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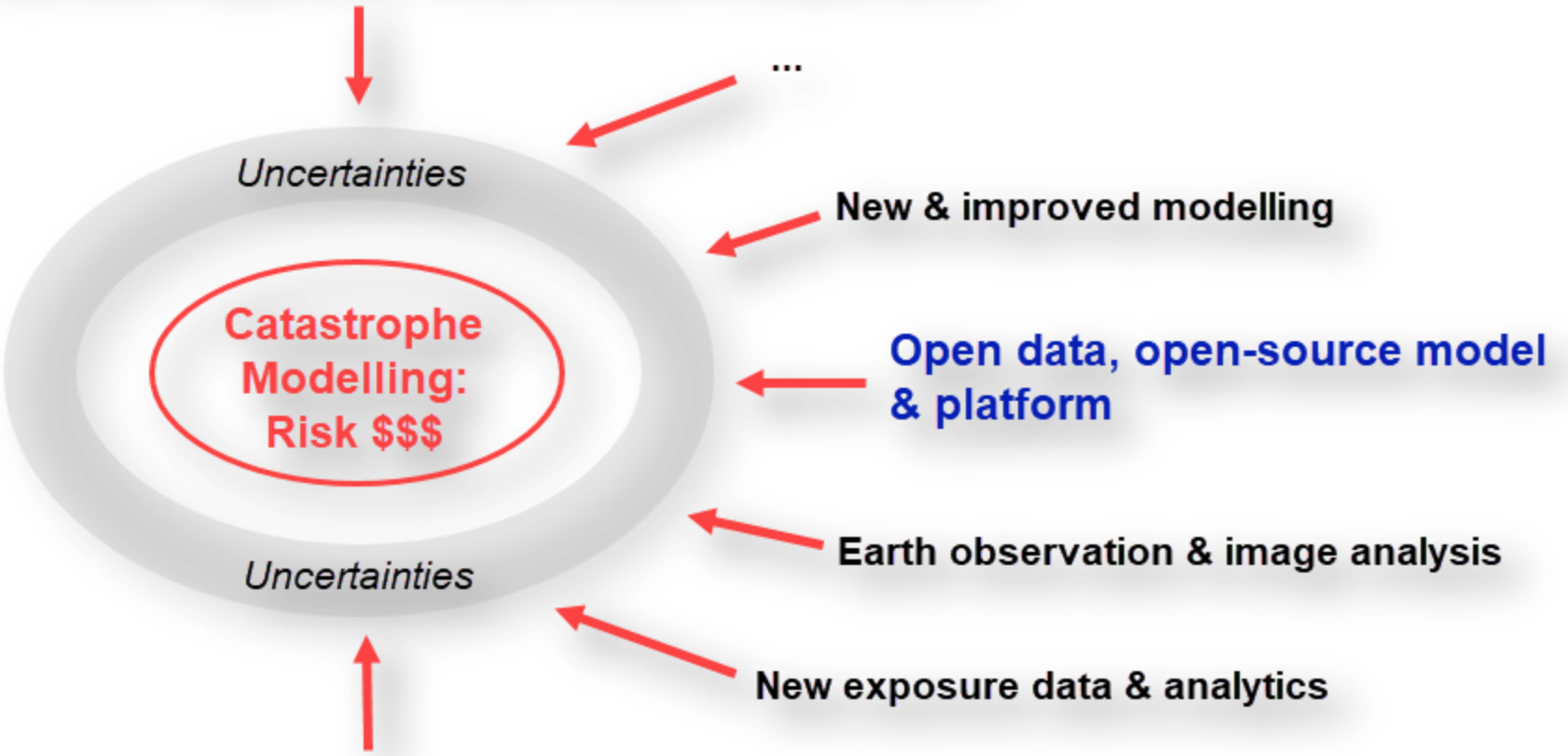
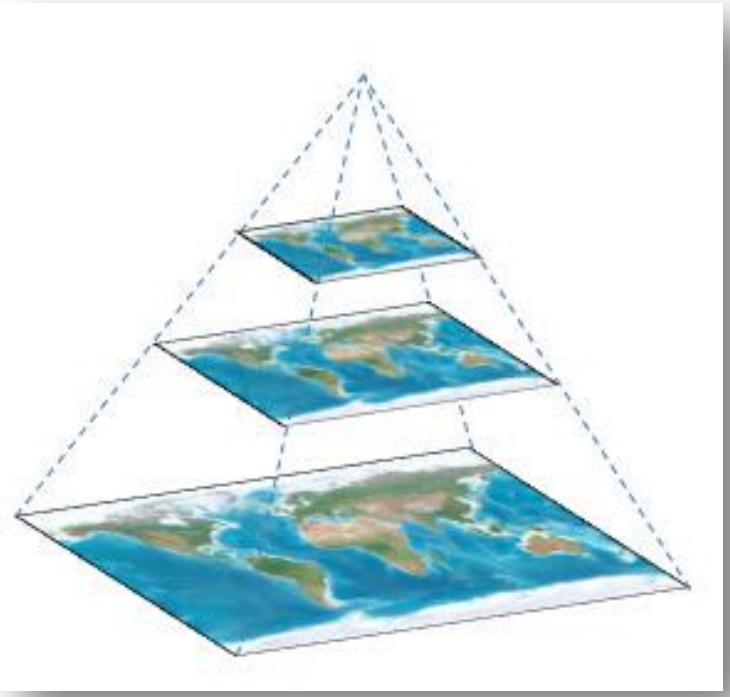
Reducing Uncertainties in Catastrophe Loss Modelling: New Advances

Dr Keping (Kevin) CHEN
R&D Innovation Scientist
BigDataEarth.com
12 December 2018

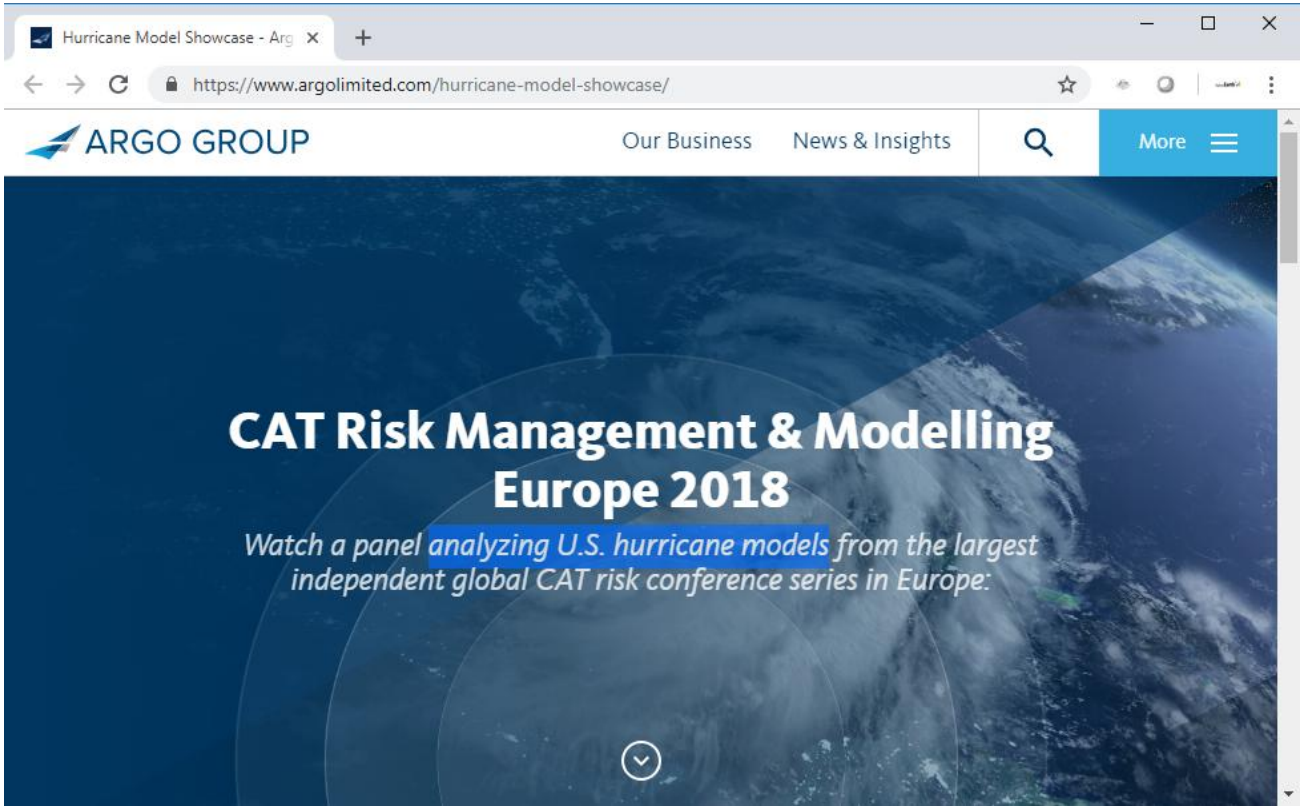
Reducing Uncertainties in Catastrophe Loss Modelling: New Advances





Part 1: Top-down Approach: Cross-model Comparisons

Cross-model Comparisons



03/2018 - Comparison of 4 U.S. **Hurricane** models**: CoreLogic | RMS | KatRisk | ARA**
Video: https://www.argolimited.com/hurricane-model-showcase/

11/2017 - Comparison of 4 U.S. **Flood** models: **AIR| CoreLogic| KatRisk | Impact Forecasting**
Video: https://www.argolimited.com/flood-model-showcase/

Cross-model Comparisons

Figure 6: Favourable Performance of Modelled Losses (Source: JLT Re, AIR, RMS, Munich Re)

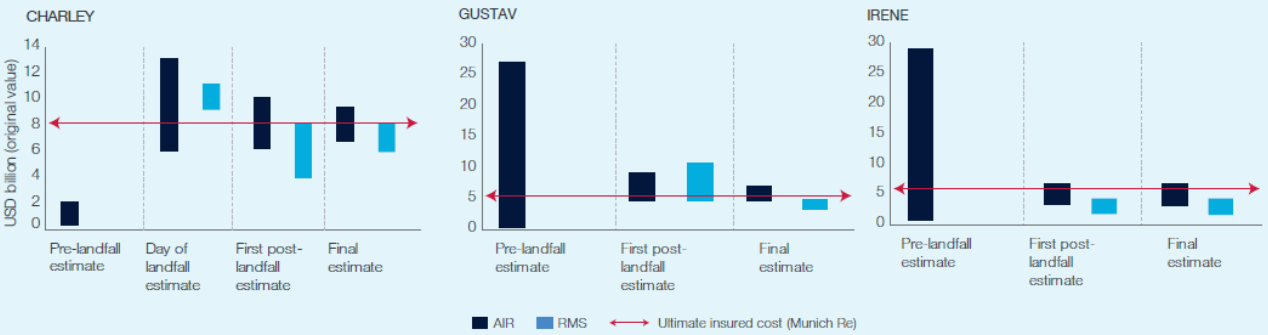
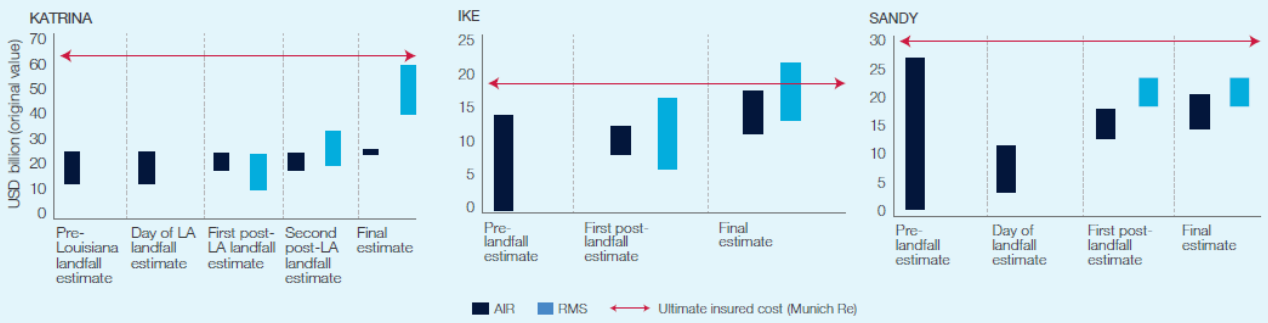


Figure 7: Substandard Performance of Modelled Losses (Source: JLT Re, AIR, RMS, Munich Re)



"The lack of consensus around modelled market losses potentially points to even greater levels of uncertainty for company-level loss estimates."

Source: 07/2018 JLT RE VIEWPOINT | Catastrophe models: In the eye of the storm
PDF: http://www.jltre.com/en-gb/our-insights/insights/natural-catastrophe/in-the-eye-of-the-storm

Part 2: Open Data, Open-source Model & Platform

Open-source Modelling Platform

https://oasislmf.org/

Home :: Oasis Loss Modelling Fra

https://oasislmf.org

OASIS LOSS MODELLING FRAMEWORK

Oasis Loss Modelling Framework

An open source catastrophe modelling platform, free to use by anyone.

It is also a community that seeks to unlock and change the world around catastrophe modelling to better understand risk in insurance and beyond.

While its development is largely driven by the global (re-)insurance community, it seeks to provide tools and utility to all.

It is constituted as a not for profit company, and our team believes passionately in empowering more people around the world to better understand risk and uncertainty

Our ecosystem consists of more than 15 suppliers covering over 80 models in 2018.

Our Modelling Platform

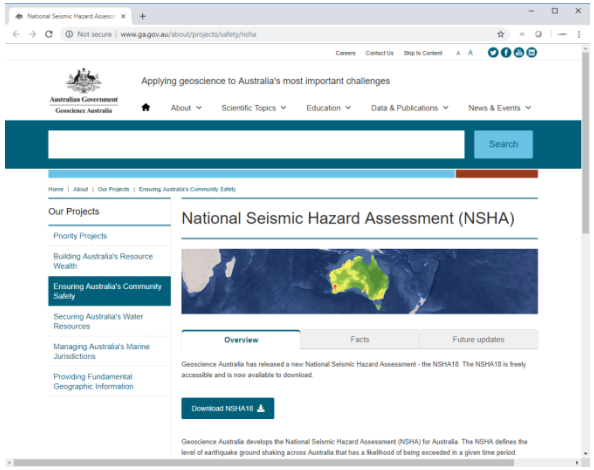
The Oasis Loss Modelling Framework provides an open source platform for developing, deploying and executing catastrophe models. It uses a full simulation engine and makes no restrictions on the modelling approach. Models are packaged in a standard format and the components can be from any source, such as model vendors, academic and research groups. The platform provides:

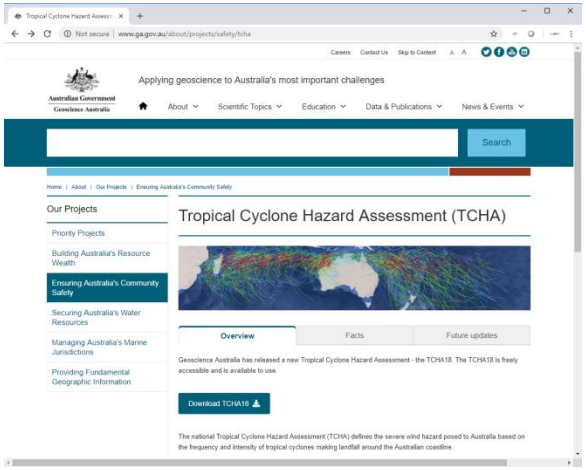
- A platform for running catastrophe models, including a web based user interface and an API for integration with other systems (Oasis

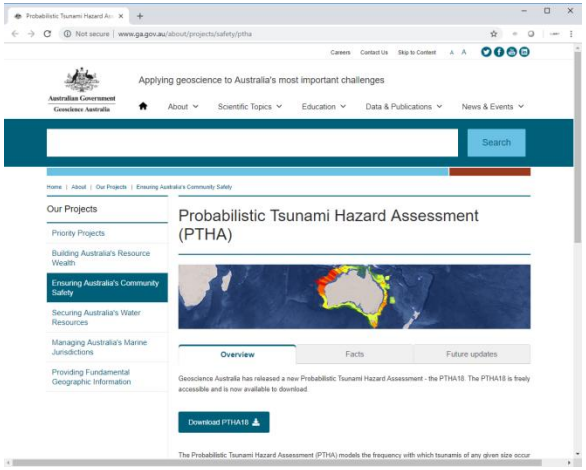
Open-source Models, e.g. GEM

https://www.globalquakemodel.org/

Open-source Models, e.g. from GA







October 2018: Geoscience Australia - National Seismic Hazard Assessment (NSHA)
http://www.ga.gov.au/about/projects/safety/nsha

October 2018: Geoscience Australia - Tropical Cyclone Hazard Assessment (TCHA)
http://www.ga.gov.au/about/projects/safety/tcha

October 2018: Geoscience Australia - Probabilistic Tsunami Hazard Assessment (PTHA)
http://www.ga.gov.au/about/projects/safety/ptha

Part 3: Global Earth Observation, Image Analysis & Major Events

Cloud-based Geospatial Processing Engines

Earth observation data on the cloud, e.g.

- Earth on AWS - https://aws.amazon.com/earth/
- Google Earth Engine - https://earthengine.google.com/

Engines, e.g.

- Google Earth Engine (GEE)
  - Earth Engine Timelapse
  - Global Forest Loss Map
  - Global Surface Water Map

- DigitalGlobe's Geospatial Big Data Platform (GBDX)
- Planet's Planet Explorer
- EU Sentinel-hub EO Browser, Radiant Earth, etc.

Earth Observation & Major Events

Wildfires (bushfires or forest fires)

- Wildfires in California
  - #MendocinoComplexFire and #CarrFire (**link**)
  - #HolyFire (**link**)
  - #CountyFire (**link**)
  - #PawneeFire (**link**)
- Wildfires in British Columbia, Canada (**link**)
- Wildfires near Athens, Greece (**link**)
- Wildfires in Southern Portugal (**link**)
- Wildfires in Manchester, the UK (**link**)
- Wildfires in Siberia, Russia (**link**)
- Bushfires in Australia
  - Winter bushfires in NSW (**link**)
  - Planned hazard-reduction burns in Sou
  - Bushfires near Darwin, Northern Territo
  - Rockhampton, QLD (**link**)

Floods

- Flooding in the south and west of Japan (**link**)
- Flooding in Kerala, India (**link**)

Volcanic eruptions

- Lava from the Kilauea volcano in Hawaii (**link**)
- Ongoing eruption of the Krakatau volcano (**link**)

https://www.bigdataearth.com/bushfire/monitoring-major-events-with-global-earth-observation-and-geospatial-big-data-analytics/

Earth Observation & Major Events

Share the latest on social media

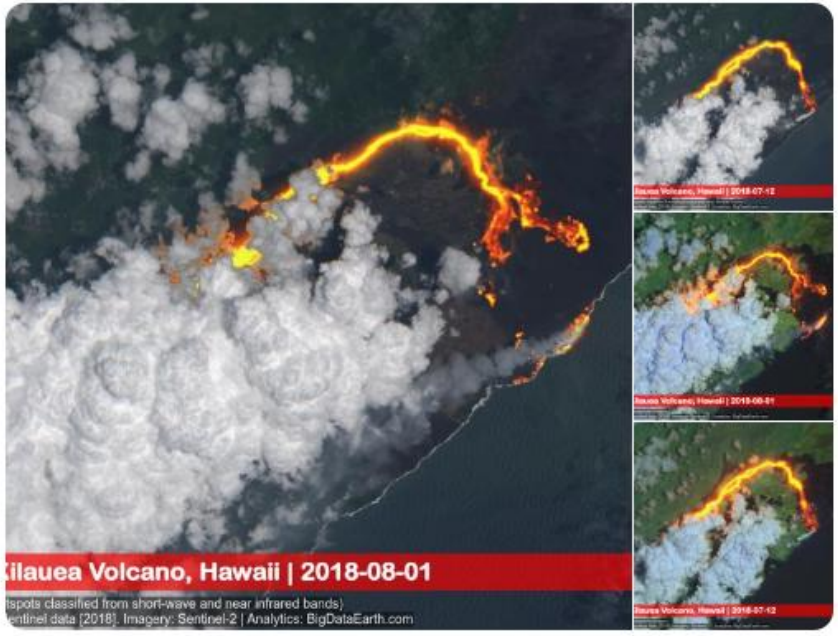
BigData Earth
@BigDataEarth

Devastating #wildfires near #Kineta, #Greece observed by the new #Sentinel2 imagery on 23 July 2018
1. The use of image band combinations to observe fire front & hotspot
2. Climate-warming trend for the region
Thank you @CopernicusEU @ESA_EO for the excellent EO imagery source!

7:13 PM - 24 Jul 2018

97 Retweets **55** Likes

BigData Earth @BigDataEarth · Aug 2
Update: Lava from #KilaueaVolcano in #Hawaii observed by the new #Sentinel2 imagery on 1 August 2018
1. See changes 20 days apart (from 12 July to 1 August 2018)
2. SWIR bands able to detect hotspots / lava flows
@CopernicusEMS @CopernicusEU @USGSVolcanoes
#Kilauea #KilaueaErupts



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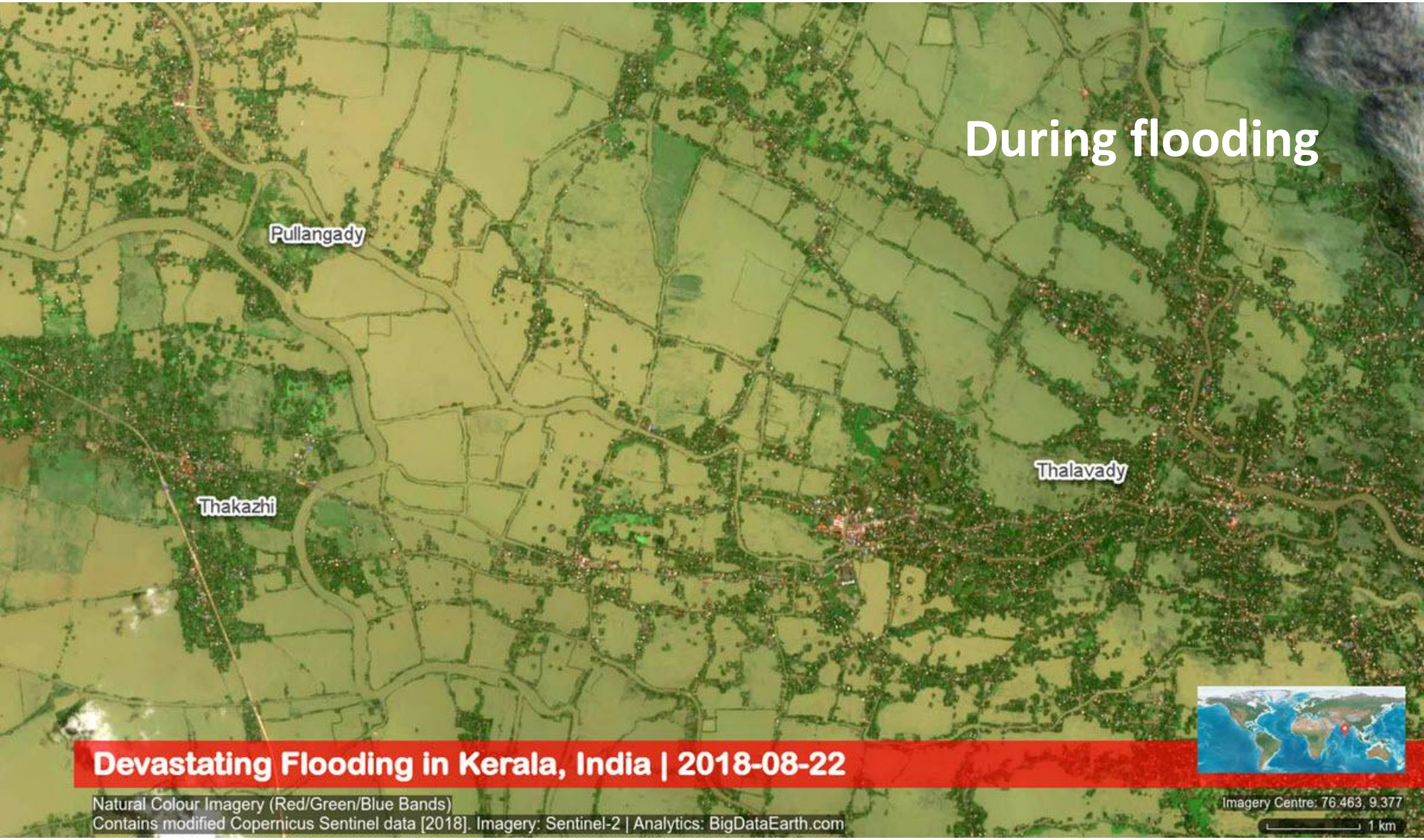
Earth Observation & Major Events



https://twitter.com/BigDataEarth/status/1032287139990396930

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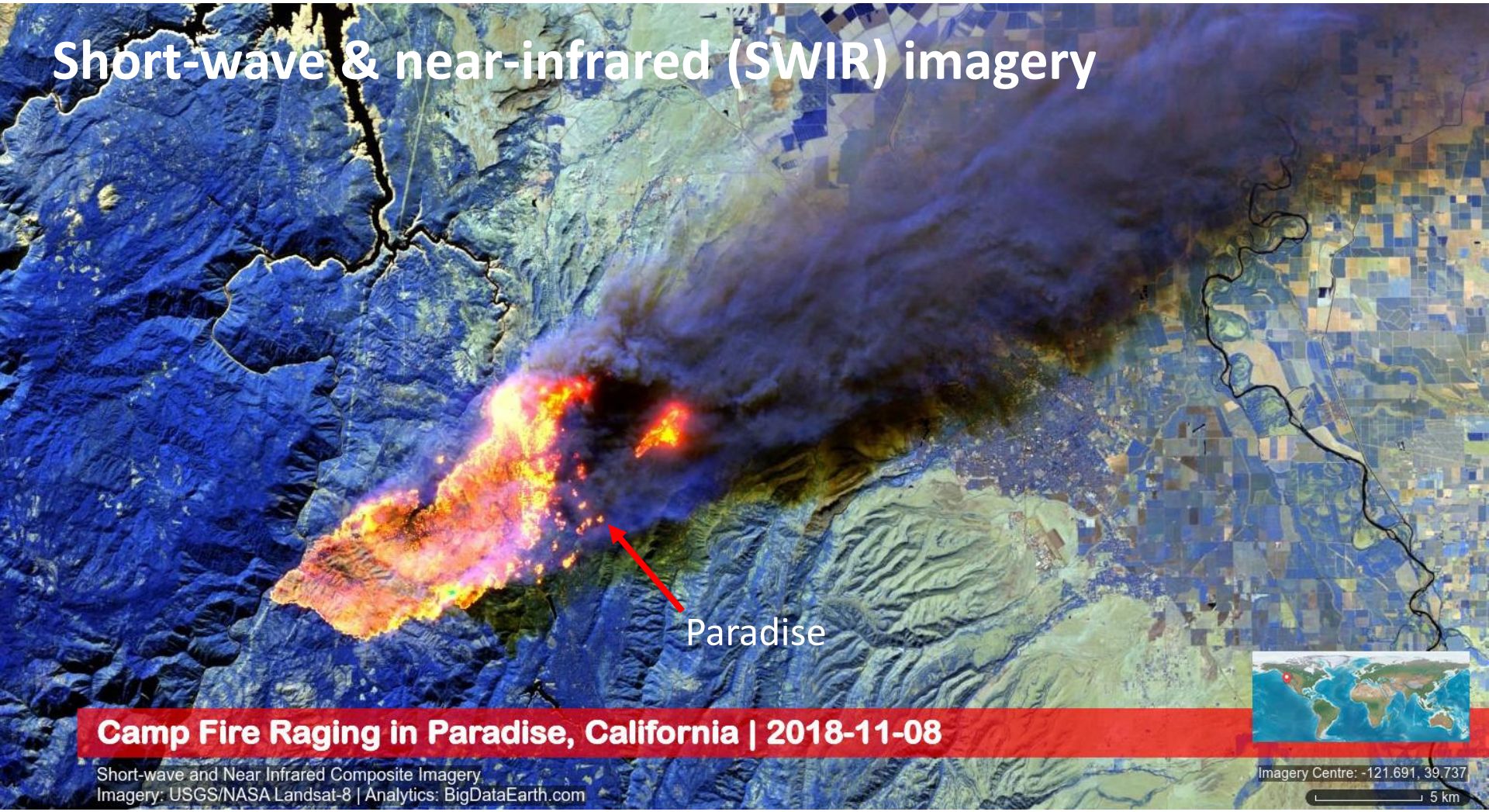
Earth Observation & Major Events

Fire hotspots and propagation



https://twitter.com/BigDataEarth/status/1061777349555892224

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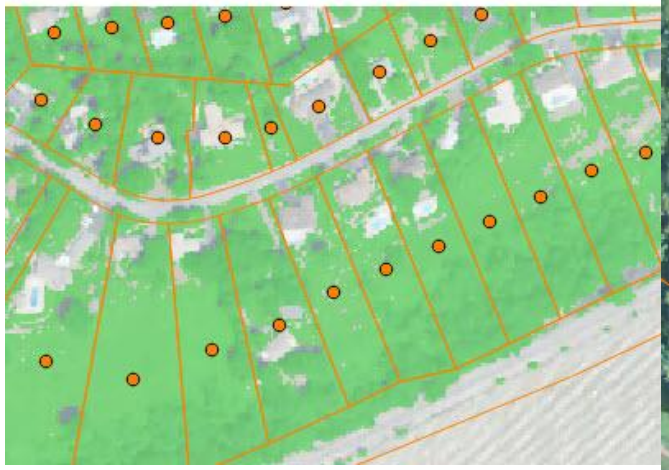
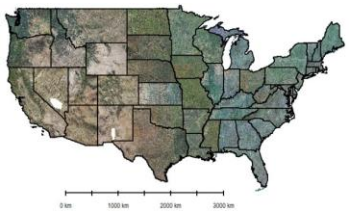
Part 4: New Exposure Data & Analytics

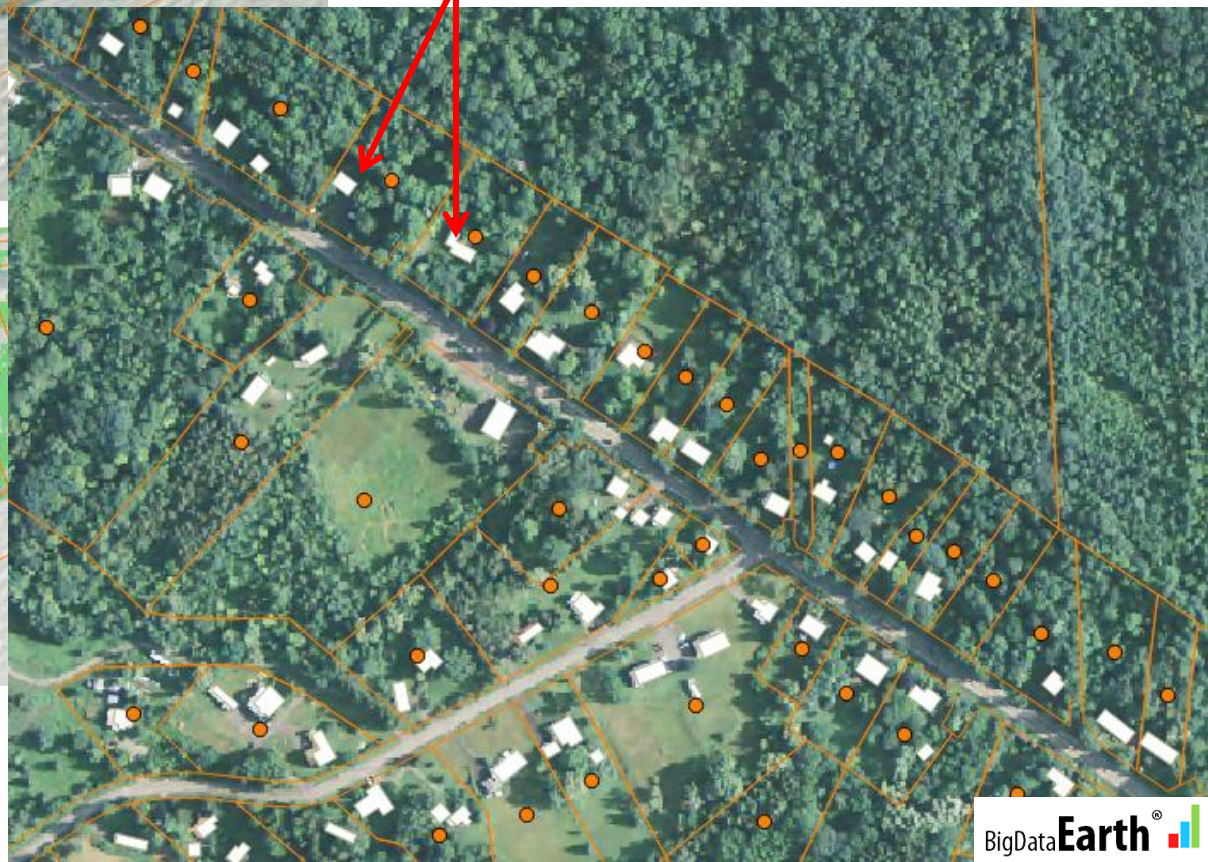
Exposure Data - Geocoding

Land-parcel geocoding





Roof-top geocoding

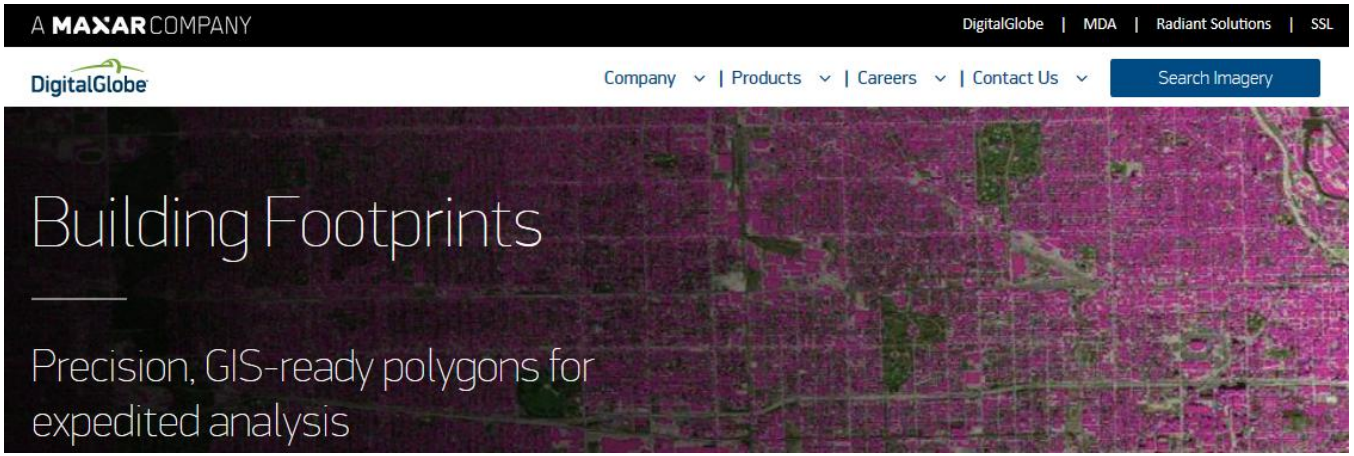


Exposure Data - Building Footprints

06/2018: Microsoft releases 125 million building footprints in the US as open data

Source: https://blogs.bing.com/maps/2018-06/microsoft-releases-125-million-building-footprints-in-the-us-as-open-data

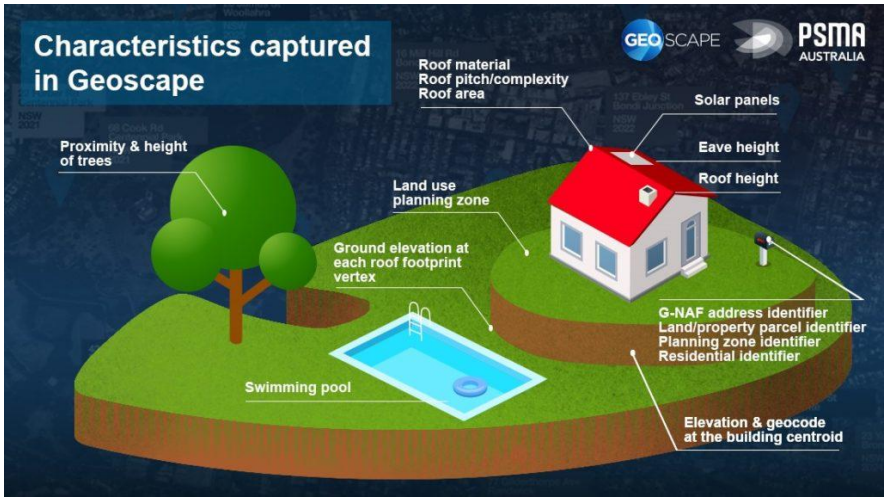
10/2018: DigitalGlobe releases 169 million building footprints in the US



Source: https://www.digitalglobe.com/products/building-footprints

Exposure Data - Building Footprints

11/2018: PSMA releases built environment data for 15 million buildings nationwide

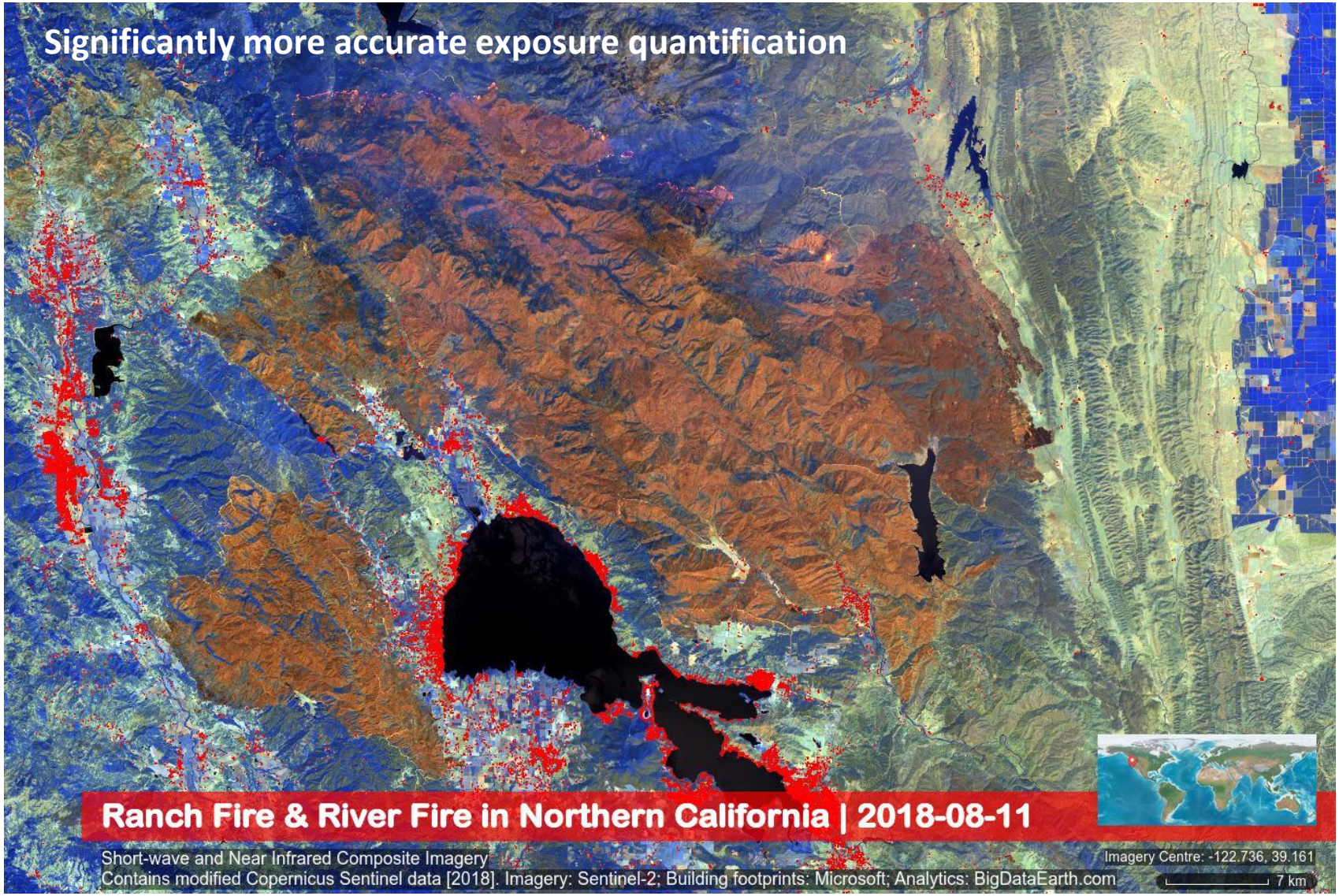


Source: https://www.geoscape.com.au/how-many-buildings-in-australia-geoscape-achieves-national-coverage/

Exposure Data - Building Footprints

Open data: A very small % of false-positive and false-negative errors

Building Footprints - Applications



https://twitter.com/BigDataEarth/status/1029242799504281602

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Part 5: Bottom-up Approach: Site-level Location Profile Report Revealing Underlying Data, Context & Processes

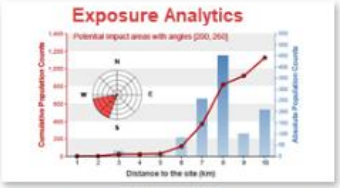
New R&D at BigDataEarth.com

New Products and Services

Main Applications: Property location information, emergency & insurance, the news media, etc.
Coverage: Australia, the U.S., China & other regions

– Building cloud-based big data and analytics platforms
– Creating address-level property location profile reports
– Developing unique hazard and exposure investigation tools
– Creating new software for Earth observation image processing
– Developing a suite of timely information products from Earth observation imagery to reports to animations in response to major events
– Delivering products via web APIs and web services

Location Profile APIs and Cloud-based Big Data Analytics Solutions Creating New Values



New Methods and Tools (Web APIs) for Innovative Exposure Analytics in Risk Management

Follow our Twitter for the Latest EO Imagery, Reports & Animations in Response to Major Events

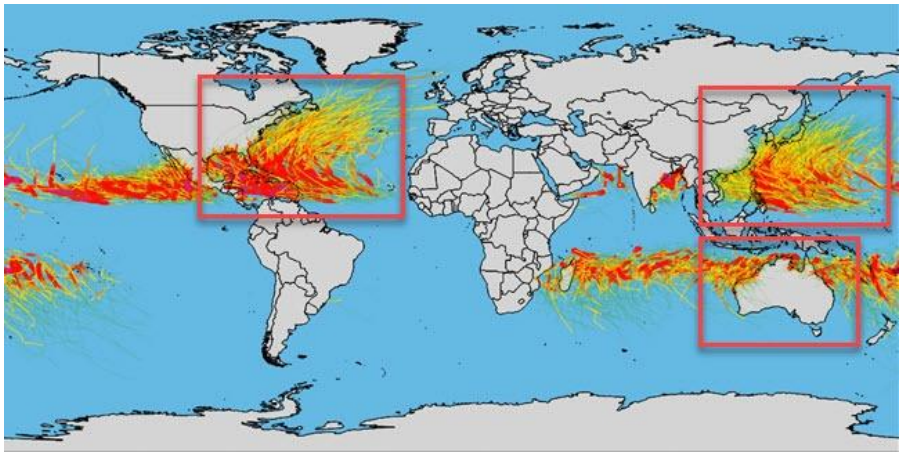
Advancing Bushfire Risk Analytics with Location Profile APIs and Web Services – 4 New Info Products

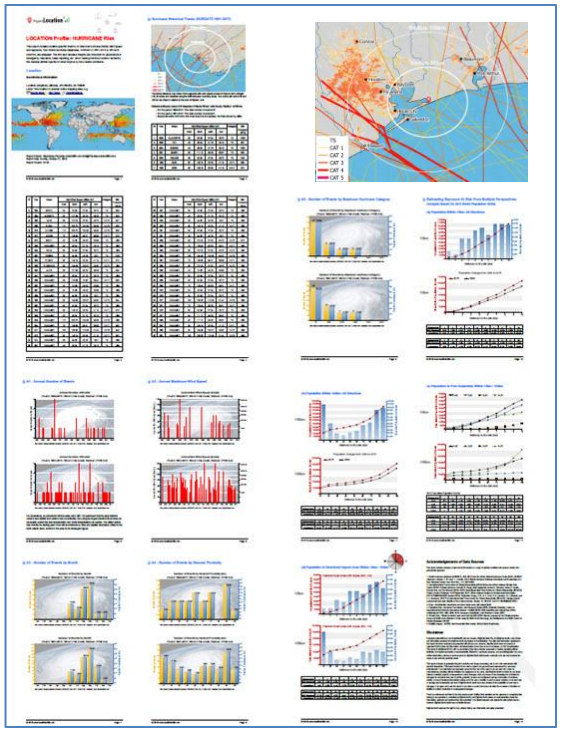
Advancing Flood Risk Analytics with Location Profile APIs and Web Services – 3 New Info Products

Advancing Cyclone Risk Analytics with Location Profile APIs and Web Services – 3 New Info Products

https://www.bigdataearth.com/blog/

Site-level Location Profile Report – Tropical Cyclone (North Atlantic, West Pacific & Australia)





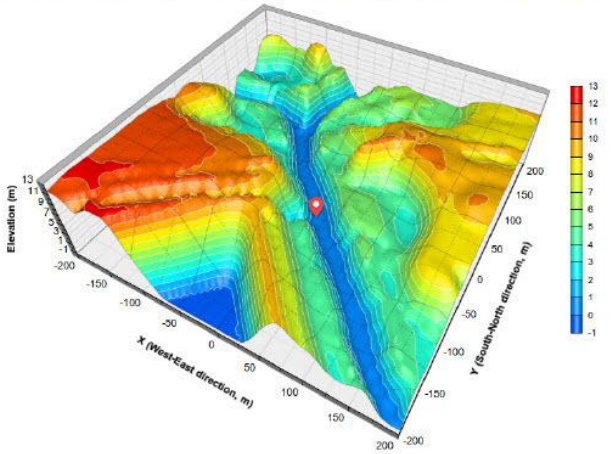
Two well-known, publicly-available tropical cyclone databases are analysed:

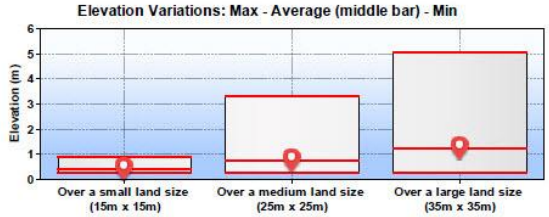
1. Atlantic hurricane database (**HURDAT2**, 1851-2017) from the NOAA National Hurricane Center (NHC)
2. The International Best Track Archive for Climate Stewardship (**IBTrACS v03r10**, released September 2017) from the NOAA National Climatic Data Center (NCDC)

https://www.bigdataearth.com/hurricane/advancing-tropical-cyclone-risk-analytics-with-location-profile-apis-showcases/

Site-level Location Profile Report – Flood (Australia, the Contiguous U.S. & other Regions)

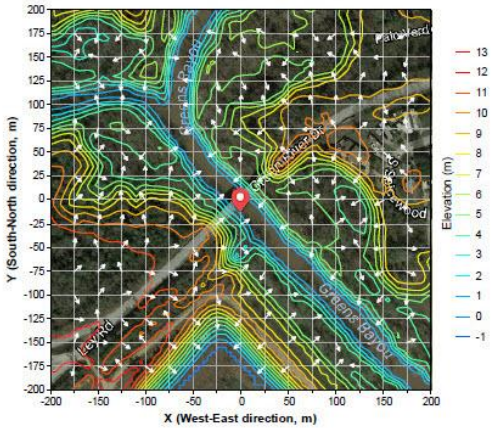
▶ Terrain: Average Elevation & Slope Over Various Land Sizes

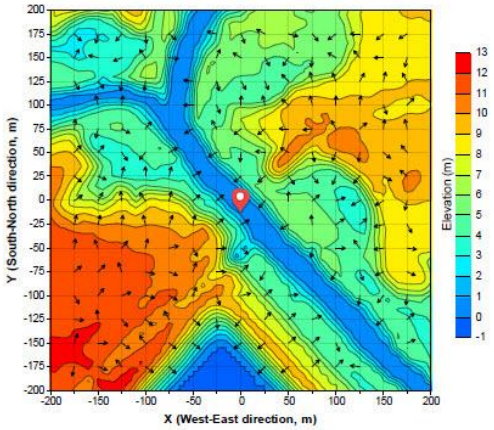




© 2017 www.PropertyLocation360.com

▶ Flood: Surface Water Flow Directions related to Flash, Riverine, or Coastal Flooding





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https://www.bigdataearth.com/flood/advancing-flood-risk-analytics-location-profile-apis-showcases/

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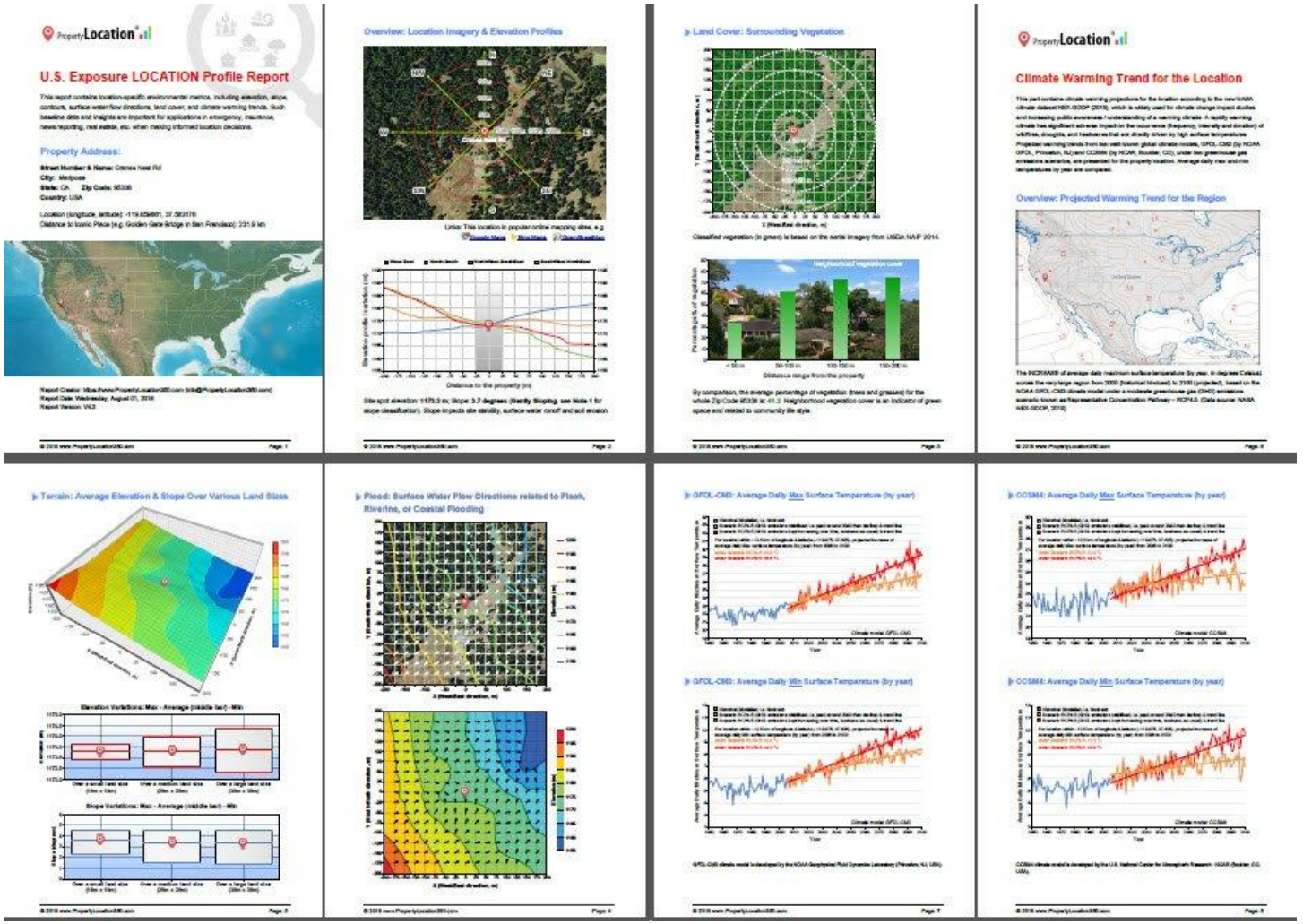
Site-level Location Profile Report – Forest Fire (Australia, the State of California & other Regions)



https://www.bigdataearth.com/bushfire/advancing-bushfire-risk-analytics-location-profile-apis-showcases/

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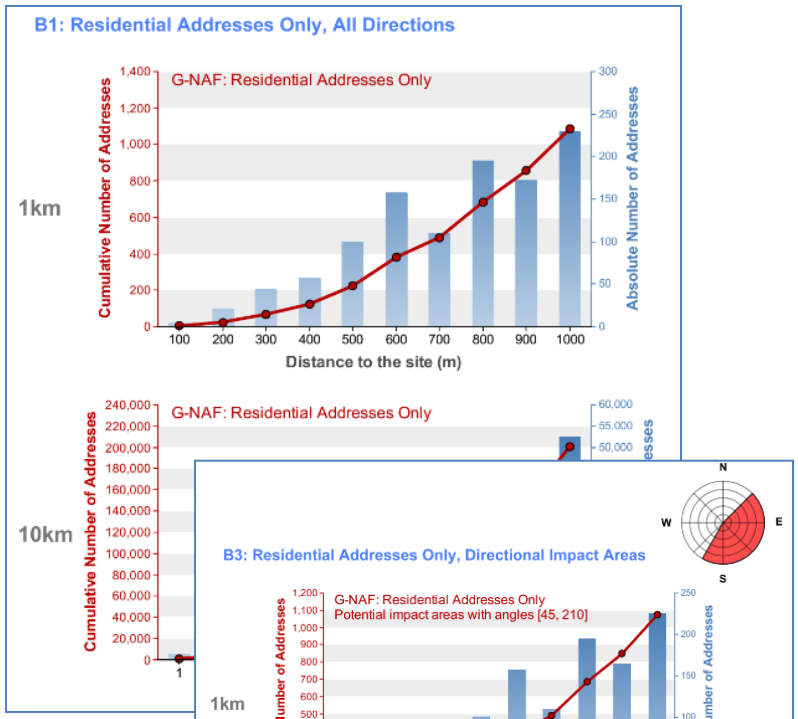
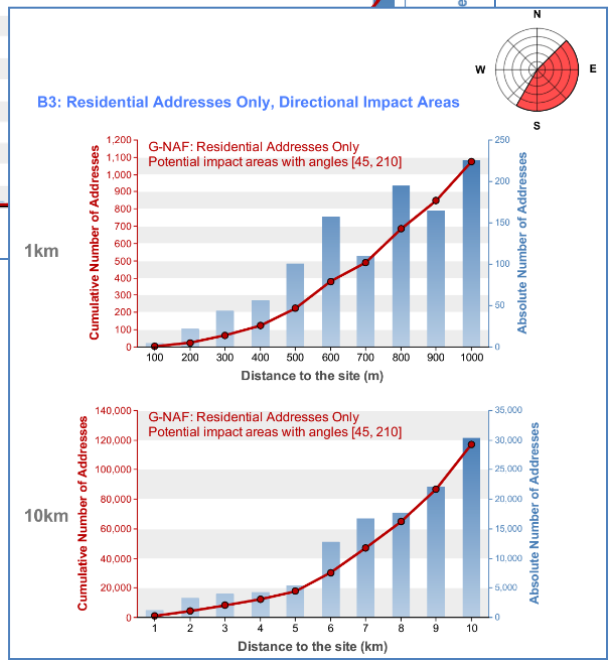
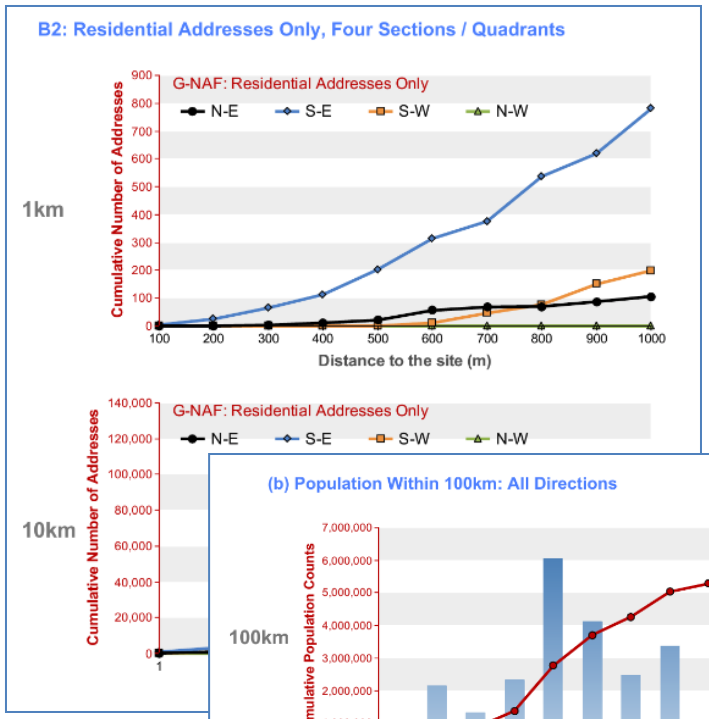
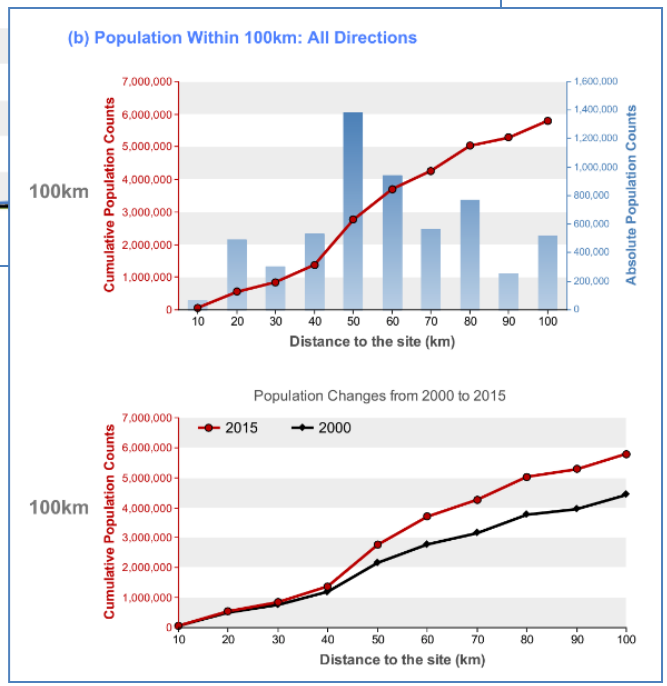
Plus Rapid Exposure Analytics with Multiple Spatial & Temporal Analysis Methods









https://www.bigdataearth.com/australia/innovative-exposure-analytics/

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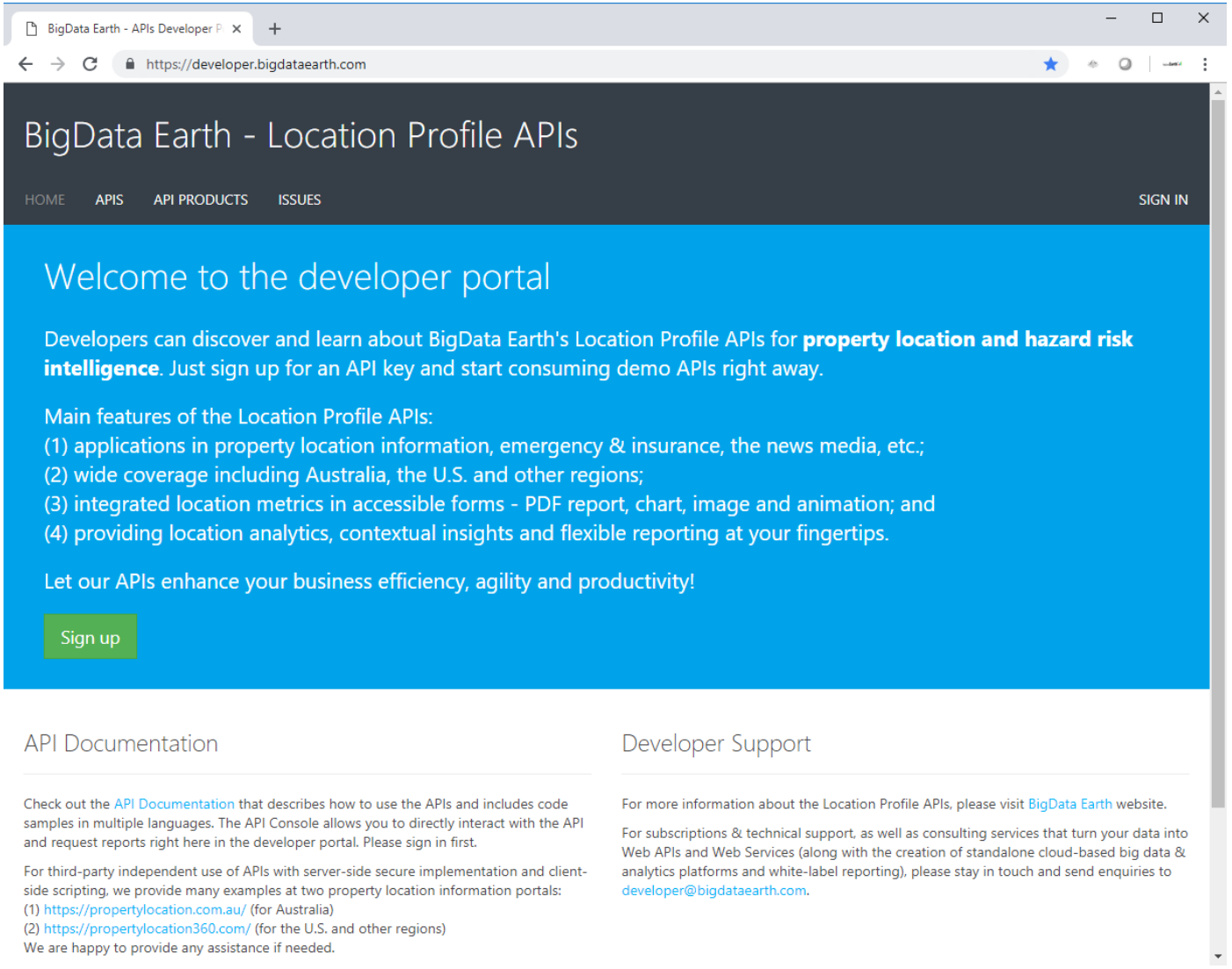
Each Site-level Location Profile Report Delivered in Seconds via Web APIs

APIs Developer Portal: https://Developer.BigDataEarth.com



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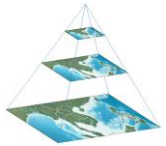


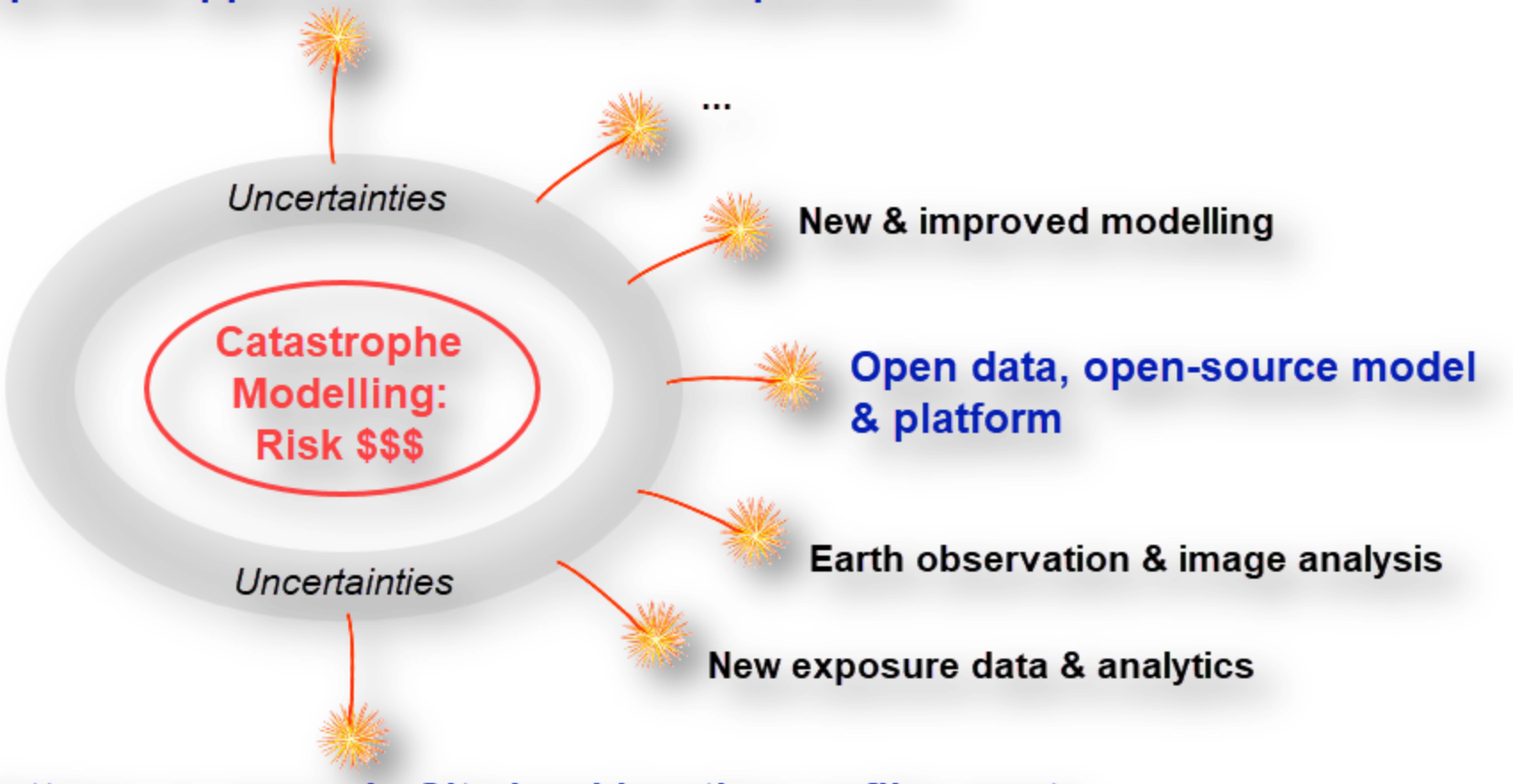
BigData Earth Products and Solutions Enabled by Geospatial Big Data Analytics, Cloud Computing & Automation

Applications, e.g.	Implementation
1 – Major Events and Earth Observation	Desktop-based software & basemaps
2 – Major Events and Location Profile Report	Web APIs & Apps
3 – Tropical Cyclone Risk Analytics	Web APIs & Apps
4 – Flood Mapping & Risk Analytics	Web APIs & Apps
5 – Bushfire Risk Analytics	Web APIs & Apps
6 – Exposure Analytics	Web APIs & Apps

- Most R&D on implementation of **web APIs and Applications** at scale - Australia, the U.S. and other regions.
- New opportunities enabled by **geospatial big data analytics (on hazard & risk modelling)**, **cloud computing** and **automation**.
- Extending the experience to client tasks using the same workflow, i.e. from raw data to analytics to API-enabled information products to web services.

Summary

Reducing / Blasting off
Uncertainties in Catastrophe Loss Modelling



Thank you!

For more presentations and demonstrations, please contact Keping at BigData Earth. Email: Keping.Chen@BigDataEarth.com

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