Australia's intergovernmental agreement on bushfires, floods and extreme events

Dr Ray Canterford
Former Division Head,
Hazard Services
Bureau of Meteorology

Mark Crosweller
Former Director-General
Emergency Management
Australia
Department of Home Affairs

Chris Beattie
Chief Officer, South
Australian State Emergency
Service

Introduction

Extreme meteorological and ocean-related events, including the tragic Victorian Black Saturday bushfires in 2009, heat waves that preceded the catastrophic bushfires, and severe tropical cyclones, resulted in the Australian Government implementing recommendations from a comprehensive independent review (Bureau of Meteorology 2013). The review received significant and positive response from government and the Bureau of Meteorology (Bureau) over the following years. One of the major recommendations and subsequent government response was the standardisation and harmonisation of Bureau services to jurisdictions in order to maximise the efficiency and value of its partnership with emergency service organisations.

For hazard warning systems to be effective, they must be multi-faceted and be developed and operated collaboratively and across different levels of government and jurisdictional boundaries. Emergency services organisations use the Bureau's information, forecasts, warnings and advice to plan for and manage the effects of natural hazards.

The Bureau worked closely with Emergency Management Australia and all jurisdictions, as well as the Australasian Fire and Emergency Services Authorities Council (AFAC) and the Australian Local Government Association (ALGA) over a period of 3 years. This was a unique opportunity for a strengthened 'natural hazards partnership' similar to that in the United Kingdom. The teams from all emergency services agencies and the Bureau established a landmark intergovernmental agreement (Council of Australian Governments 2018) as well as an ongoing peak consultation body: the Hazards Services Forum.

The work was undertaken within the Australian-New Zealand Emergency Management Committee (ANZEMC 2020) through a joint Standardisation of Bureau of Meteorology Services Taskforce. Outcomes from this work included significant improvements to bushfire, flood and extreme event services; addition of further embedded meteorologists in incident control centres and a high-level policy accomplishment: an intergovernmental agreement under the Council of Australian Governments (COAG) in 2018, which was endorsed by state and territory governments and the Australian Government. The intergovernmental agreement enshrines the Hazards Services Forum and provides additional clarity of roles and responsibilities for emergency management agencies at all levels of government. The substantial outcomes resulting from the collaborative process are discussed in this paper with a focus on shaping government and agency policies and operations to enhance community safety.

The work described here to achieve national consistency and standards across major hazards, especially forecast and warning types, structure and technical content, will be an important input to the Australian Warning System, which was recently launched (see AFAC Warnings Group, Australian Institute for Disaster Resilience 2021). While the AWS is now in place for bushfires, the intergovernmental agreement and Hazards Services Forum should also assist that framework development as other hazards are introduced. The outcomes described in this paper are essential to the national consistency of the forecasts and warnings for particular hazards, while the AWS will provide the essential national consistency of messaging and icons and calls to action. Both are necessary for an effective Total Warning System.

Forecasting and warnings services

Economic activity and public safety are heavily affected by severe weather, climate and floods. The forecasting and warning services of the Bureau (several million each year) are relied on whenever there are heatwaves, fires, tropical cyclones, gales, floods, thunderstorms, fog, frost

and other weather and ocean-related events such as storm surge and marine services. Further, the Bureau provides an extensive range of other forecast and warning services, including smoke and radiation atmospheric modelling, volcanic ash warnings for aviation, space weather services and tsunami warnings and advisories for Australia and the Indian Ocean region. In addition, the Bureau provides extensive climate services such as seasonal outlooks. The effects of extreme weather in Australia, combined with its growing population, infrastructure and assets, has increased demand on the services offered by the Bureau.

The Bureau's mission is to 'provide trusted, reliable and responsive weather, water, climate and ocean services for Australia - all day, every day'. In undertaking this mission, the Bureau has partnerships with state and territory emergency services organisations to ensure the safety and resilience of Australian communities.

The 2011 review (Bureau of Meteorology 2013) examined the Bureau's capacity to respond to future extreme weather and disaster events and to provide seasonal forecasting services. The review identified 13 priority actions to mitigate risks and 16 options that could provide savings and enhance efficiency. The first 2 priority actions - bolstering meteorologist and hydrologist numbers and upgrading flood warning systems, were addressed by the Bureau with Australian Government support.

In response to the review, the Australian Government, in partnership with the states and territories, progressed the other issues raised under:

- Priority Action 3: formalise and standardise service levels provided to emergency services
- Priority Action 4: agree clear allocation of responsibilities to state and local government for flood management, with defined boundaries on the Bureau's role
- Option 21: apply a consistent cost-recovery model to all supplementary services delivered to state/territory fire agencies.

This was achieved through the ANZEMC establishing the Standardisation of Bureau of Meteorology Services Taskforce on 4 October 2013, which then reported to the Law, Crime and Community Safety Council (LCCSC) of COAG in 2015.

The Munro Review and the government response

In the years leading up to the 2009 Black Saturday bushfires, the Bureau had been developing high-resolution weather modelling as well as expanding its interactions and collaboration with fire and emergency services organisations. This included specialist severe weather meteorologists being embedded in some incident control centres. Additionally, the Bureau was an active partner in the Bushfire CRC (and the following Bushfire and Natural Hazards CRC), which enabled fire weather research to be advanced and adopted into services.

It was recognised that during extreme weather events, briefing requests from representatives from government and media organisations were often handled by a small number of highly respected and sought-after senior Bureau forecasters. These pressures were particularly acute during protracted severe weather events. The pressure on the Bureau to satisfy a wide-ranging client base was particularly evident during the severe weather season of 2010–11 that included severe floods in many parts of Australia, tropical cyclones (including Cyclone Yasi) and bushfires in Western Australia. These incidents, including an international response to the Fukushima tsunami and associated nuclear radiation fallout modelling, demonstrated the increasing demand for Bureau services and the sustained pressure this can produce.

The Australian Government appointed Ms Chloe Munro to undertake the review with a support team from other agencies. The review noted the imbalance between demand and the Bureau's capacity to deliver critical services to states and territories and Australian Government agencies. Among other findings, the review recommended boosting the numbers of frontline hydrologists and meteorologists. Additionally, the review noted that:

- further storm surge experts were necessary for high-risk regions, especially along the Queensland coastline
- a review of Space Weather services was necessary
- an extreme weather centre should be considered
- standardisation of Bureau services across all jurisdictions was a priority (taking into account differing climate and hazard regimes to optimise current and future services in a sustainable approach).

Consistent with review recommendations to formalise service levels with emergency services agencies, the Australian Government agreed to standardise many bespoke services.

One of the issues highlighted in the review related to the issuing, interpretation and dissemination of flood warnings. The review identified a lack of clarity regarding roles and responsibilities, inconsistent arrangements across jurisdictions and the absence of binding agreements on service levels in relation to flood management. This situation had the potential to cause confusion and elevate the risk that not all communities would have access to the highest standard level of information.

Standardisation of forecast and warning services

The Bureau's weather, flood and ocean forecasting and warning services, as well as critical climate services, are essential to decision-making, especially for emergency management. Australia's states and territories have, historically, had different needs and governance structures for emergency management. The evolution of locally focused arrangements and models of operation had resulted in variations in the services provided by the Bureau. These variations led to increasing complexity in the delivery of services and were inhibiting its ability to effectively meet expectations and respond nationally to concurrent hazard events.

The taskforce recommended that the Bureau standardise its hazards services and allocated responsibilities across the Bureau, states, territories and local governments for flood management. The taskforce provided an implementation plan that was endorsed by the ANZEMC and the LCCSC. Additionally, the taskforce recommended a time-limited working group to focus on flood warning infrastructure and risk-based network planning.

The taskforce members from state and territory emergency services agencies were at the senior operational and policy levels (Deputy Commissioner, Chief Officer, CEO) as well as the CEO of AFAC and the Senior Policy Advisor of the Australian Local Government Association. The Australian Government was represented at Division Head level by the Bureau and Emergency Management Australia (part of the Attorney-General's Department at the time and now within the Department of Home Affairs). The taskforce members' roles and contributions to this work were critical and enabled an effective decision-making body for the standardisation to be overwhelmingly successful. The taskforce was very effectively supported by working groups of senior officers in all jurisdictions who specialised in fire, flood, extreme weather events and community understanding and response to warnings.

The taskforce was operational for 3 years and used face-to-face and video meetings as well as numerous working group meetings to examine the substantial jurisdictional variations in fire, flood and extreme weather services. The key achievements were:

- standardising 117 of the 129 (subsequently updated to 131) identified hazard services provided by the Bureau to states and territories
- agreeing roles and responsibilities for flood management, including ownership and maintenance of flood warning infrastructure
- producing an intergovernmental agreement under COAG on the 'Provision of Bureau of Meteorology Hazard Services to the States and Territories'
- establishing the Hazards Services Forum
- creating a services-focused National Flash Flood Information Repository
- establishing the National Flood Warning Infrastructure Working Group.

ANZEMC, and subsequently the LCCSC, agreed to all recommendations, including the intergovernmental agreement to provide the Bureau's hazard services to states and territories. Figure 1 shows the 9-year timeline (2009–18) of the major event triggers and the critical steps to establishing the intergovernmental agreement. These steps included the 2011 review, the Australian Government response and the ANZEMC Standardisation Taskforce Report in 2015 and the intergovernmental agreement in 2018.

A substantial action agenda was established to achieve the agreed standardisation of the 117 services. In accordance with the intergovernmental agreement, the ongoing Hazard Services Forum was established to:

- complete the remaining standardisation actions of the taskforce
- consult with state and territory emergency services agencies on current and future development of the Bureau's hazard services
- provide advice to the Bureau on the appropriateness and relative priority of requested changes to ensure its services meet the expectations of the national emergency services community
- consider the 12 services yet to be agreed for standardisation and to oversee the implementation of the 3 hazard-specific action plans for fire, flood and extreme weather.

Figure 1: The timeline of the major event triggers and the critical steps to establishing the intergovernmental agreement (2009–18).

Other hazard services that had not been agreed originally were addressed by the forum and by March 2019, forum members and specialised working groups had completed 98 of the 131 standardisation actions.

The National Flood Warning Infrastructure Working Group was very active and in 2019 met its 3 year timeline for completion of its work. The National Flash Flood Information Repository was developed by the Bureau in consultation with state and territory flood stakeholders.

The intergovernmental agreement

The intergovernmental agreement was endorsed by the ANZEMC and the LCCSC in 2015 and was agreed by COAG in 2017–18 after extensive consultation, over 2 years, between the Bureau (Canterford, personal communication) and all state and territory senior officials and emergency services ministers and federal ministers. The agreement sets the roles and responsibilities and implementation of standards for meteorological and hydrological services across governments in Australia. It also added clarity on agency responsibilities and roles within total warnings systems. Although this may have appeared to be a relatively simple problem to solve, over 100 years of Bureau operations, forecast and warnings services had grown organically to over 129 variations of services across the country. Additionally, products and outputs from emergency service agencies were at times divergent and the taskforce addressed many of those.

To illustrate, while the Bureau undertakes a national heatwave forecast service (www.bom.gov.au/australia/heatwave/) that provides maps (see Figure 2) of the next 5 3-day periods, which show the heatwave forecast areas and intensities, more 'detailed high-resolution advisory' services are undertaken in collaboration with jurisdictions. However, Figure 3 is an example of one of these bespoke extreme heat 'detailed high-resolution advisory' services, which was developed and used by South Australia from 2010 until 2019 to support all heatwave warnings within only one jurisdiction. Heatwaves are Australia's most deadly and costly disaster, and because of the non-standard approaches in each state and territory for detailed high-resolution advisories, work initiated by the Hazards Services Forum is currently being progressed by a time-limited National Heatwave Working Group. It was established by ANZEMC at the request of the forum to finalise a national heatwave warning framework to bring a consistent approach and consensus to heatwave public information and warnings in all Australian jurisdictions.

Other examples of jurisdictional variations and Bureau variations that have been addressed by the intergovernmental agreement and the forum include the resolution of variations of jurisdictional input to fire danger ratings, such as grassland curing and fuel mapping, cell-based thunderstorm warning services (now available in all capital cities) and major advances and standardisation of flood infrastructure and warning services.

Having so many unique services at the jurisdictional level created community misunderstanding and uncertainty and risk. These services were analysed in the categories of fire weather, flood services and extreme weather and hazard-impact services. The intergovernmental agreement established roles in the warning process, established over 100 agreed standards for services and created a governance framework centred around the Hazards Services Forum to oversee the agreement and ensure the completion of the harmonisation and standardisation of the over 100 services. This means that the forecasts and warnings are in the same form and provide the same detail no matter where the service is provided. The national arrangements are also more efficient in building new services on a national basis that is based on the latest technology and expertise, and communities will receive similar types of warning independent of where in the country they live. With workforces being more mobile in emergency services and populations continuing to move, such standardisation across jurisdictional boundaries simplifies community education and understanding of particular warnings.

However, the agreement recognises that jurisdictions do not always have uniform requirements for weather services and products. Queensland, for example, makes extensive use of tropical cyclone products, whereas Tasmania may rely heavily on frost warnings. When states or territories receive the same service, it is now delivered in accordance with an agreed standard. The agreement also identifies supplementary services that can be provided on a cost-recovered basis for specific demands.

Outcomes of the intergovernmental agreement

For fire weather services, as well as the Bureau progressing its own services, the Hazards Services Forum supported the AFAC Predictive Services Group to progress several fire weather service improvements. This was valuable and successful in agreeing common products across borders (firefighters need consistent national products for firefighting) and the Bureau improved its special fire weather forecasts. The main features of improvement were:

- hourly time steps
- spatial variation information
- forecast uncertainty information
- focus on wind changes.

A range of other fire weather services have also been standardised, developed and implemented across all jurisdictions, in partnership with emergency services agencies. These include improved fire weather danger indices and ratings.

Flooding in Australia causes significant direct and intangible costs. Floods have major financial and social impacts on individuals, communities and businesses (Department of Home Affairs 2018). The agreement formalises the responsibilities of the Bureau, state, territory and local governments for flood management. It also leads to increased cooperation among agencies for flood warnings and river gauge networks.

The intergovernmental agreement recognises the role of Flood Warning Consultative Committees in developing service-level

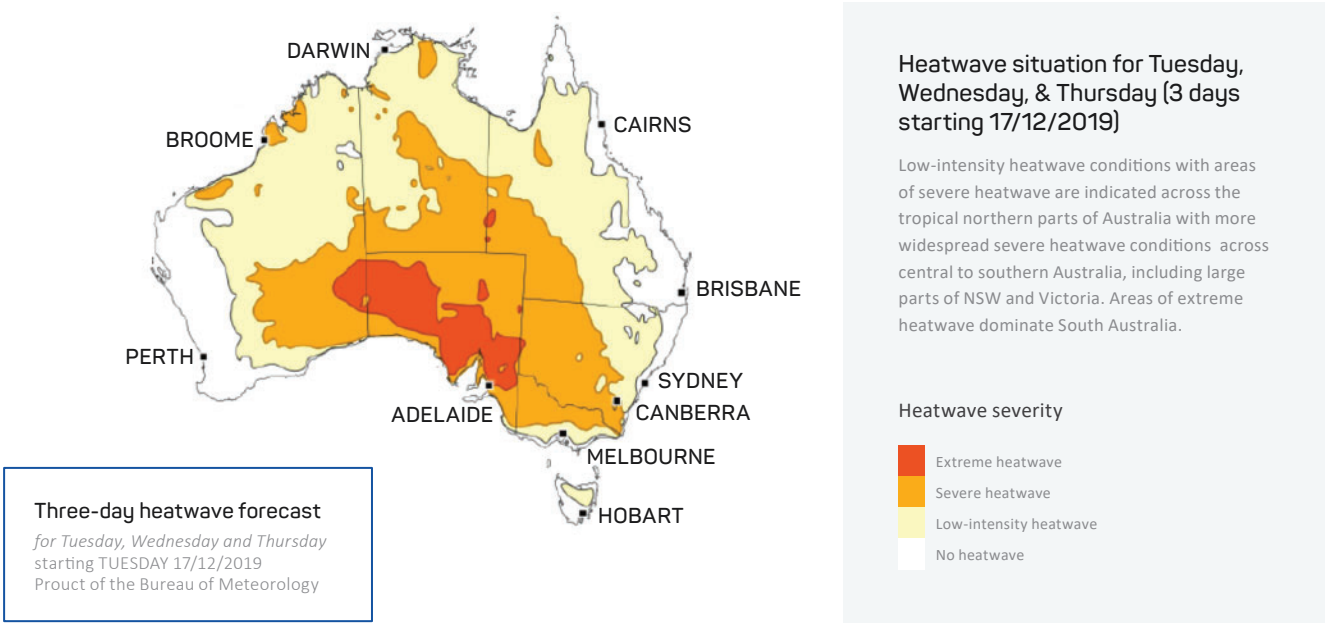
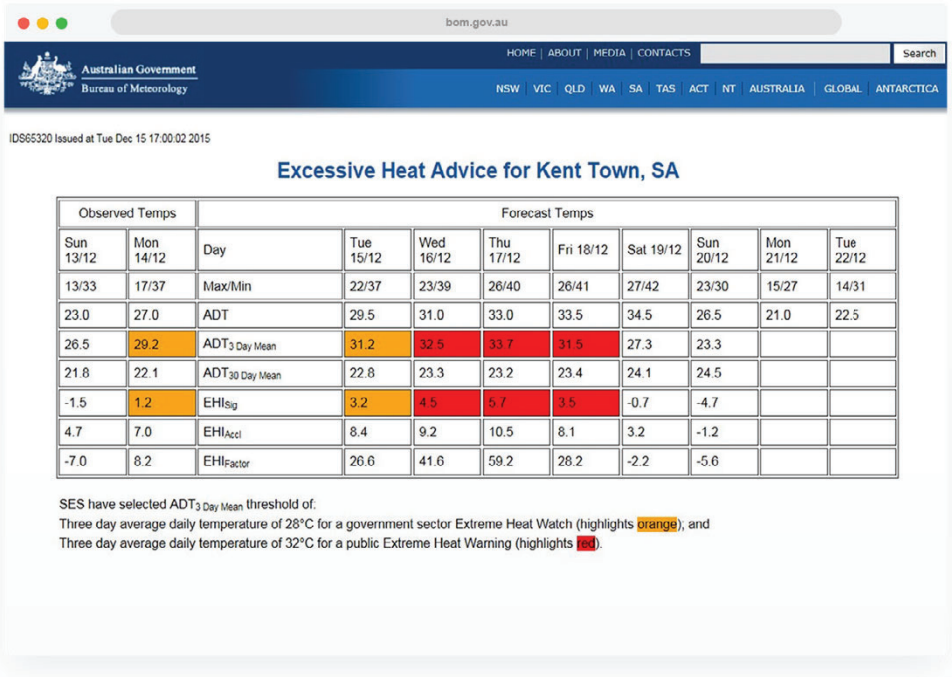


Figure 2: Output map from the Bureau of Meteorology National Three-Day Heatwave Forecast Service.
Source: www.bom.gov.au/australia/heatwave/



bom.gov.au

Australian Government
Bureau of Meteorology

HOME | ABOUT | MEDIA | CONTACTS | Search

NSW | VIC | QLD | WA | SA | TAS | ACT | NT | AUSTRALIA | GLOBAL | ANTARCTICA

IDS65320 Issued at Tue Dec 15 17:00:02 2015

Excessive Heat Advice for Kent Town, SA

Observed Temps		Forecast Temps								
Sun 13/12	Mon 14/12	Day	Tue 15/12	Wed 16/12	Thu 17/12	Fri 18/12	Sat 19/12	Sun 20/12	Mon 21/12	Tue 22/12
13/33	17/37	Max/Min	22/37	23/39	26/40	26/41	27/42	23/30	15/27	14/31
23.0	27.0	ADT	29.5	31.0	33.0	33.5	34.5	26.5	21.0	22.5
26.5	29.2	$ADT_{3\ Day\ Mean}$	31.2	32.5	33.7	31.5	27.3	23.3		
21.8	22.1	$ADT_{30\ Day\ Mean}$	22.8	23.3	23.2	23.4	24.1	24.5		
-1.5	1.2	EHI_{Sig}	3.2	4.5	5.7	3.5	-0.7	-4.7		
4.7	7.0	EHI_{Accl}	8.4	9.2	10.5	8.1	3.2	-1.2		
-7.0	8.2	EHI_{Factor}	26.6	41.6	59.2	28.2	-2.2	-5.6		

SES have selected $ADT_{3\ Day\ Mean}$ threshold of:
Three day average daily temperature of 28°C for a government sector Extreme Heat Watch (highlights orange); and
Three day average daily temperature of 32°C for a public Extreme Heat Warning (highlights red).

Figure 3: Example of a bespoke heatwave warning service developed for South Australia.

specifications and describes the responsibilities of all parties for flood arrangements, including riverine and flash flooding.

The National Flood Warning Infrastructure Working Group undertook an extensive investigation of networks and has detailed the gaps and variable processes across the nation. This work showed that further national leadership is necessary to ensure effective sustainable investment at all levels of government. The group's report provides recommendations on what is required to achieve effective uplift of networks, their maintenance and where investment is best targeted. All states and territories and the Bureau have undertaken considerable analysis of their networks as a pathway for this national network uplift.

Another major achievement of the National Flood Warning Infrastructure Working is a national technical performance standard for flood forecasting and warning and an agreed path to consistently improve networks across all jurisdictions, including those of the Bureau.

The Bureau's flood services have also been enhanced by a flash flood information portal requested by all jurisdictions. The National Flash Flood Information Repository, renamed the Flash Flood Advisory Resource (FLARE) (Bureau of Meteorology 2020), was initially funded by the Disaster Resilience Australia Package and supported further by the Bureau. Since its launch, over 50 activities were completed in all states and territories. In 2018, the number of registered FLARE users had increased by 150 per cent (86 to 207) and the number of registered organisations increased by 100 per cent (42 to 86). Consultants have access to the repository and FLARE services are managed by the Bureau's flood services teams.

For extreme weather and high-impact services, all 48 jurisdictional variations of services were agreed to be standardised. Achievements include thunderstorm warnings that provide a threat of severe thunderstorms and graphical content, and tsunami threat bulletins and warnings that are consistent.

Other services that have been standardised include coastal wind warnings, hazardous surf warnings, ocean wind warnings, extreme heat advice, pre-season briefings and tropical cyclone services, including updated frequencies and bulletins.

Conclusions

Through a review of Bureau services and an intergovernmental agreement, Australia now experiences improved standardised services and a higher level of cooperation and collaboration in forecasting and warnings and in preparing for and responding to disasters. The major outcomes of this collaborative approach with the Bureau are due to the level of attention and understanding provided by emergency services commissioners and chief officers, together with Emergency Management Australia, AFAC and ALGA.

This work, initiated to harmonise and standardise, has resulted in benefits and services across Australia. It has improved Bureau services and collaboration with emergency agencies, provided a high-level national forum to maintain standards and incorporate new services, established a new flash flood information portal and enabled advanced flood planning and standardisation of risk-based national networks, instruments and infrastructure.

Acknowledgments

The dedication and vision of the taskforce senior emergency experts from all jurisdictions and many Bureau of Meteorology specialists who contributed over several years is acknowledged, particularly, Shoni Maguire, Bureau of Meteorology for his essential support, Stewart Ellis, AM, CEO of AFAC and his AFAC colleagues as well as Robert Cameron, OAM, retired Director-General Emergency Management Australia for his support and co-chairing of the Hazards Services Forum. Additionally, the lead author acknowledges the current Bureau leadership for their continuing support of the intergovernmental agreement and advancement of its outcomes in partnership with state and territory emergency services agencies, EMA and AFAC. The authors also acknowledge the invaluable review and editing by Christine Belcher. The author may be contacted at Ray.Canterford@icloud.com.

References

Australian Institute for Disaster Resilience 2021, *Australian Warning System. At: https://knowledge.aidr.org.au/resources/australian-warning-system.*

Australia-New Zealand Emergency Management Committee (ANZEMC) 2020, *Australia-New Zealand Emergency Management Committee. At: www.homeaffairs.gov.au/help-and-support/how-to-engage-us/committees-and-fora/australia-new-zealand-emergency-management-committee.*

Bureau of Meteorology 2013, *Australian Government Response to the review of the Bureau of Meteorology's capacity to respond to future extreme weather and national disaster events and to provide seasonal forecasting services, Australian Government.At: www.bom.gov.au/governmentresponse/doc/munro-review.pdf.*

Bureau of Meteorology 2020, *Annual Report 2019–20. At: www.transparency.gov.au/annual-reports/bureau-meteorology/reporting-year/2019-20.*

Bureau of Meteorology 2020, *FLARE – Flash Flood Advisory Resource. At: www.bom.gov.au/australia/flood/flashfloodadvisoryresource/.*

Council of Australian Governments 2018, *Intergovernmental Agreement on the Provision of Bureau of Meteorology Hazard Services to the States and Territories, 22 January 2018 update. At: www.coag.gov.au/about-coag/agreements/intergovernmental-agreement-provision-bureau-meteorology-hazard-services-0.*

Department of Home Affairs 2018, *National Disaster Risk Reduction Framework, At: www.homeaffairs.gov.au/emergency/files/national-disaster-risk-reduction-framework.pdf.*