to more routinely provide exposure and impact information to emergency management after events.
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Thank You

Natural hazard modelling and post-disaster response for community risk assessment and mitigation.

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