

# FUTURE TECHNOLOGIES FOR PREDICTING NATURAL HAZARDS



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**PREDICTIVE MODELS OF NATURAL HAZARDS HAVE BECOME A NECESSITY FOR EMERGENCY MANAGEMENT, MITIGATION AND ADAPTATION PLANNING. OUR TEAM IS WORKING TO INTEGRATE NEW TECHNOLOGIES INTO A PREDICTIVE FRAMEWORK TO PROVIDE MORE ACCURATE AND UP-TO-DATE INFORMATION FOR STAKEHOLDERS AND DECISION MAKERS.**

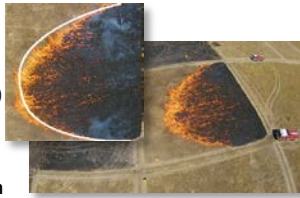
## REMOTE SENSING DATA SOURCES

### Satellite remote sensing

Earth observation satellites are continuously improving, adding greater resolution, acquisition frequency and increasing number of spectral bands with each generation. Imagery from these satellites can be used to determine **live fire hotspots**, **burn scars** and **flood extents**. Research in partnership with Monash University is investigating using spectral data to determine fuel recovery and moisture levels for more accurate inputs to fire prediction models.

### Unmanned aerial vehicles

The ability to record high resolution video streams from unmanned aerial vehicles (UAVs) allows highly accurate measurements of fire perimeter propagation. These are being used to build the **next generation of fire models** incorporating dynamic behaviour effects.



UAV footage with rectified image and model prediction (white curve)

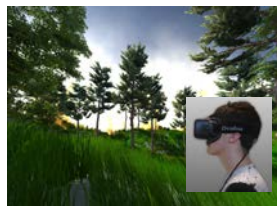
New methods of photogrammetric processing allow **reconstruction of three-dimensional terrain** from UAV video streams. The three dimensional terrain can be used for more accurate prediction of natural hazards such as **landslides**, **flash floods** and **lahars**.



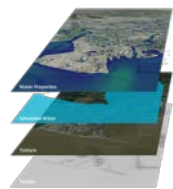
Photogrammetric reconstruction for lahar prediction. UAV over terrain (left) and reconstructed terrain (right)

## VISUALISATION TECHNOLOGY

The next generation of virtual reality devices allows users to be placed with an **immersive simulated environment**. The technology allows interactive training and planning for fire and flood scenarios.



Bushfire scenario in virtual reality



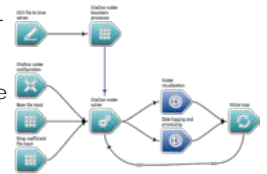
Townsville flood visualisation

Dynamic three-dimensional visualisation can be used for **community engagement**, **planning or presentation** of findings to a broad audience.

## INTEGRATED SOFTWARE FRAMEWORK

### Workspace

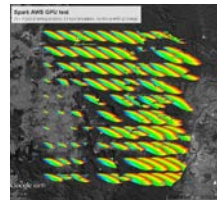
Our software is developed using CSIRO's **Workspace** framework, a modular architecture allowing separate processing blocks to be joined in an easy-to-use GUI environment to form workflows. Workspace leverages the power of many open software systems, providing geospatial support, image analysis, scripting and database integration.



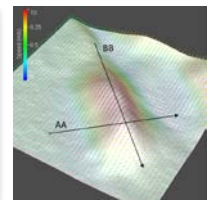
Workflow for flood prediction

### Spark: bushfire prediction

Spark is a fully configurable fire propagation system allowing rate-of-spread models for **any fuel type** based on the latest fire science research. The system includes a range of plug-in packages including real-time **topographic correction** for wind fields, **road/transmission line crossing** and **spotting behaviour** models.



Ensemble run of fire prediction



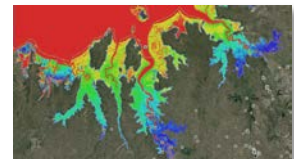
Diagnostic wind model

### Swift: flood prediction

Swift is a flexible software system for modelling coastal and catchment flooding from **heavy rainfall**, **dam breaks** and **storm surge events**. The system includes a coupled hydraulic model for drainage and models for rainfall, evapotranspiration and infiltration. The system is used for **C-FAST**, the city-based flood adaption and solution tool, currently being developed for coastal councils around Australia.



Urban storm surge model City of Port Phillip



Environmental impact assessment of salinity intrusion in Kakadu national park

### Amicus: decision support

Amicus encapsulates state-of-the-art Australian bushfire spread models based on the latest fire research. Through an easy to use interface, the system complements bushfire analyst expert knowledge to streamline and **enhance bushfire prediction** capability.



Bushfire spread rate comparison

