The atmosphere is warming



Where does the excess heat go?



The ocean is warming





Changes faster than predicted



Human activities making it warmer



The Angry Summer – heatwaves



- Severe heatwave across 70% of Australia late Dec 2012 /early Jan 2013. Temperature records set in every state and territory
- Hottest ever area-averaged Australian maximum temperature, 7 January 2013: 40.30 C
- Hottest month on record for Australia January 2013
- All-time high maximum temperatures at 44 weather stations
- Average daily maximum temperature for the whole of Australia was over 39 C for seven consecutive days (2-8 January)

Heatwaves





Commonwealth of Australia 2013, Australian Bureau of Meteorology ID code: IGMapAWAPDailyTemps

Melbourne 2009 heatwave



We are living in a new climate



Influence of warming on the water cycle



Consequences of sea-level rise











Increased risk of coastal flooding with sea-level rise of 0.5 m



Influence of sea-level on coastal flooding



www.climatecommission.gov.au

Heavy rainfall and flooding





Queensland 2010/11 floods



- December 2010 was Queensland's wettest December on record
- Floods broke river height records at over 100 observation stations
- 78% of the state was declared a disaster zone
- Economic cost estimated to be in excess of \$5 billion
- 300,000 homes and businesses lost power in Brisbane and Ipswich

Fire Weather Index, 8 Jan 2013



Bushfires and Climate Change

- Climate change exacerbates bushfire conditions by increasing the frequency of very hot days.
- Between 1973 and 2010 the Forest Fire Danger Index increased significantly at 16 of 38 weather stations across Australia, mostly in the southeast. None of the stations showed a significant decrease.
- Projected increases in hot days across Australia, and in dry conditions in the southwest and southeast, will very likely lead to more days with extreme fire danger in those regions.





Source: BoM, 2013c

www.climatecommission.gov.au

Coral reef states under increasing CO₂ and T



Source: modified from Hoegh-Guldberg et al., 2007

www.climatecommission.gov.au

The carbon maths: future pathways



Overspend in the carbon budget

For a 75% chance of meeting the 2° C limit we can emit no more than 1,000 billion tonnes of CO₂ between 2000 and 2050.

CO2	CO ₂				CO2	CO ₂	CO ₂		CO ₂
CO2		CO2			CO ₂	CO ₂			
CO ₂						CO ₂			
In the years	first we ha	13 ave				CO ₂			
emitteo 40%	d <mark>nea</mark> of ou	rly r		CO2					
carbon	budg	jet.	~~~	00	<u> </u>	00	00	00	
CO2			CO2	LU ₂	CO ₂	So	, we l	nave	CO2
CO ₂		CO ₂	CO2			only carb	7 60% on bu	o of ou dget t	r 00 0 2
					CO ₂	CO ₂ 3	7 yea	ars. ₂	CO2
CO ₂					CO ₂				

If we continue to spend our allowable emissions at our current rate, we will use up all of our allowable emissions by 2028. After the budget is completely spent, the world's economy will need to be completely decarbonised.

The fossil fuel equation



- The remaining global budget for CO₂ emissions from fossil fuel combustion is about 600 billion tonnes if we are to stay within the 2°C limit.
- The world's indicated fossil fuel reserves (coal, oil and gas), if all were burnt, would emit nearly 3,000 billion tonnes of CO₂ (IEA, 2012).
- This means that we can burn only about 20% of the world's known fossil fuel reserves. Most will have to stay in the ground.
- Australia's coal reserves represent about 51 billion tonnes of CO₂ emissions, about one twelfth of the world's allowable budget.





- The evidence for climate change is overwhelming and clear. It is beyond reasonable doubt that the burning of fossil fuels is the primary cause.
- We are already seeing the social, economic and environmental impacts of a changing climate, especially extreme events. The risks rise as climate shifts further.
- To stabilise the climate at a manageable level, most of the world's fossil fuel reserves must stay in the ground.
- This is the critical decade. Decisions we make from now to 2020 will determine the severity of climate change our children and grandchildren experience.