CASE STUDY 3

ESTIMATING FLOOD CLIMATOLOGIES AND PREDICTION SKILLS (AUSTRALIA)

SUMMARY

Title
Establishing flood climatologies and prediction skills

Service
Flood management and climate change; disaster risk reduction in high-impact weather

End users
Governments (Australia initially), river basin management authorities, Global Flood Partnership, European Flood Awareness System, provincial and local authorities, international donor agencies such as the World Bank, humanitarian relief services such as the World Food Programme

Intermediate users
Research institutes and academia

Application(s)
Flood risk assessment and forecasting

Models used
- Variable Infiltration Capacity (VIC), a macroscale hydrological model which solves full water and energy balances and uses reanalysis precipitation datasets to simulate flows into the coupled
- LISFLOOD-FP, a 2D hydrodynamic model, specifically designed to simulate floodplain inundation in a computationally efficient manner over complex topography (Bates et al., 2010; Neal et al., 2012)

Climate data records used
- Benchmarking with continent-wide flow gage records spanning 40 years (1973–2012)
- Reanalysis of precipitation incorporating a range of climate data records
- ICESat canopy (Simard et al., 2011)
- Lakes and reservoirs from the Global Lakes and Wetlands database

Satellite observations used
- Landsat flooded area, MODIS flood product, MODIS snow, MODIS evaporation, SAR flood maps, radar and ICESat altimetry for water levels and canopy heights, SRTM-DEM topography
- Planned within the VIC model: SMAP soil moisture, MODIS snow cover

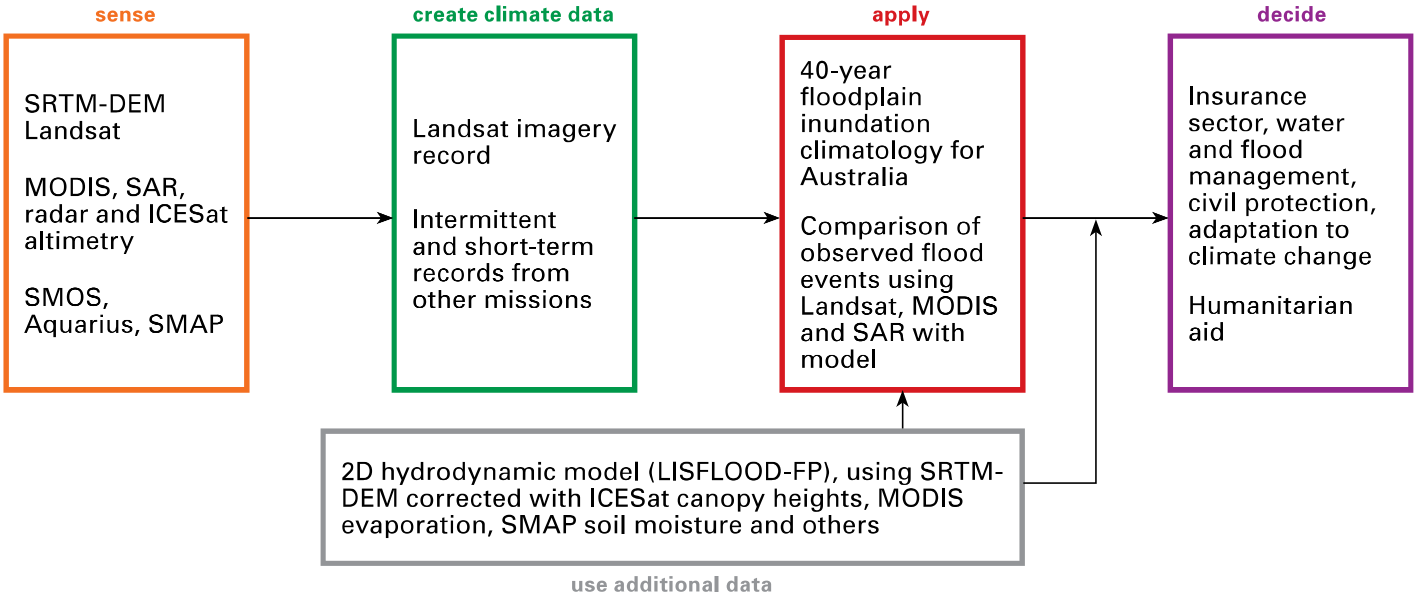
Agencies that produce records
JPL, NASA, WWF

Sustainability of service (demonstration or ongoing)
Proof of concept; intended for open-access use of flood-event climatologies

MICHAEL SPENCER

Flash flooding in Perth, Australia, 2010

INFORMATION FLOW



DESCRIPTION

To improve flood climatologies and flood prediction skills, a database is being generated new which deals with observed or simulated flood-event inundation and magnitude at continental to global scales. The only dataset compiled to date which shows a consistent but spatially and temporally discontinuous history of flood-inundation area and extent at a near-global scale is provided by the Dartmouth Flood Observatory at MODIS and the NASA GSFC near real-time flood mapping archive. The proof of concept study for the flood event database was presented by Schumann et al. (2014*a*). It uses a computationally efficient 2-D hydrodynamic model (LISFLOOD-FP; Bates et al. (2010), Neal et al. (2012)) complemented with a sub-grid channel formulation to generate a complete flood inundation climatology of the past 40 years (1973–2012). It will initially be for the entire Australian continent (Figure 1) at 1-km floodplain resolution and based on gauged stream-flow records. This dataset can easily be downscaled if a higher-resolution digital elevation model is available (Schumann et al., 2014*b*).

Generating the flood-event database is based on SRTM-DEM topography, MODIS and Landsat flood records, ICESat and radar altimeters (water levels), SAR-derived flood maps, and a range of other snow and soil moisture-related products. Use of SMOS and SMAP soil moisture data and the planned SWOT mission is being explored. The floodplain inundation climatology has been compared to Landsat flood-event observations.

The modelling chain used for generating the flood-event database is similar to that used for the operational European Flood Awareness System (EFAS (Thielen et al., 2009)) and the Global Flood Awareness System (GLOFAS (Alfieri et al., 2013)). EFAS was improved by assimilating satellite data, such as MODIS snow cover (Thirel et al., 2013). EFAS has been operational since 2012 and works under the auspices of the European Copernicus emergency management service.

The flood-climatology database allows for the continental-scale assessment of flood-event impacts, improves forecasting and reanalysis of such events and is potentially very useful for the research, industrial and humanitarian sectors.

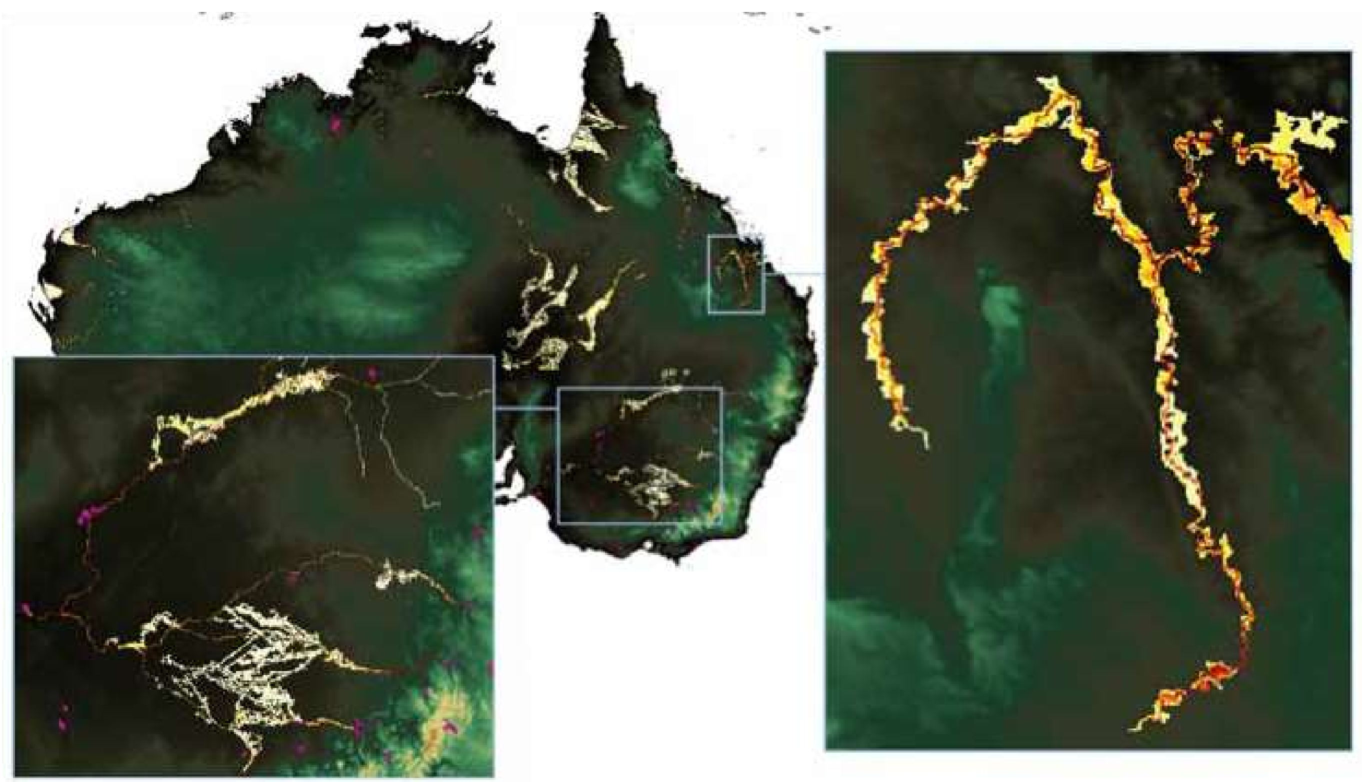


Figure 1. Maximum flood hazard in Australia over 40 years based on gauged flow records. Maximum hazard is here defined as H(V+1.5), where V is the maximum velocity in each cell over the simulation time and H is the water depth in each cell at the time of maximum velocity. Hazard is increasing from white-yellow-orange to red; the purple patches are lakes and reservoirs that do not represent a hazard.

References

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