Numerical Modelling of New Zealand Fire Weather and Utility of Fire Danger Indices

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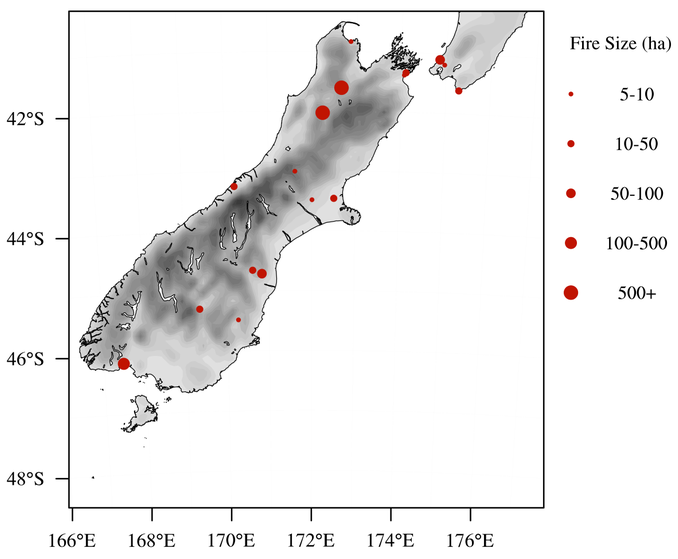
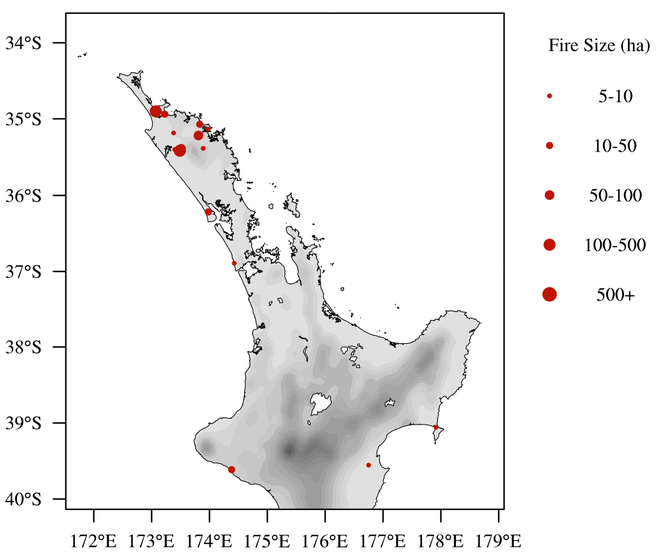
Introduction

We have conducted an investigation of the 2009/10 fire season in New Zealand. In particular we are interested in the operational utility of different fire danger indices around New Zealand. We also investigate the impacts of the Canterbury Nor'wester on regional fire danger.





Left Top and Bottom: Fire events greater than 5ha during the fire season. Clear regional variations are present

Right Top: FWI and CHI percentile values for individual fire events, showing better information from combined indices

Right Middle: mean values for CHI during fire season

Experimental Setup

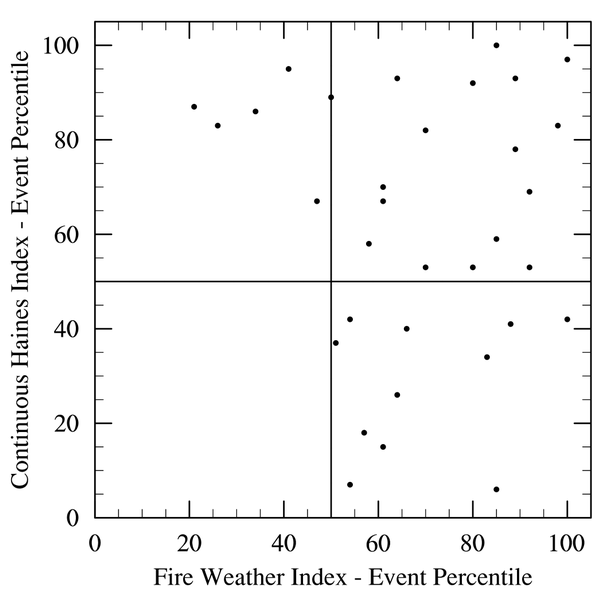
- WRF atmospheric model (V3.2.1)
- Seven month simulation of the 2009/10 New Zealand fire season
- Allows for a 3D investigation of fire weather not possible with observational data
- Results used to identify a number of foehn wind events for further study
- Simulation of foehn wind event on 01/01/2010
- Verification scores for simulations show good agreement with observed surface conditions

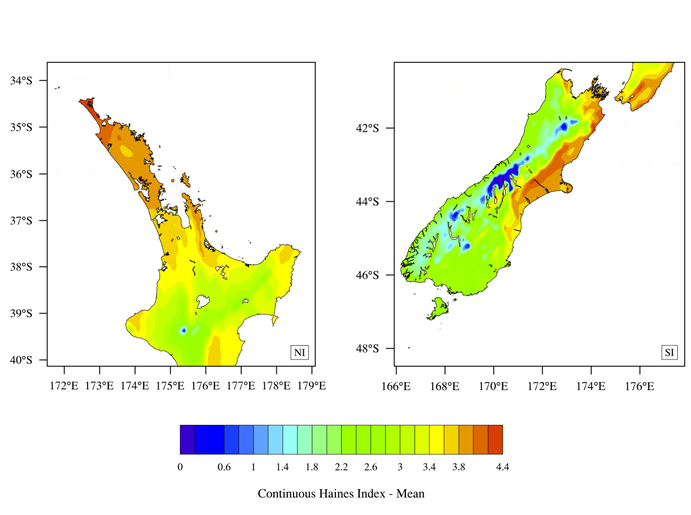
Behaviour of Fire Weather Indices

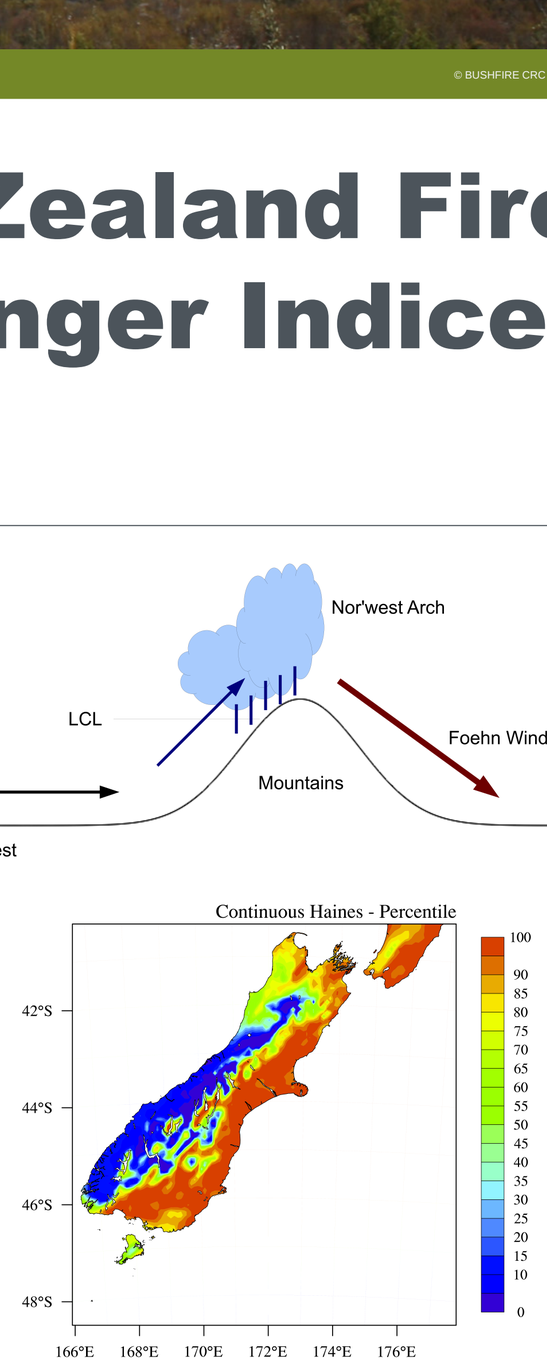
- Three fire danger indices tested:
  1. New Zealand Fire Weather Index (FWI)
  2. Haines Index (HI)
  3. Continuous Haines Index (CHI)

- FWI used operationally in NZ. Quantifies fire danger using antecedent and current fire weather conditions.
- Haines Indices quantify fire danger based on aloft atmospheric stability and dryness
- HI not readily usable due to high variability of surface elevation throughout NZ
- CHI has better operational usage though still limited to elevations less than 1200m

- Combined use of FWI and CHI provides better information on fire weather danger
- Other indices should be tested to check for further improvements through use of a combined index







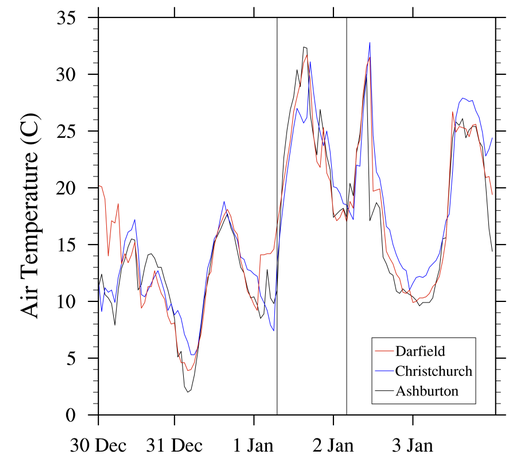
Top (Above): Schematic of a typical Canterbury Nor'wester
Bottom (Above): CHI Percentile values on day of foehn wind event (01/01/2010), showing elevated fire weather danger.

Below: Timeseries of observational data showing dramatic rises in air temperature associated with foehn event.

Foehn Wind Fire Danger: The Canterbury Nor'wester

We have investigated the fire weather behaviour of a Canterbury Nor'wester on 1st January 2010. These events occur during strong pressure gradients between the west and east coasts of the South Island. This can result in orographic lifting of air on the west coast, which drops heavy precipitation on the west coast before accelerating down the eastward slope as an extremely hot, dry and fast foehn wind.

This foehn wind event resulted in fire weather conditions that are severe in a local context: increased air temperature, wind speed and decreased relative humidity. This event scored some of the highest values of fire danger of the fire season.



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