



FINDINGS

“The PFT provided very useful guidance to forecasters briefing emergency services.” *

Real-time trial of the Pyrocumulonimbus Firepower Threshold: A prediction tool for deep moist pyroconvection

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Following the success of the real-time trial of a pyrocumulonimbus firepower threshold (PFT) forecasting diagnostic during the 2019/2020 southern Australian fire season, there has been overwhelming support from fire-weather forecasters and fire-behaviour analysts to improve usability for the next fire season. Planned improvements include: increasing the output frequency, optimizing display features and improving access to forecast products. Additional fine-tuning and adjustments to the suite of products are also planned.

Introduction

The PFT was designed to help predict deep, moist pyroconvection (MPC) including fire-generated thunderstorms. It provides a theoretical estimate of the minimum firepower required to generate deep MPC in the fire plume. The PFT flag is designed to identify the specific range of conditions that support both large and intense fires and moist plume development, necessary for deep MPC. It is essentially the PFT divided by a modified fire danger index. Examples are provided in Fig. 1. Forecast plots of these fields were provided to fire-weather forecasters and fire-behaviour analysts twice-daily for six regions around Australia, at six-hourly intervals.

Performance

The PFT and PFT flag provided very useful guidance for almost all deep MPC cases including most fire-generated thunderstorms. It became apparent during the trial that favourable conditions can vary greatly in space and time, especially when associated with relatively small-scale meteorological features such as wind-change lines. High spatial and temporal resolution forecasts were produced manually for high-risk events, when possible, and found to provide a substantial increase in forecast value.

Product development feedback

Users expressed interest in a number of product developments to improve ease of use, including: additional labelling to more easily relate the timing of PFT features as they approach fire

locations (e.g., local time, fire-district boundaries, prominent topography); more accessible forecast products; and forecast data that can be incorporated into existing display systems. Additional feedback identified areas to improve the accuracy of the PFT and PFT flag.

Utilization Project

The utilization project aims to implement, as much as possible, the feedback development ideas raised by users. This will include:

- Substantial improvements in computing efficiency to enable more forecast domains to be run, including the routine running of high-resolution forecasts from operational numerical weather prediction models.
- Improved labelling to more easily identify threat location and timing
- Password-protected web access to forecast products
- Tuning to eliminate false triggering of the PFT flag during cold-outbreaks (e.g., Fig. 2).
- Incorporation of buoyancy losses from entrainment in the cloudy part of the plume.

Additional improvements will be added in consultation with end-users as the project progresses.

For more information, please email kevin.tory@bom.gov.au

Figures

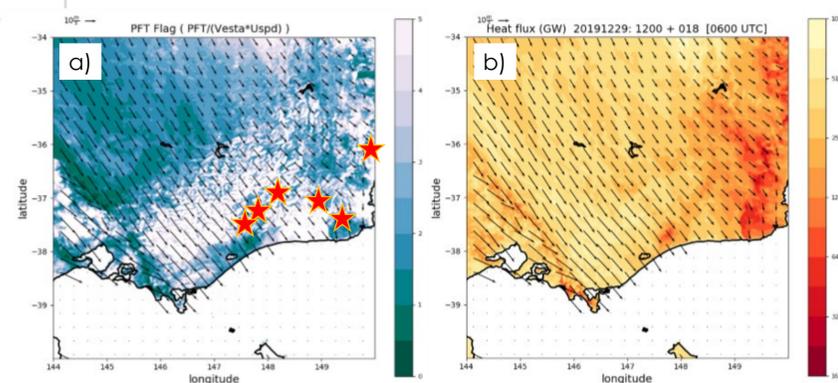


Figure 1: The most active day of the season, 30 December 2019 saw seven confirmed fire-generated thunderstorms on six fires (starred) and many more fires produced deep moist pyroconvection. a) PFT flag b) PFT. Darker shading indicates increasing favourability.

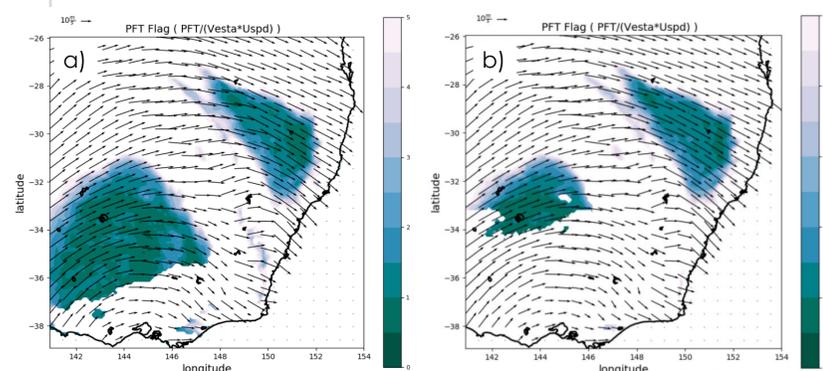


Figure2: PFT flag 6-hour forecasts, 0600 UTC 6 September 2019. (a) Original PFT flag, (b) PFT flag adjusted to reduce triggering over green vegetation during cold outbreaks. Two distinct patches are evident in both panels. The patch to the northeast correctly warned of the potential for deep MPC (e.g., Bees Nest fire), whereas the patch to the southwest was triggered during a cold outbreak. In (a) this includes regions with green vegetation, and in (b) the adjusted PFT flag removes the green-vegetation region.

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