https://github.com/davidnbresch/climada module drought fire beuschl@student.ethz.ch, horatc@student.ethz.ch (2016) & doerger@student.ethz.ch, dinah@student.ethz.ch, tschumie@student.ethz.ch (2017) & david.bresch@gmail.com

This module implements a method to generate a local bushfire model any place on the globe, using a cellular automat for the small-scale fires and based on satellite information for the large(r) scale events.

This module is planned to also provide a global drought model (not implemented yet).

In essence, this module currently implements three approaches for bushfire

- Firms-data based historic fires → see bf generator large
- Cellular-automata generated fires → see bf TEST small
- Combined approach → see bf\_TEST\_jumpy

All details are documented in the headers of the respective routines (for the time being). See below for a brief guide about how to retrieve the FIRMS fire data.

This module is in TEST (very much beta) state. There are three relevant (higher level) codes, namely **bf\_generator\_large('TEST')**, **bf\_TEST\_small** and **bf\_TEST\_jumpy**.

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### Bushfire based on FIRMS data

Based on satellite-observed fires, generate a purely historic hazard event set.

## Fire Information for Resource Management System

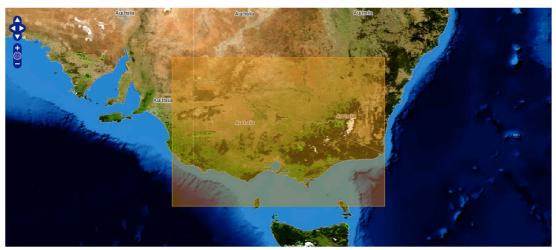


Figure: the region for which TEST data in Australia is available<sup>1</sup>. Obtained from <a href="https://firms.modaps.eosdis.nasa.gov/download">https://firms.modaps.eosdis.nasa.gov/download</a> . See bottom of this document for larger dataset(s).

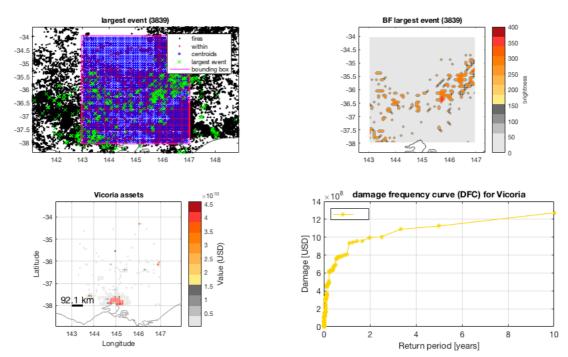


Figure: The result screen for TEST mode. Bushfire database on the top left and rendering of largest single event on the top right panel. Melbourne at the bottom center of the plots. Asset distribution in the lower left and resulting damage frequency curve (DFC) in the lower right panel. Generated by

hazard=bf\_generator\_large('TEST').

<sup>1</sup> file firms.csv in the module's data/hazards/external\_model\_output folder.

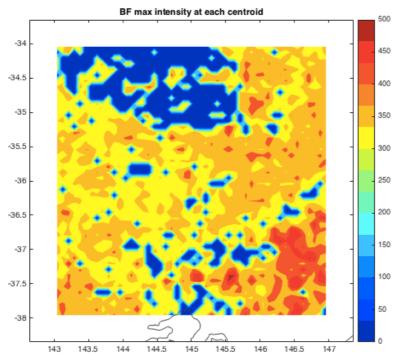


Figure: Maximum bushfire intensity at each centroid, based on the TEST data for Victoria (2006-2015). Melbourne at the bottom center of the plot. Plot generated by plotting climada\_hazard\_plot(hazard,0) after calling hazard=bf generator large('TEST').

## Cellular automat to generate (artificial) bushfires

See climada\_bushfire\_cellular.pdf for a brief introduction into this approach (by beuschl@student.ethz.ch, horatc@student.ethz.ch, 2016).

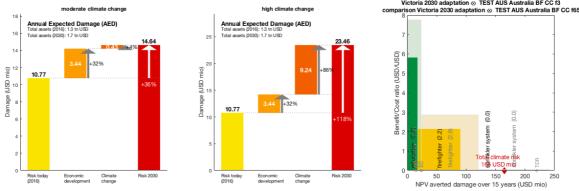


Figure: The results for the cellular automata approach (see climada\_bushfire\_cellular.pdf). Left and centre panels the waterfall charts for moderate and high climate change, right panel the adaptation cost curves for both moderate and high change (semi-transparent). Generated by bf TEST.

# Combined approach, cellular automat 'seeded' by historic bushfire record

Implementation of this combined approach by <u>doerger@student.ethz.ch</u>, <u>dinah@student.ethz.ch</u>, <u>tschumie@student.ethz.ch</u>, 2017.

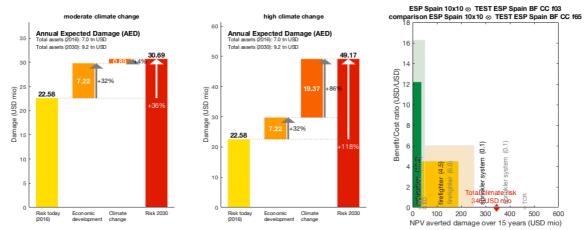


Figure: The result of  $bf_{TEST_jumpy}$  (Spain, based on data 2001-2016). See section "How to retrieve ... data" below to obtain the latest FIRMS fire data (also for the example of Spain).

## How to retrieve the FIRMS (MODIS/VIIRS) fire data

In order to retrieve the archived fire activity (since 2001) from the Fire Information for Resource Management System (FIRMS), please go to the Archive Download: <a href="https://firms.modaps.eosdis.nasa.gov/download">https://firms.modaps.eosdis.nasa.gov/download</a>. Select New request, create and switch to country selection and enter something like:

+ 0	☐ firms.modaps.eosdis.nasa.gov/download/request.php  C	
FIRMS MODIS C6/VIIRS Fire Archive Download  Fire Information for Resource Management System (FIRMS)   O Map © Country O Protected Area		
	Choose a Country	
Spain		
Options		
Fire Source	MODIS C6	
From what date?	2001-01-01	
To what date?	2016-12-31	
Output Format	Comma-Separated Text (.csv)	
Email Address	dbresch@ethz.ch	
Please note:		
<ul> <li>The MODIS data is available from from November 2000 (for Terra) and from July 2002 (for Aqua) to the present. VIIRS 375 m data is currently available from 8 January 2016. The full VIIRS archive (2012 to the present) will be available later this year.</li> <li>If you selected "MODIS C6 &amp; VIIRS" as the Fire Source, note that you will receive two separate emails with your download requests, one for the MODIS C6 data and one for VIIRS data.</li> <li>All requests are monitored and approved by the FIRMS team. Please provide us with accurate and valid information in order to prevent delays in processing your request.</li> </ul>		
Submit Your Request		
Send email confirmation for this data request		
Cancel		

Figure: the download screen.

You might choose any time period, but full years (1 Jan – 31 Dec) are easier to process later (in terms of correct fire frequencies). For easy processing in climada, you might add the country ISO3 code to the file once downloaded, such as e.g. **ESP\_**fire\_archive\_M6\_13387.csv (ESP for Spain). Then invoke firms=firms\_read('',1) in MATLAB and you get:



Figure: all fire locations in Spain for the data period 01-Jan-2001 22:07:00 ..31-Dec-2016 22:25:00, 16635 events (76880 records).