Regional water strategies
Use of new climate data

Frequently asked questions

July 2020

Use of new climate data in the regional water strategies

On the development of new data

As part of the development of the regional water strategies, new, state-of-the-art climate data has been prepared to give an improved understanding of climate variability and change. The NSW Government has invested heavily in the preparation of this data across regional NSW to give us a much better understanding of the likelihood of droughts and floods than we have ever had available to us before.

In the past, regional water management decisions have been based on 130 years of climatic data. This means that many of the planning decisions are made around a small number of historic droughts. Recent conditions in many parts of the state have been more severe than anything seen in these climate records. This has meant that our towns and high-security needs have been at risk.

The new data brings together information from:

- the recorded data
- paleoclimate records (which is information before historical records began) such as tree rings, ice cores and limestone deposits.

Combined with an understanding of the drivers of climate in NSW, this data will give us the ability to understand the level of risk to our towns and high-security users better than previously possible.

The new data also gives us the opportunity to understand the potential effects of human-induced climate change on our water resources.

Why have we used the driest climate change scenario?

The new climate data gives us two datasets to improve our understanding of risk. The first is a generated 10,000-year record of streamflows derived from statistical analysis of our recorded climate and paleoclimate. This gives us a long-term understanding of streamflow behaviour under present-day climate conditions. The second dataset builds on this information, but introduces the potential effects of human-induced climate change on our streamflows.

There is still a degree of uncertainty when forecasting future climate change rainfall forecasts, and there are several models that give a range of future climate outcomes.

For the purpose of the draft strategies, we have chosen one of the driest future scenarios. Choosing the driest scenario gives us an idea of what the most extreme risks could look like and will help us stress-test the resilience of any identified options.

These driest, worst-case scenarios will not necessarily eventuate. There is a small probability that some of the extreme scenarios will occur. But they give us an opportunity to begin planning for what we may need to do to protect water for critical human needs.

What can this new data be used for?

The new climate data has been developed to be used in river system models to compare the outcomes of policy, planning or infrastructure options. It can help us understand how effective a particular pipe, or dam or rule option will be in extreme scenarios relative to other options.

It is possible that the new climate data may be used for other purposes. For instance, the Department of Planning, Industry and Environment is reviewing the useability of this new data within the existing guidelines for town water security assessments under the Safe and Secure Water Program.

What are the advantages and risks associated with using this data?

The new climate data gives us a much better understanding of the likelihood of extreme events such as drought occurring than has been available previously.

Modelling is a useful tool, but it is not a firm prediction of the future. In reality, if we experience extreme droughts, we will operate the system to prolong the availability of water for critical human needs.

We have had this new climate data method peer-reviewed by an independent panel of climate scientists, who found it was fit for purpose, and consistent with best practice. However, we need to explain how this science was developed, and how it can be used. We cannot make rushed decisions about how to use this information without a detailed and transparent conversation with the community. That takes time.

We still need to recognise that there is a very small risk of droughts and floods occurring that are more severe than the most severe events seen in the modelled information. For this reason, we need to move to managing the risks of these events, rather than managing to one event, as has been done in the past. We need to begin our planning so we can be as prepared and resilient as possible for the next record-breaking drought.

Why are you not including this data in water sharing plans now?

Water sharing plans set out the rules for managing the allocation of water to different classes of users.

Within regulated rivers, the plans make decisions on allocations based on the worst drought on record, at the time the first plan was made. In a number of valleys, recent conditions have seen droughts significantly worse than the drought on which this planning is based.

A recent private members' Bill has sought to amend these rules to recognise the more recent worst drought in the plans. The NSW Government does not support making this unilateral change without a full understanding of the level of impact on all classes of water users.

In 2014, the Government decided against becoming more conservative when making allocations and locked in the allocation risk as that taken at the commencement of the first water sharing plans rather than moving to a new drought of record. This was viewed as the appropriate balance between productive use of water and drought security. It concluded that alternative drought contingency measures including subsidies, and infrastructure to secure town water, were preferable to setting water aside in reserves.

This followed an assessment of the impact of changing the drought of record after the Millennium drought. The Lachlan Valley was used as a case study. The modelling indicated that using the Millennium drought as the drought of record would require a significant increase in storage reserves to continue to guarantee high priority licences and demands. This in turn would significantly reduce the water allocations for general security licences in all years.

Any change in the allocation framework needs to be carefully analysed, and both technical and policy aspects considered. This will need to be a detailed, nuanced and transparent discussion with potentially affected stakeholders and the broader community. Complex issues of risk appetite and risk sharing need to be explored.

This discussion will be conducted in the development of NSW's Regional Water Strategies. The Regional Water Strategies will include more detailed analysis of drought and water security risks, and include modelling to examine the severity and duration of drought beyond the current period of record.

This new analysis will allow us to move away from making our planning decisions based on one "drought of record", and towards a risk-based decision framework for the allocation of water.

The Regional Water Strategies will consider community views and hydrologic data to ensure a transparent, measured and pragmatic approach to setting future water allocation rules is adopted.

This will help to balance regional economic outcomes against future water supply security. Carrying out the allocation policy positions set through the Regional Water Strategies may require changes to water sharing plans. Community consultation will be completed on the strategies before any final decisions are made.

Water sharing plans can be amended at any time if it is in the public interest to do so, not just at their 10 year remake. This will happen as part of the implementation phase of approved regional water strategies, not just in response to any agreed changes to our approach to allocating water, but also as any new approved infrastructure comes on line.

This new data will allow us to review the management decisions about water allocations in a way that provides a fuller understanding of the level of risk faced by different water users under current arrangements, and whether changes to the rules are warranted.

The new climate data is cutting-edge science. It is being developed as we speak. And we are publishing the data as we receive it to be as transparent as possible and to begin the conversation about how we can use this data. We did not have access to this data before the last drought.

This government is committed to undertaking this review of allocation rules as part of the Water Strategies Program and considering how to use this data to develop a new method for calculating the allocations. However, this will take time, and significant community input about the level of risk for different categories of users. We want to understand the effects this could have on all parts of the community and the environment—we don't want to rush and create new rules that could have unintended consequences.

Will this mean that government will further reduce my licence reliability?

Our new climate modelling results indicate that, with climate change, there may be more times when the amount of water we currently have available to share cannot meet all of the needs of water users. This new data provides us with the tools to better understand our risk than we have been able to previously. We can then use this information to plan for such times by considering alternative water supplies, changing how we use water, or looking at different ways of sharing the available water. This is a key purpose of the regional water strategies.

Why do we need new climate data; can't we just use our historical measured data?

Our observed climate information (especially rainfall and temperature) has only been measured for about 130 years. Over this time, we have seen some droughts and wet periods. But those observations don't tell us about all of the possible droughts or wet periods that we could experience in the future, only those that have happened in those 130 years.

Our new method adds 500 to 1,000 years of climate history to our knowledge by analysing things such as tree rings, river sediments and ice cores that have spent a long time in our landscape and carry tell-tale marks of significant climate events This gives us a much better idea of possible climate patterns and variability in the future.

We also need to take account of possible changes to our historical climate patterns—even 500 years' worth—due to climate change. The new method includes global and regional climate change projections.

Why do we need to consider climate change in our strategies?

Our regional water strategies firstly need to consider our knowledge of historical climate variability and what drives different patterns of variability. But under a changing climate, some of the drivers of our climate variability are changing and we need to also consider the influence and risks of such changes to our water availability.

The challenge in responding to climate change is that there are still uncertainties about how quickly changes will happen or what our responses might be to reduce the negative effects of any changes.

We need to understand how climate change might influence the risks to our water security and water availability in the future. We use the data from global and regional climate models to stress-test our water systems to see how they might be affected. We want to know the areas that could be the most vulnerable to climate change so we can focus on ensuring their future water security.

Does the new method mean we will run out of water sooner?

No, the new method only tells us what might happen under different scenarios of climate risk. This varies across different regions of NSW. Having this information provides us with a better understanding of the risks to water availability, allowing us to plan how we might overcome these challenges.

More work is required to apply the new climate data to our understanding of groundwater systems to determine how secure groundwater supplies will be in the future.

Our new method indicates that under the future climate change scenario, the runoff that comes from rainfall and fills the dams may not happen as often, or we may not see the same amount of runoff as we currently do. Understanding this now means we can plan to deal with these situations should they eventuate. This might mean looking for alternative water supplies, changing how we use water, or looking at different ways of sharing the available water.

Why do we need models to understand our water security?

Models are tools that we use to understand complex systems. We can use them to simulate many different scenarios of climate risk and see possible outcomes rapidly.

Models are very useful for understanding huge amounts of data across long periods of time or for large areas. They can be tailored to specific NSW regions to give more detailed and relevant data.

But to be effective, models first need to be carefully set up and tested to check how good they are at predicting the measured data we already know (that is, 130 years of observed climate and 500 years of paleoclimate). We can then use them for forecasting the future climates we don't know, including understanding long-term changes, or different scenarios of change.

What are global climate models?

Global climate models (GCMs) seek to represent the different physical processes of weather and climate. Building and running a climate model means representing physical processes using complex mathematical equations. Variables are then set to represent initial conditions and subsequent changes in climate. Powerful supercomputers then repeatedly solve the equations.

We can tell how good a GCM might be by seeing how well it describes historical and current weather and climate. They have proven to be effective at predicting temperature, and therefore evaporation, but there is much more uncertainty in predicting rainfall.

Global climate models predict the whole world, which means their predictions for regional and local climate is less precise. We use regional climate models to provide more detailed estimates of rainfall over different regions of NSW.

How sure are you of the results of climate models: GCMs and regional ones?

The global and regional climate models produce projections of what may happen in the future under a number of different scenarios. They cannot predict exactly what will happen.

We look at the results from a range of independent GCM models to understand what each one means for how our current climate may change. We use the models that provide the best estimates (based on how well they simulate current climate) for different areas of NSW.

We apply how much we know about how climate varies across different parts of NSW to refine global climate data to use with regional climate models.

The global and regional models don't give us one answer. Instead, they give us predictions that we can use to explore the range of changes likely to happen in the future. We are not 'sure' of any of the predictions, but they do give us the best guide we have for future climate risk.

How certain are you of the projections of the new method?

The new method for generating climate data provides us with a much better understanding of the range of climate patterns we are likely to see in the future. This means we are better able to understand our future climate risks and what that means for NSW's water security.

The new method's projections give us a clearer and more accurate understanding of the full range of possibilities of how the climate may vary and change in the future. It gives us more confidence in considering future climate risks to NSW's water security compared to only considering 130 years of climate records. In particular, we now have a better understanding of the probability of future extremes of droughts and floods.

With the new method, we can now base our regional water strategies on more comprehensive knowledge about the likely climate risks to our water resources.

However, this new method does not 'predict' the future. We can use the projections in this new method to begin planning for extreme events, knowing that there is a probability they may not eventuate.

What is paleoclimate?

Paleoclimate is an estimate of what the climate was like before recorded measurements of climate were taken. To go beyond our 130 years of climate records and build a paleoclimate record,

scientists investigate things that have spent a long time in our landscape: tree rings, cave stalactites and stalagmites, river sediments, soil patterns, and ice cores.

Paleoclimate scientists study these items to find out responses to past climate, such as increased tree ring growth during wetter periods; or for ice cores, different concentrations of sea salt depending on whether it was drier or wetter. Ice cores are usually obtained from areas on and around Antarctica, where research has shown strong relationships between Australia's past climates and different characteristics of the ice.

Using paleoclimate research, we can extend our historical climate records to over 500 years. We can then research the climate patterns over a much longer time period and investigate what may have caused these patterns. This helps us to better under possible future climate variability.

How sure are you of the accuracy of the paleoclimate records?

The paleoclimate records are used to help us understand patterns of past climate. For example, we can find out how long a drought has lasted in the past, and how often droughts occurred. We can look at the past climate from several hundred years ago to 1,000 years ago.

Researchers can then use paleoclimate records to see what it would might mean if our 130 years of recorded climate varied in the same way as patterns in the past.

Paleoclimate records are based on what we see between the landscape characteristics (for example, tree rings, ice cores, river sediments) and climate. They are not perfect, but the relationships used in the new method are the ones that we know are strong and relevant for NSW.

How can data found in ice cores in Antarctica tell us anything about climate in NSW?

Many ice cores have been taken and studied from an area of ice in Antarctica called the Law Dome Ice Sheet. It is around 200 km across and more than 1 km deep. Research has shown strong relationships between Australia's past climates and different characteristics of this ice. Researchers measure the carbon dioxide and sea salt that is trapped and preserved within the ice.

Recent studies have shown that the Interdecadal Pacific Oscillation (IPO) has a strong influence on NSW's climate. IPO describes swings in climate over a decade or more. During 'negative phases' of the IPO, the eastern Pacific Ocean tends to be cooler and wetter than average. During positive phases, the same regions tend to be warmer and dryer. The IPO influences the frequency of El Niño and La Niña events, and how severe they are.

A number of scientific studies have shown that IPO also influences how much salt from sea spray is trapped in the ice. The ice cores provide a 'lens' in time where we can look back at how the sea salt concentrations varied over hundreds of years. This tells us how many time IPO cycles happened in Antarctica's distant past. This matches IPO cycles in Australia, meaning we can then use the ice cores to tell us how climate patterns varied over NSW over the past 200 to 1,000 years.

Could this new data affect the market value of my licence.

We have developed two separate 10 000 year datasets to better understand the climate risks associated with managing our water resource. The first of these provides us with an understanding of the behaviour of our river systems under current climatic conditions. The second dataset provides us with an understanding of the behaviour of our river systems under a future climate change scenario.

It is important to realise that our modelling of current climatic conditions indicates that on average, there will be little overall change (compared with our understanding from historical climate records alone) to times when water availability will be limited, although there are longer periods of drought in the 10 000 year dataset than we have seen in our historic 130 year climate record..

The data which shows a significant impact on the reliability of licences is based on modelling of a dry future scenario. We have chosen this scenario to understand the most extreme risks. This future climate scenario is not expected to eventuate for at least 40 years. It will not happen immediately. This new data provides information on the possible impacts of climate change on water availability which we have not had available to us previously. We can use this information to start a discussion on how we are going to prepare for a potentially drying future as part of the regional water strategy. This discussion will guide what changes we need to make to our policy, planning and infrastructure now and in the next 20 years.

Could this new data affect the market value of my account water.

The market value of account water is primarily determined by scarcity of the resource. In current circumstances, with reduced or zero allocations in place across much of the state, the value of water is at a premium. During wetter times, the market value of account water decreases. We will continue to have wet and dry periods in the future. It is not expected that this new data will impact on the market value of account water.