ACCESS-FIRE

AUSTRALIA'S COUPLED FIRE-ATMOSPHERE MODEL

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END USER STATEMENT

Some bushfires exhibit extreme behaviour that exceeds the bounds of existing predictive guides. Coupling between the fire and the atmosphere has been invoked as a cause of such unexpected behaviour. Events of this type are uncommon and cannot be investigated by conventional field experiments. This modelling project allows complex interactions between a fire and the atmosphere to be studied, potentially providing physically-based explanations that will lead to more reliable predictions and reduced risk to firefighters and the community.

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ACCESS

ACCESS is the Australian Community Climate and Earth-System Simulator - Australia's premier NWP model. ACCESS is based on the UK Met Office's system, one of the best three meteorological models in the world.

ACCESS is Australia's national operational weather forecasting model. It is run every 6 hours on supercomputers at the Bureau of Meteorology.

ACCESS can also be run in research mode for a range of purposes including climate research and examining case studies of extreme events in high resolution.

ACCESS can be initialised from a range of meteorological observations in operational mode, or by using archived global analysis fields for case studies.

Simulations of fire case studies are typically run using a series of nests, down to resolutions of a few hundred metres.

COUPLED FIRE-ATMOSPHERE (CFA) MODELS

CFA models have an empirical fire model coupled to a Numerical Weather Prediction (NWP) model. They capture the interactions between a fire and the atmosphere in three dimensions as well as topographical processes.

At each time step, the fire model runs and from the amount of fuel burnt, heat and moisture fluxes are inserted into the atmospheric model. This energy release changes the winds in the vicinity of the fire – known as 'fire-modified winds'. The feedback processes can change the direction and speed of fire spread. Coupled modelling also provides information about the structure of the fire plume above the surface and the potential for pyro-convective cloud to develop. ACCESS-Fire has been developed at Melbourne and Monash Universities.

JULES

JULES (the Joint UK Land Environment Simulator) is the land surface model in ACCESS.

The land surface scheme models process such as surface energy balances, hydrological cycle, carbon cycle and vegetation.

JULES provides the interface between the fire model and the atmospheric model.

At each time step the fire code runs it feeds heat and moisture fluxes through JULES to the atmospheric model and also passes the atmospheric conditions back to the fire model.

ROSE-CYLC

Rose-Cylc is the framework for interacting with and running the ACCESS model.

Rose is the Graphical User Interface for the ACCESS model. It is used to control settings (including the complex nested options) and to monitor the running of jobs.

Cylc is the scheduler component of the Rose-Cylc interface. It partitions the numerous individual jobs required for the ACCESS run and submits them to the supercomputer so as to minimise running time and maximise supercomputer utilisation.

Simulations for the project are run on NCI computing facilities.

PLANNED CASE STUDIES

The Coupled Fire-Atmosphere project will deliver a series of case studies including the Waroona fire in WA and the Sir Ivan fire in NSW.

WAROONA FIRE

The Waroona fire was ignited by lightning in January 2016. It burnt over 69,000 ha and more than 160 homes. There were two fatalities. Four episodes of extreme fire behaviour occurred. There were two pyrocumulonimbus events and two destructive evening ember storms associated with downslope winds.

SIR IVAN FIRE

The Sir Ivan fire, on 12 February 2017, burnt more than 55,000 ha, 32 homes a church, a community hall and the historic "Tongy Homestead". The hot, dry, windy conditions were described as the worst seen in NSW. The afternoon passage of a frontal wind change triggered development of pyrocumulonimbus cloud.

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