Impact Forecasting for Severe Wind Events

Research advisory forum / 2018

Harald Richter, Serena Schroeter, Beth Ebert, Shoni Maguire, Jeff Kepert / Bureau of Meteorology

Craig Arthur, Martin Wehner, Mark Dunford, Jane Sexton, Mark Edwards / Geoscience Australia

@bnhcrc  @bnhcrc

© BUSHFIRE AND NATURAL HAZARDS CRC 2018
To develop a pilot capability that will make useful predictions of community impacts of extreme wind & rain with the goal of improving timely mitigating actions by a range of stakeholders.
ACCESS-C Weather Forecasting Model +XX hrs

Variable extraction (e.g. 10m winds, rainfall rate)

Hazard conversion (e.g. maximum 10m winds, maximum rainfall rate)

Building locations and attributes (NEXIS)

Vulnerability relationships (derived from damage surveys)

Automated Hazard Impact Model (Hazard → Impact Converter)

Impact Forecast

VisualWx, impact forecaster display

Data & Methods

WORKFLOW
Wind Output → Wind Hazard

Most likely damage creator (= “the hazard”) is a derived field: Looking for the maximum gust over a period of time →

Experiment with maximum wind speeds / gust duration:

• Wind maximum over several vertical model levels (2.5; 13.3; 33.3; 60.0 .. m)
• Wind maximum over every dynamical model time step ("HMF“ concept)
• 3 sec gust encapsulated in the "gust" parameter $U_g$
Surface Wind Hazard

24-hr 10 m AGL wind maximum

21 April 2015
Vulnerability Relations
Wind Hazard -> Damage Potential: Heuristic Vulnerability Relations to set up Workflow
First attempt of a Damage Data-driven Vulnerability: April 2015 Dungog Case

Damage Rating X Based on EICU Data for 20-22 April 2015

Model Max. Wind Gust Speed (m s⁻¹) at EICU-Surveyed Locations
Dungog Case: What happened?

What derails a nice clean wind / house damage relationship?

[1] Building design wind speeds in the area mostly exceed 30 m s\(^{-1}\) → need an event with stronger winds

[2] Building damage seems to have been inflicted mostly in an indirect manner (impacts tend to be multi-hazard)

[3] Summative damage reporting inside the damage assessment reports does not permit establishment of clear links to individual hazards → SES BEACON
damage reporting template to update
Exposure

ACCESS-C Weather Forecasting Model +XX hrs

Building locations and attributes (NEXIS)

Vulnerability relationships (derived from damage surveys)

Variable extraction (e.g. 10m winds, rainfall rate)

Hazard conversion (e.g. maximum 10m winds, maximum rainfall rate)

Automated Hazard Impact Model (Hazard \to Impact Converter)

Impact Forecast

VisualWx, impact forecaster display
Data on Asset Types & Locations

National Exposure Information System (NEXIS)

- Buildings Location, Size and Shape
- Infrastructure and Institution asset Location
- Administrative Area
- Land Tenure
- Land Use
- Construction Period
- Structural Characteristics
- Agriculture
- Demographic or Social Characteristics
- Economic Characteristics
- Environmental

USE CASES
- Exposure reports
- Risk modelling
- Risk assessments
- Insurance modelling
Dungog – Exposure Uncertainty: Statistically Derived Asset Types

Relationship of NEXIS-extracted and surveyed house types for all of Dungog post-1982 houses.

A "house type" is defined as a specific combination of wall material (10 categories) and roof material (6 categories).

Red circle: Proportion of house type X
NEXIS says: 18%
Survey says: 2%
Spatial Impacts in Visual Weather
Spatial Impacts (Sensitivity to Hazard)
1) Test joint wind & rain hazard predictors for reported residential building damage

2) Include additional case studies with stronger winds and clean damage assessment data to derive single-hazard and joint multi-case vulnerability relationships (use BARRA reanalysis)

3) Validation of predicted impacts against reported damage data – need for good data!