

# Japan Earthquake 2011 – an insurance perspective

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Satellite Earth Observation for the Insurance Sector: New Technologies and Opportunities, ESRIN, Frascati, Feb 23rd

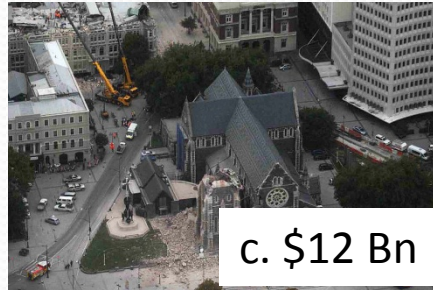
# 2011 'unprecedented' insured losses

January



Flickr: Werribee River in flood 14 Jan 2011, Tony Bryer

February



March



Flooding around Sendai Airport March 13th

April



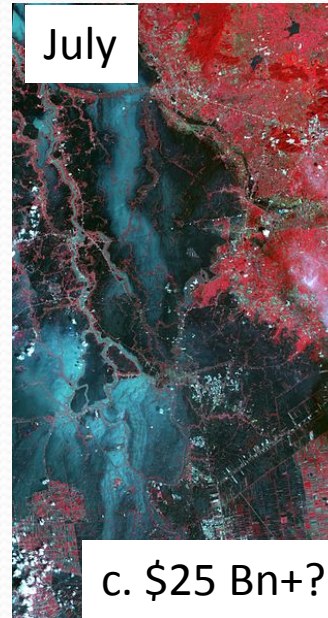
c. \$13 Bn

May



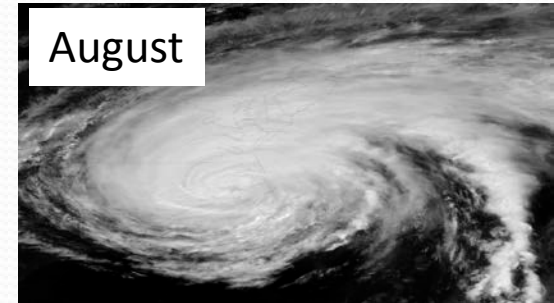
c. \$7 Bn

July



c. \$25 Bn+?

August



c. \$5 Bn

# Global events highlighted uncertainty

|          | <i>Region</i> | <i>Event</i>                     | <i>Modelled</i> | <i>Insured loss (\$USBn)</i> |
|----------|---------------|----------------------------------|-----------------|------------------------------|
| January  | Australia     | Flooding                         | No              | 2                            |
| February | New Zealand   | Earthquake                       | Partially       | 12                           |
| March    | Japan         | Earthquake (sequake) and tsunami | Partially       | 35                           |
| April    | US            | Severe storms and tornadoes      | Yes             | 13                           |
| May      | US            | Severe storms and tornadoes      | Yes             | 7                            |
| July     | Thailand      | Flooding                         | No              | 11-25?                       |
| August   | US            | Hurricane Irene                  | Yes             | 5                            |

Swiss Re Sigma, various modelling and broker sources

# Tohoku – March 11<sup>th</sup> 2011

- M9 Earthquake, seaquake and tsunami event
- Extensive damage zones
- Widespread impact, uncertain losses
- Partial modelling availability

# Tohoku – post event imagery applications – use stages

**12-15 Mar**

## **Primary image capture**

Inundated areas  
Key damage zones  
Restricted areas

- MODIS
- RADARSAT-2
- High-Medium Resolution Panchromatic / MS

**WK 2 – 4 Damage**

## **assessments:**

Manual image interpretation  
Semi-automated textural / change analysis  
Vegetation change (IR/R)

## **Ongoing: Model calibration**

Updated exposure data  
Reconstruction data  
Integration with detailed loss / damage surveys



Mar 11 - Event

## **WK 1-2 Initial assessments:**

Image based interpretation and visualisation  
Tsunami extents

## **3 Months: Detailed tsunami runup mapping**

Integrated with ground surveys, modelling  
Damage / loss accumulations

# Tohoku – immediate EO coverage

- By March 18<sup>th</sup>, over 200 image scenes from commercial satellites were captured and available
- Whole affected area covered
- Variable cloud cover for optical capture
- 1m – 20m spatial resolution
- Radar/Optical (Pan & MS)
- C. 10 – 100km swathes
- Data integration essential
- Manual and semi-automated interpretation and extraction
- Expert (and local) analysis and information extraction a critical component
- Much made available publicly by agencies

# Data and applications

| Application                  | Imagery sources  | Temporal                                   | Processing / derivation  |
|------------------------------|--|--|--|
| Tsunami runup extents        | <ul style="list-style-type: none"><li>•MODIS / Landsat / SPOT</li><li>•ASTER / ALOS</li><li>•C/X band RADARSAT / ERS / TerraSAR X</li><li>•Pan / MS high res (tasked and archived)</li></ul> | Initial: Days-Week<br>Ongoing: Weeks       | Manual (expert) interpretation<br>Change analysis  |
| Damage assessment            | Pan / MS High Res (tasked and archived)  | Initial: 1-3 days<br>Ongoing: Weeks-Months | Manual interpretation<br>Change & textural analysis (kernel operators)<br>Aerial imagery |
| Post event model calibration | <ul style="list-style-type: none"><li>•Interferometric SAR</li><li>•Pan / MS High Res (tasked and archived)</li></ul>  | Initial – Days<br>Ongoing – Weeks - Months | Manual interpretation<br>Change analysis<br>Mapping<br>Ground survey field checks        |



# Tohoku – sources of image based information

- Disaster agencies / Govt.
- Catastrophe Model Vendors
- Re/insurance Intermediaries
- Data intelligence companies
- Some re/insurers themselves
- Imagery is not generally used 'downstream', but processed and derived outputs applied within risk assessment



# Comparing Tohoku to Thailand flooding events

- No CAT models
- Cloud cover imagery
- Localised, urban impacts – hard to image
- Flood peak timing
- Indirect losses – BI, Contingent BI
- Compounded by a lower level of modelling (an ‘unmodelled’ risk?)



July 2011 Advanced Land Imager – Wikipedia Commons

# Ideals and challenges

- Geographic coverage - Wide area vs High resolution
  - Cover whole event area
  - 1-10m spatial resolution, feature extraction and interpretation
- Temporal resolution and early processing
  - 'Immediate' coverage
    - Flood: +/- 12-48 hours of flood peaks (data collection coupled to warning systems?)
    - Quake / tsunami: days/weeks
  - Early delivery (preliminary information / reports) 1 day – 2 weeks
- Intelligence assessments – expert, fast and accurate
  - Geocoding / insurance model focussed (portfolio, risk identification, relative damage assessments)
  - Data integration – multi-source, multi-temporal
  - 'Go-to' sources for information

# What 2011 has taught us

- Unmodelled risk is still risk – imagery can provide one source of valuable intelligence
- Insurers demand improved risk assessment
- Image based intelligence has been critical to risk assessment and model adjustment
- Requires expert interpretation, delivery and analysis
- Integration and validation are essential
- For insurance, data needs to be contextualised and relevant to risk assessments

# Challenges and opportunities for 2012 and beyond

- Regulation (Solvency II)
- Better exposure inventories – consistent, global (what role will GEM play?)
- Improved access to post event imagery – and downstream intelligence - data broking?
- Exploitation of new platforms and technologies – X-band radar, Sentinel data
- Better validation methodologies – ground truthing, post event data fusion
- Industry education and outreach – more confident use and interpretation