



Spark

Operational



Spark - What is it, and how does it use Bureau weather data.

A real-world application

DATE

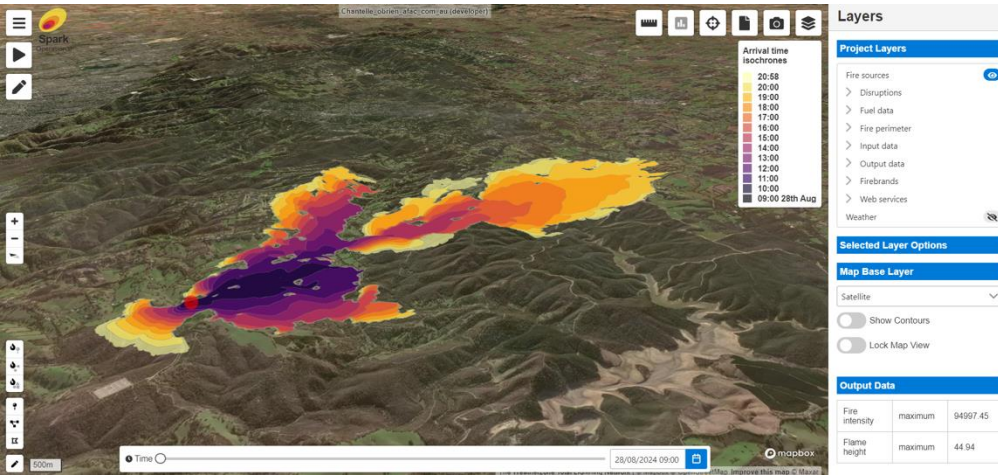
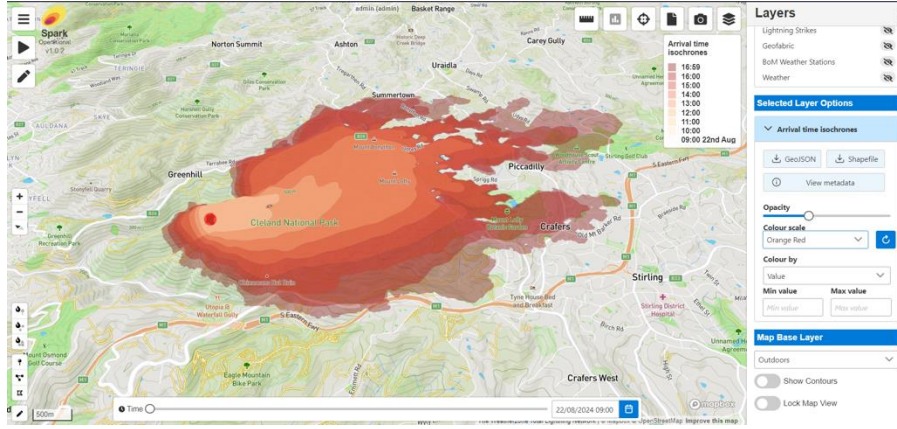
Sept 2024

PRESENTER

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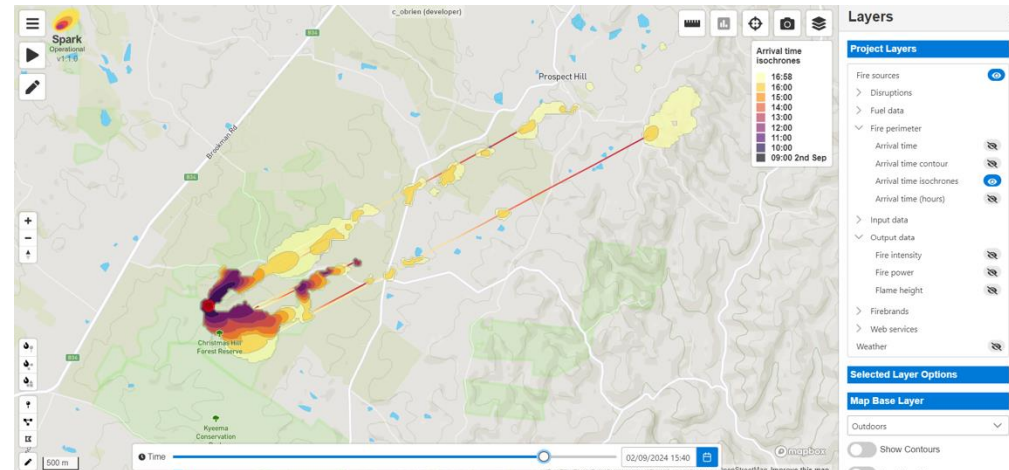
What is Spark



- Collaborative project between CSIRO and AFAC
- Fire simulation tool
- Uses fuel load, fuel age, topography, road network, weather data
- Data sensitivities
- Adapted AFDRS fire behaviour models
- Sub models simulate plume and firebrand generation

What is Spark

- Different to weather model (ACCESS Fire)
- Time to run
- Computer/server types
- Differences in spatial data resolutions (Spark can be 30m, ACCESS C 1.5 km, GFE 6km)
- Need high resolution for simulations



BoM_Semo

Basic

Sources

Layers

Initialisation

Advection

Rate of Spread

Update

Processing

Sub Models

Input Layers

Input Vectors

Gridded Layers

Output Layers

Variables

BoM_Semo

Firebrands

Plumes

Name

z

Code

```

1 // Vertical position (eq. 3.9)
2 REAL du = Hu/Ht;
3 REAL dw = Hv/Ht;
4 REAL Usc = hypot(Ua+du, dw);
5
6 return du/Usc;
7
8

```

Add element to Plume models

Update model

```

1 // Set u
2 u = Ua*(Hu/Ht);
3
4 // Set w
5 w = Hv/Ht;
6
7 // Gaussian conversion factor
8 const REAL gauss = 2.65;
9
10

```

Weather topography

/data/IDY25001.AP53.topog.surf.2023040512.000.surface.nc4

Weather atmosphere

/data/access_g3_nwp4/IDY25001.AP53.pop-flds.all-lvs.*.model.nc4

Gridded Layers

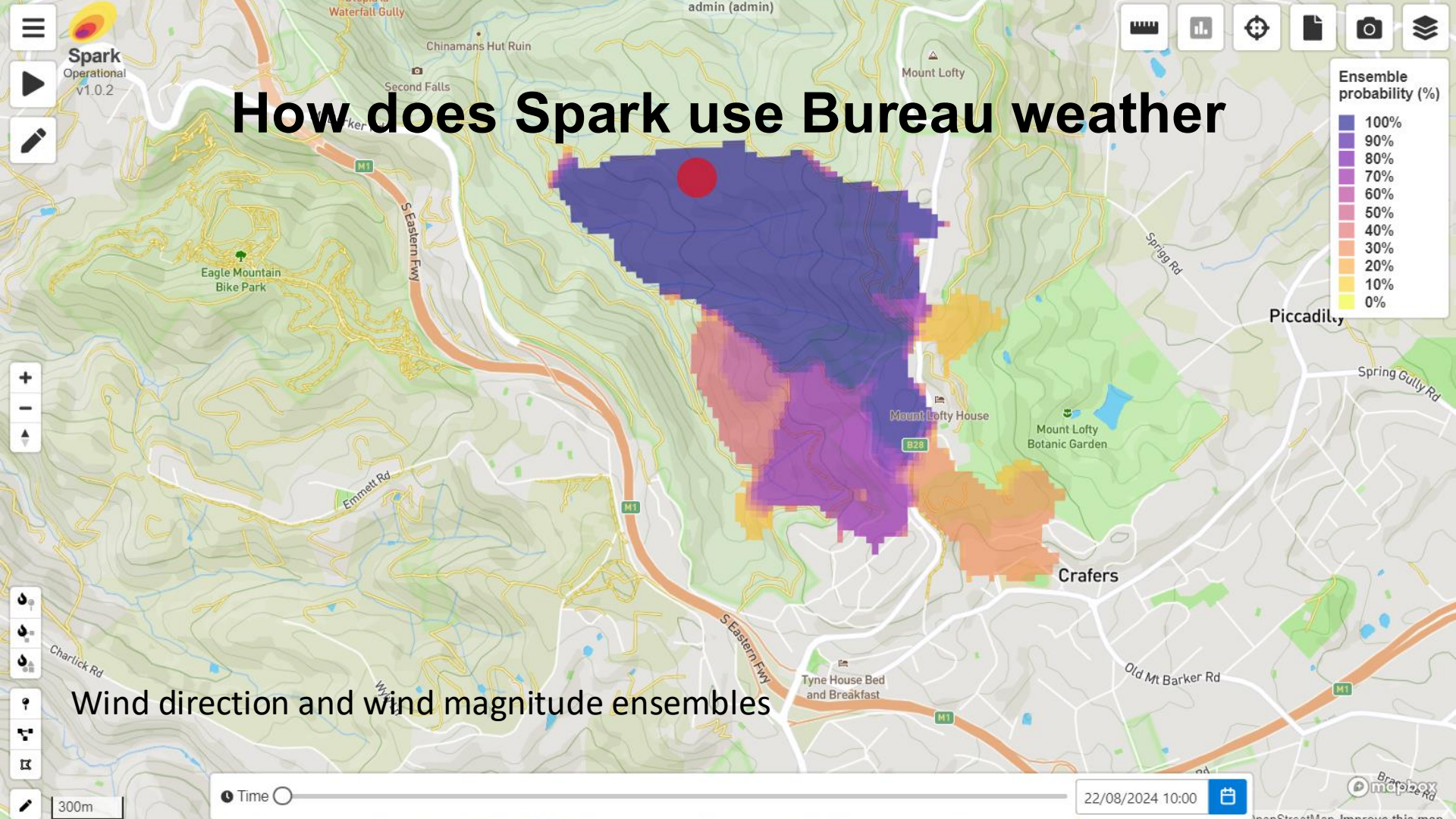
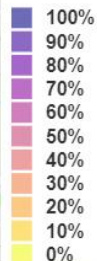
Name	Source	Projection	Type	Scale	Offset
WindOnHourMagKmH_SFC	/data/edfd/IDZ71075_AUS_WindOnHourMagKmH_SFC.nc	EPSG:4326	wind_magnitude	1.5	0
Wind_Dir_SFC	/data/edfd/IDZ71089_AUS_Wind_Dir_SFC.nc	EPSG:4326	wind_direction	1	0
T_SFC	/data/edfd/IDZ71000_AUS_T_SFC.nc	EPSG:4326	temperature	2.5	0
RH_SFC	/data/edfd/IDZ71018_AUS_RH_SFC.nc	EPSG:4326	relative_humidity	0.2	0
grass_curing	/data/edfd/IDZ10148_AUS_FSE_curing_SFC.nc	EPSG:4326	curing	5	0
DF_SFC	/data/edfd/IDZ71127_AUS_DF_SFC.nc	EPSG:4326	drought_factor	2	0

Add element to Gridded Layers

How does Spark use Bureau weather

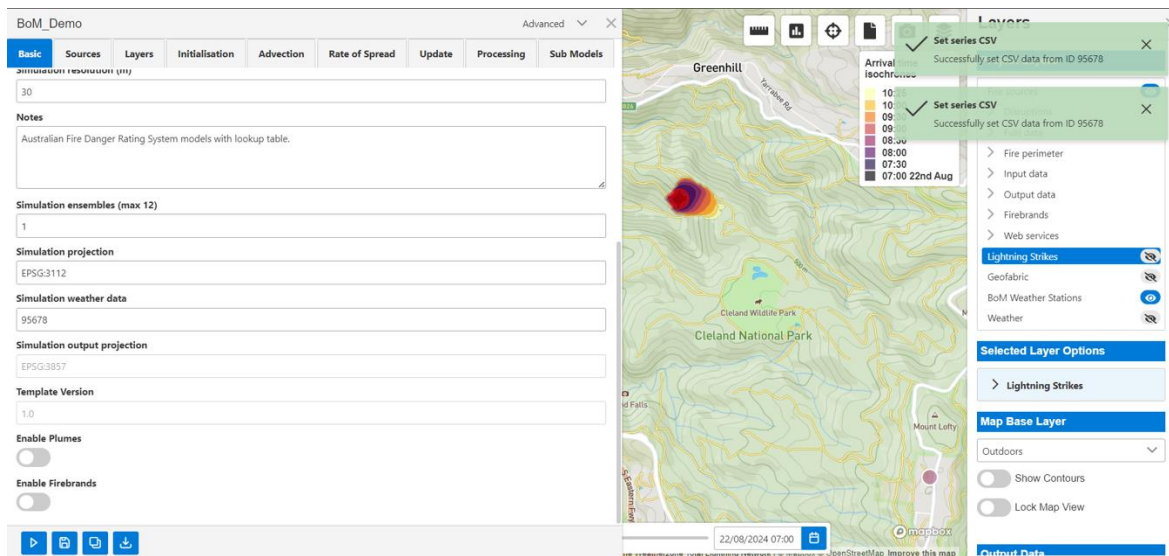
Wind direction and wind magnitude ensembles

Ensemble probability (%)



AWS observations

Spark can use AWS point observations to do hindcasting simulations
– if runs beyond observations, will fill with gridded forecast



Weather manipulation

BoM_Demo Advanced ✕

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Name	Source	Projection	Type	Scale	Offset
WindOnHourMagKmh_SFC	./data/adfd/IDZ71075_AUS_WindOnHourMagKmh_SFC.nc	EPSG:4326	wind_magnitude	1.5	0
Wind_Dir_SFC	./data/adfd/IDZ71089_AUS_Wind_Dir_SFC.nc	EPSG:4326	wind_direction	1	0
T_SFC	./data/adfd/IDZ71000_AUS_T_SFC.nc	EPSG:4326	temperature	2.5	0
RH_SFC	./data/adfd/IDZ71018_AUS_RH_SFC.nc	EPSG:4326	relative_humidity	0.2	0
grass_curing	./data/adfd/IDZ710148_AUS_FSE_curing_SFC.nc	EPSG:4326	curing	5	0
DF_SFC	./data/adfd/IDZ71127_AUS_DF_SFC.nc	EPSG:4326	drought_factor	2	0

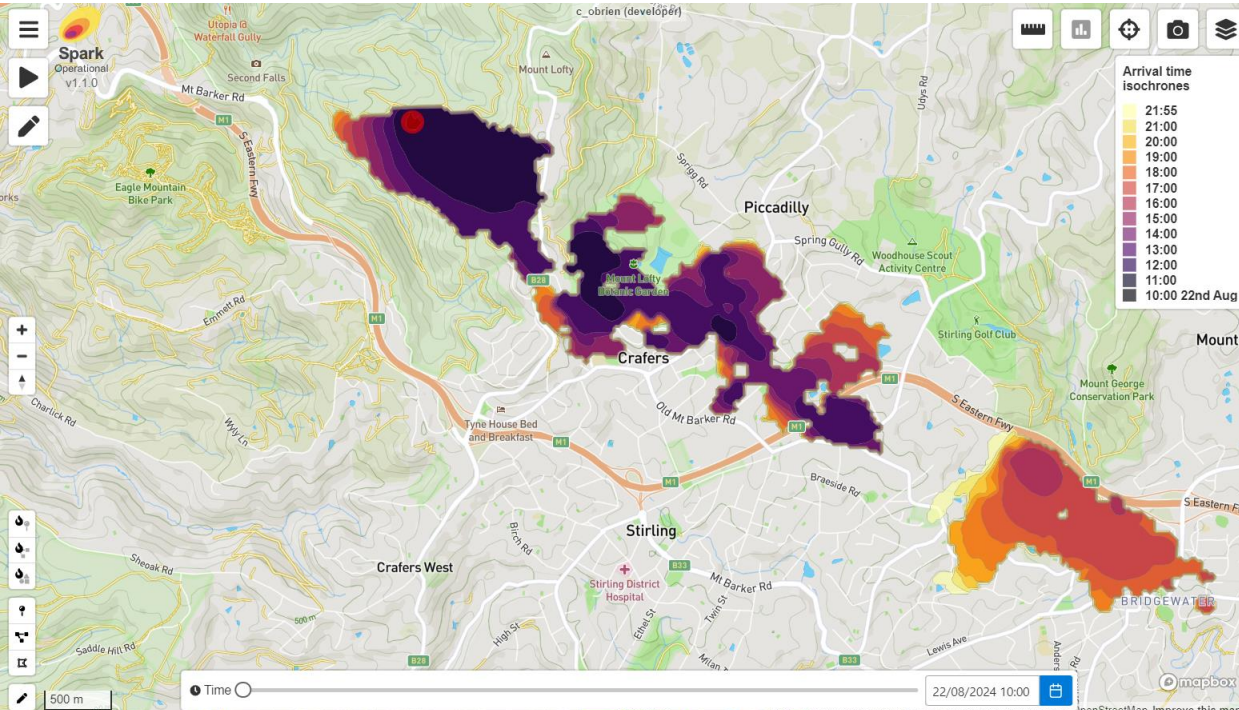
➕ Add element to Gridded Layers

If forecast weather isn't matching on ground observations or AWS observations, weather inputs can be manipulated.

Scale and offset

Editing of csv and xml files

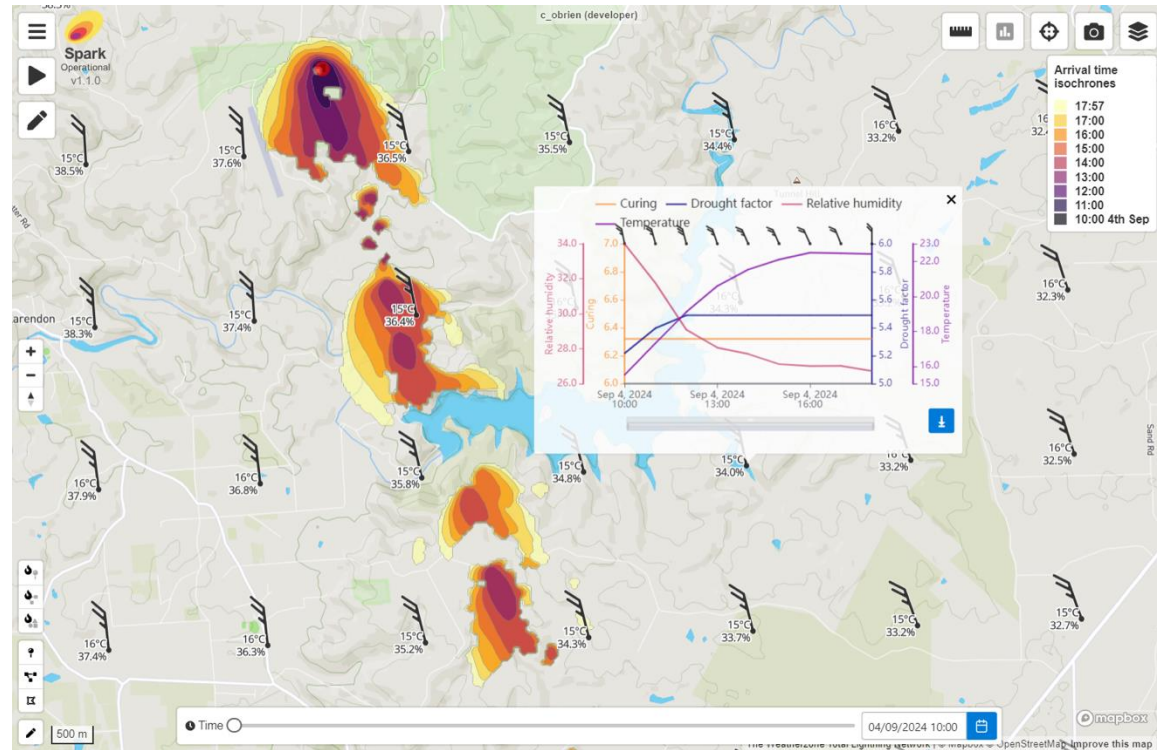
Current challenges



- Ease of access of Bureau weather – CSIRO built downloader
- NetCDF format
- Historical and realtime datasets different
- ADFD grids are overwritten 5 times a day
- Gridded weather – 6km grid – lack of local effects
- IWF ingestion – currently only receive as a PDF – electronic aren't distributed

Future Opportunities

- World leading in fire simulation
- Test with winds at 300 or 100m resolution using high resolution ACCESS
- Test with ACCESS Fire with spotting – combine ACCESS Fire with Spark spotting simulation model
- Jeff Keper's parametric Ember Transport scheme
- Compare with satellite data for real time verification
- Potential for forecast demo collaboration project
- Real time collaboration using satellite data, mobile radar data which enables real time verification of fire perimeters





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Thank you

