

# SMOKE PLUME INJECTION INTO THE ATMOSPHERE AND SUBSEQUENT PYROCUMULUS 'BLOW-UP'



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## GEOSPATIAL ANALYSIS OF THE JANUARY 2013 FIRE SEASON IN DUNALLEY, TASMANIA

### BACKGROUND

- ▶ Fire influences climates through emission of gas and particles into the atmosphere
- ▶ Advances in geospatial technology have permitted analysis of fire dynamics
- ▶ Tasmania experienced severe fires in January 2013 that burnt ca. 120,000 ha of forested and urban landscapes
- ▶ Dunalley town was the worst affected, where a convective column and ember storms were observed

### ▶ RQ3: Chemical species simulation

Lab analysis: burn vegetation from different forest types and quantify emission factors



Fig. 1: CSIRO pyrotron. photo credit: Sullivan et al., 2012

### PRELIMINARY RESULTS

Proof of concept. Possible to:

- convert 3D radar into GIS usable format (Fig. 2)
- correlate plume development and fire severity

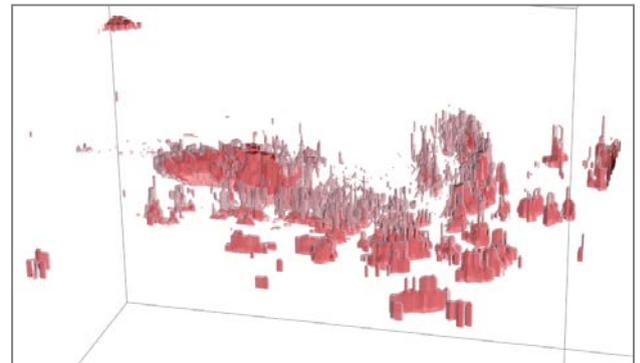


Fig. 2: Smoke distribution in the atmos. at 5km ASL, 4<sup>th</sup> Jan 2pm



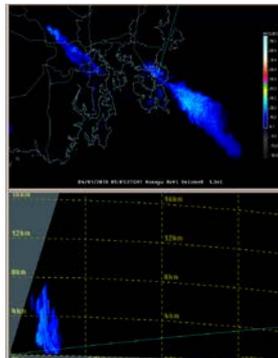
### RESEARCH QUESTIONS

1. What was the process of smoke plume evolution and injection into the atmosphere?
2. How did ground and atmospheric conditions cause pyrocumulus formation and 'blow up'?
3. What chemical compounds were emitted and in what quantities?

### METHODS

#### ▶ RQ1: Smoke plume analysis

- Radar data obtained - shows path of the plume
- Converted into 3D cartesian coordinates of plume
- Max. plume height determined at each time step to estimate vertical distribution of emissions



#### ▶ RQ2: Pyrocumulus blow-up

- Determine how atmospheric conditions caused pyroc. 'blow up'
- Assess landscape conditions affecting fire severity



Fromm et al., 2006

### NEXT STEPS

- ▶ Conduct vegetation burning in the lab to determine emitted chemical compounds
- ▶ Analyse pyrocumulus formation and eventual blow-up
- ▶ Determine fire severity across vegetation types

### TAS. FIRE SERVICE STATEMENT

- ▶ As we expand our fuel reduction programs, it is important we understand environmental outcomes of our chosen mitigation actions
- ▶ Smoke impacts from burning are a concern in the community. This research will help us understand not only plume behaviour, but also to explore any differences between fuel reduction burns and summer bushfires

