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# Australia's Environment

## *Account-ready Earth observation data?*

Albert van Dijk

Canberra, 10 May 2018

Centre for Water and Landscape Dynamics
Fenner School of Environment & Society
The Australian National University

# About "Australia's Environment"

www.ausenv.online/2017

- An annual summary of environmental conditions in Australia
- Summarises large amounts of data from various sources you may not be aware of, or cannot examine yourself
- Includes many openly shared data sources, and additional integrative analysis using ANU's model-data fusion system (OzWALD)
- Largely to limited to data sources that can tell us something about the previous year – so not complete
- Developed to discover if, among others:
  - environmental accounts can be usefully populated
  - State-of-Environment reporting can be partly automated and done annually
  - web-based environmental information can meet other information requirements (condition reporting, public debate, research, education, industry)
- Collaborative effort : NCI, TERN, IMOS, ALA, CSIRO, GA, and various others

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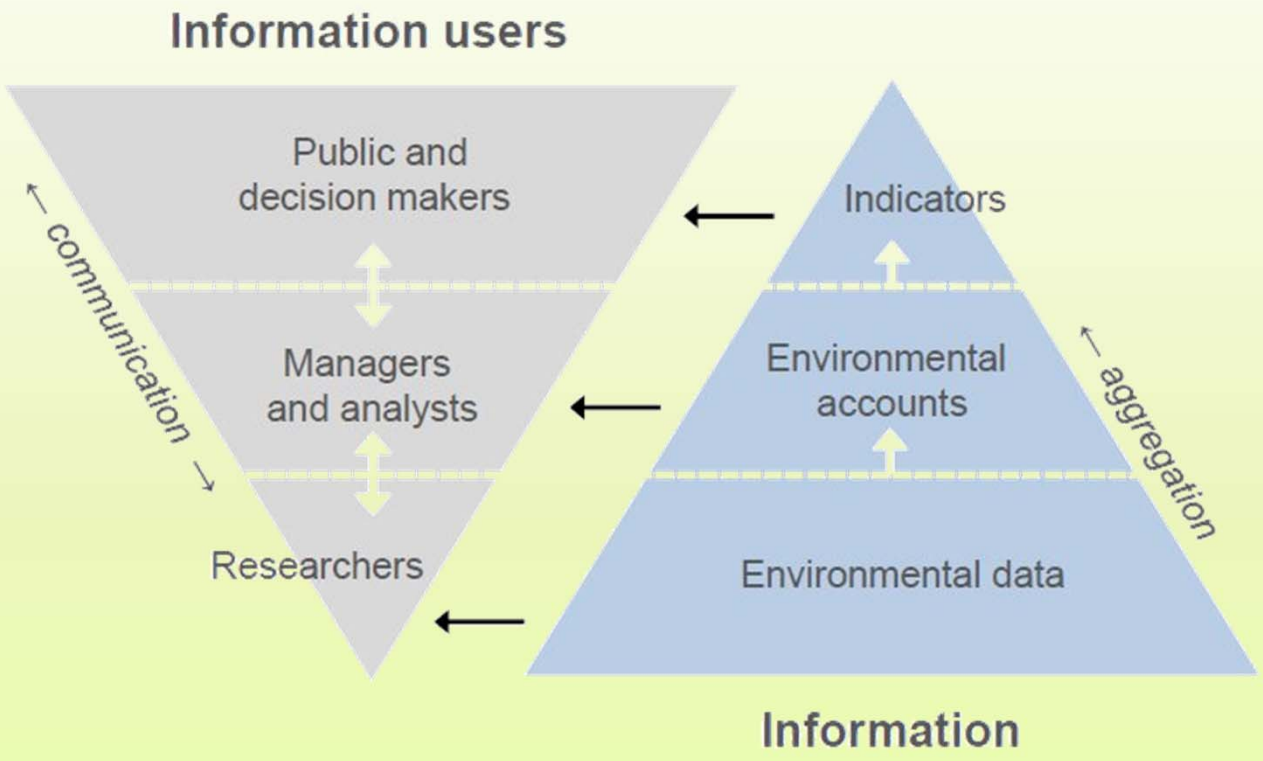
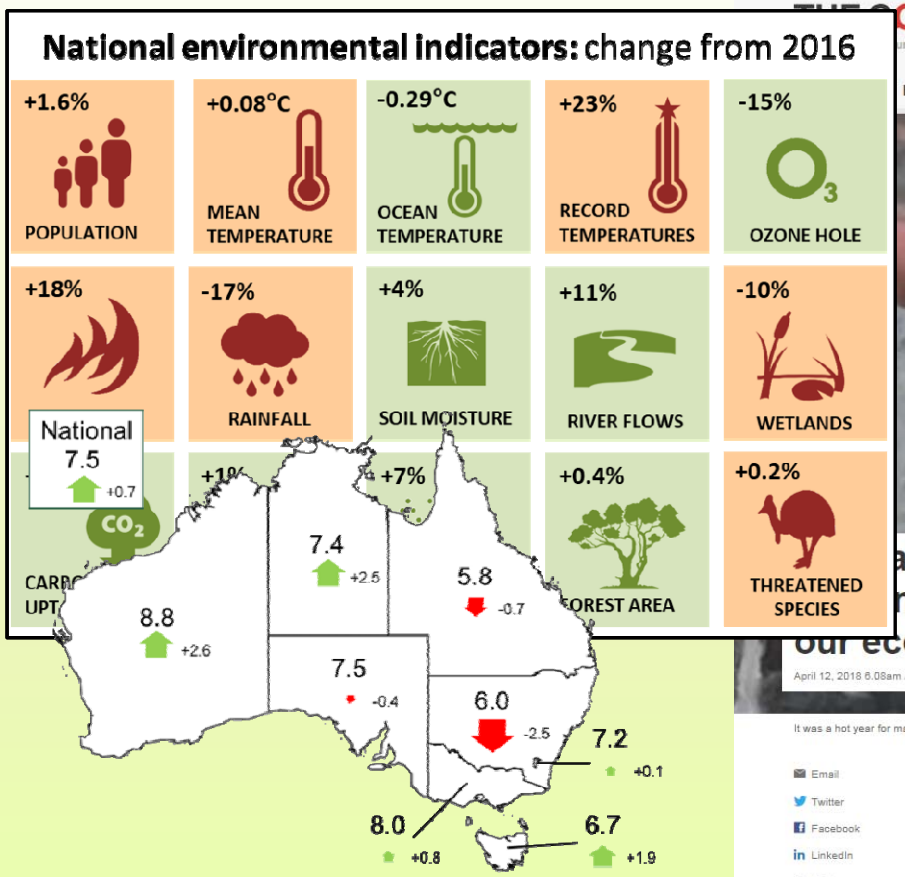
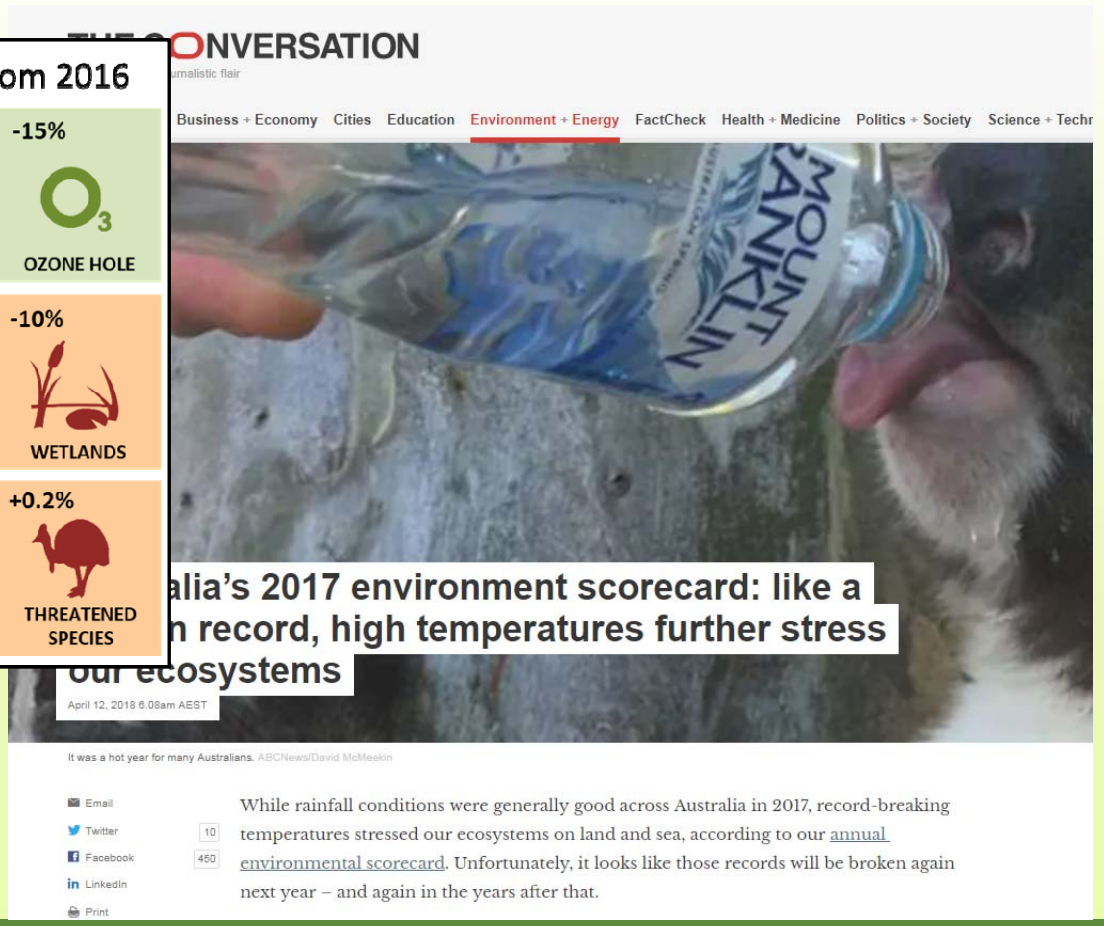
# The information pyramid




National environmental indicators: change from 2016
+1.6%
POPULATION
+0.08°C
MEAN TEMPERATURE
-0.29°C
OCEAN TEMPERATURE
+23%
RECORD TEMPERATURES
-15%
$O_3$
OZONE HOLE
+18%
-17%
RAINFALL
+4%
SOIL MOISTURE
+11%
RIVER FLOWS
-10%
WETLANDS
National 7.5 +0.7
$CO_2$
+7%
+0.4%
+0.2%
THREATENED SPECIES
7.4 +2.5
5.8 -0.7
8.8 +2.6
7.5 -0.4
6.0 -2.5
7.2 +0.1
8.0 +0.8
6.7 +1.9


NVERSATION
Business + Economy
Cities
Education
Environment + Energy
FactCheck
Health + Medicine
Politics + Society
Science + Techr
alia's 2017 environment scorecard: like a
n record, high temperatures further stress
our ecosystems
April 12, 2018 6.08am AEST
It was a hot year for many Australians. ABC News/David McMeekin
Email
Twitter 10
Facebook 450
LinkedIn
Print
While rainfall conditions were generally good across Australia in 2017, record-breaking temperatures stressed our ecosystems on land and sea, according to our annual environmental scorecard. Unfortunately, it looks like those records will be broken again next year – and again in the years after that.

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# **For more background** - Briefing, Fact Sheet

## Australia's Environment in 2017

While rainfall conditions were generally good across Australia in 2017, high temperatures stressed our terrestrial and marine ecosystems. This fact sheet summarises indicators of Australia's environment. Full details are available on the website (*www.ausenv.online/2017*)

### Global context

- The ozone hole was the smallest since 1988, responding to global reductions in halocarbon gases (NASA).
- Atmospheric $CO^2$ concentrations increased by 1.95 ppm to reach 407 ppm; a 28% increase from 1960 (NOAA).
- Global average temperatures were the second highest in the historical record (WMO).
- Sea ice extent was the least since measurements started in 1979 (NSIDC).

### Oceans

- Global ocean temperature reached the highest level on record (IAP).
- After stagnating in 2016, global sea level rose by 6.4 mm - twice the average rate since 1993 (NASA).
- Although average sea surface temperature (SST) around Australia was the lowest since 2012, record high temperatures occurred off the East Coast during several months (NOAA/BoM).
- After 2016, another mass bleaching occurred in the Great Barrier Reef, which was also impacted in direct and indirect ways by cyclone Debbie (GBRMPA).

### Weather

- Australian average temperature was the 3rd highest, and mean maximum temperature the 2nd highest on record (BoM).
- Mean maximum winter temperature was the highest on record (BoM).
- NSW and Qld experienced record mean and maximum temperatures (BoM).
- Largest number of temperature records broken since 2009 – mostly in the Eastern states in February and September (BoM).



*Average number of maximum temperature records*

- Cyclone Debbie and associated flooding in March was the most deadly and expensive since cyclone Tracy in 1974.
- National average rainfall was 7% above the long-term average, but less than 2016 rainfall.
- Rainfall was above average in WA but below average in the Eastern states.

### Soil Moisture

- Soil moisture status in the top 6m improved further across most of Australia, and in parts of WA and SA reached the highest values since at least 1999.
- Soil moisture declined to average or below-average levels in parts of interior Queensland and NSW and Eastern Victoria.

### Rivers and Wetlands

- Total runoff into waterways was greater in 2017 than in 2016, mainly due to wetter conditions in the Top End.
- Major flood events occurred in several inland drainage systems in WA in January and February,

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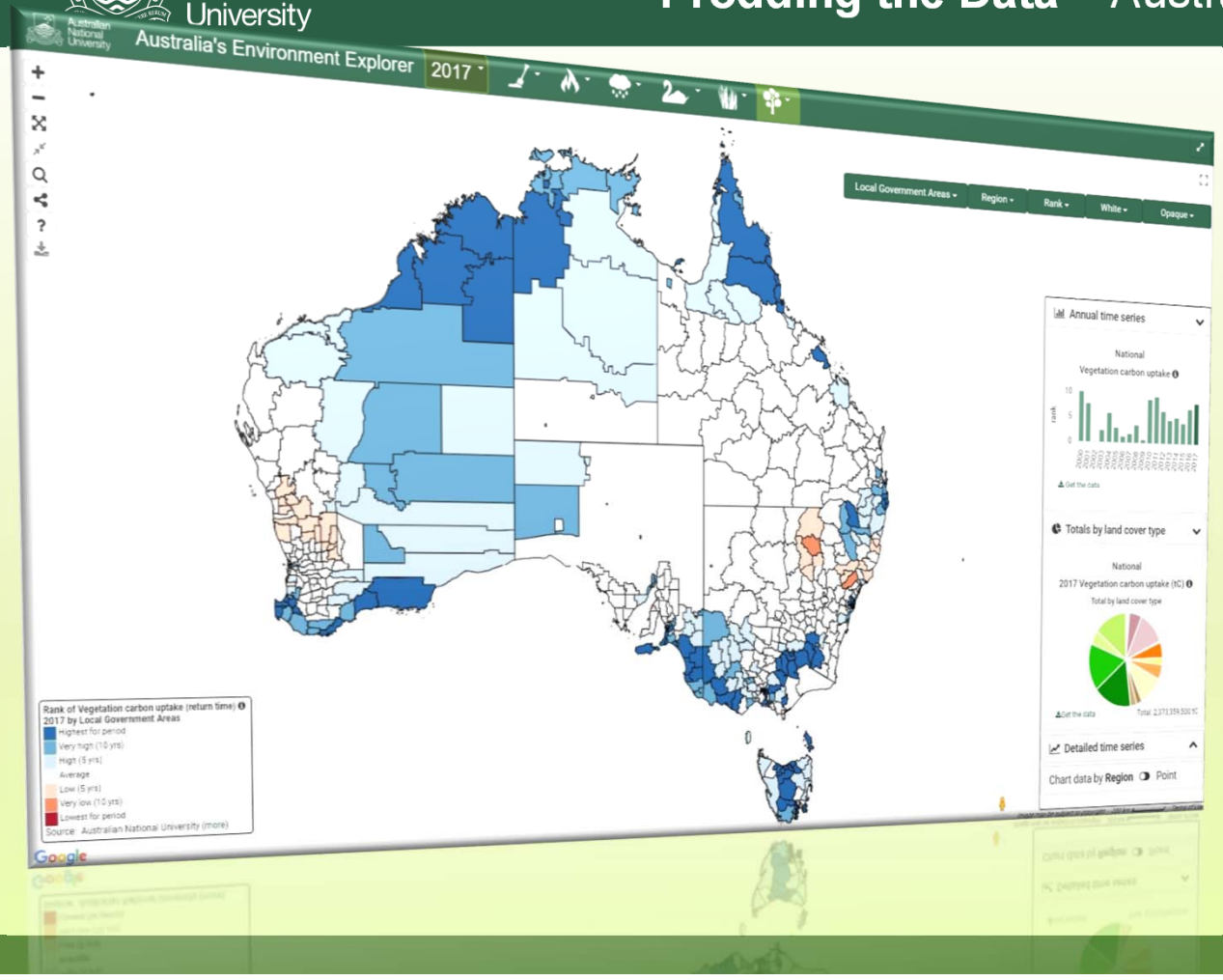
# **Prodding the Data** - Australia's Environment Explorer




**www.ausenv.online**

- Land cover change
- Bushfire
- Water availability
- Rivers and wetlands
- Landscape condition
- Carbon storage

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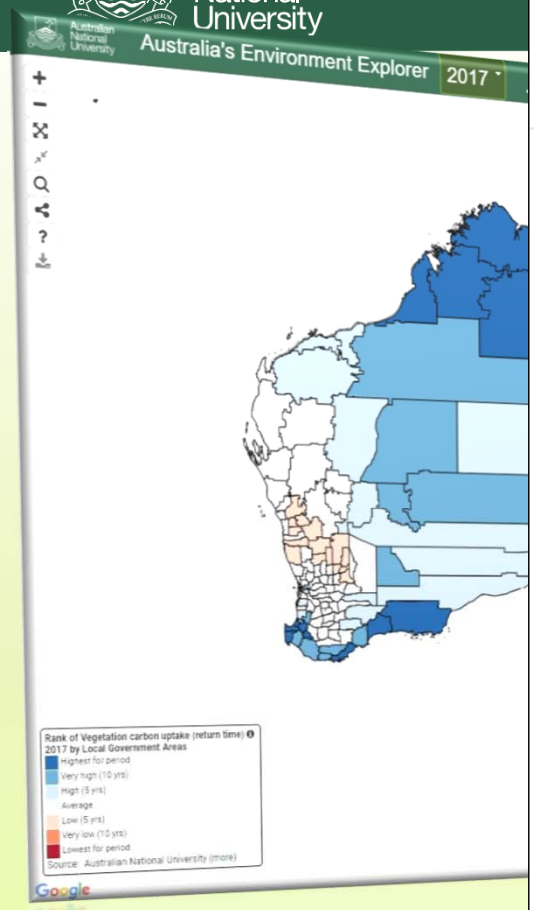
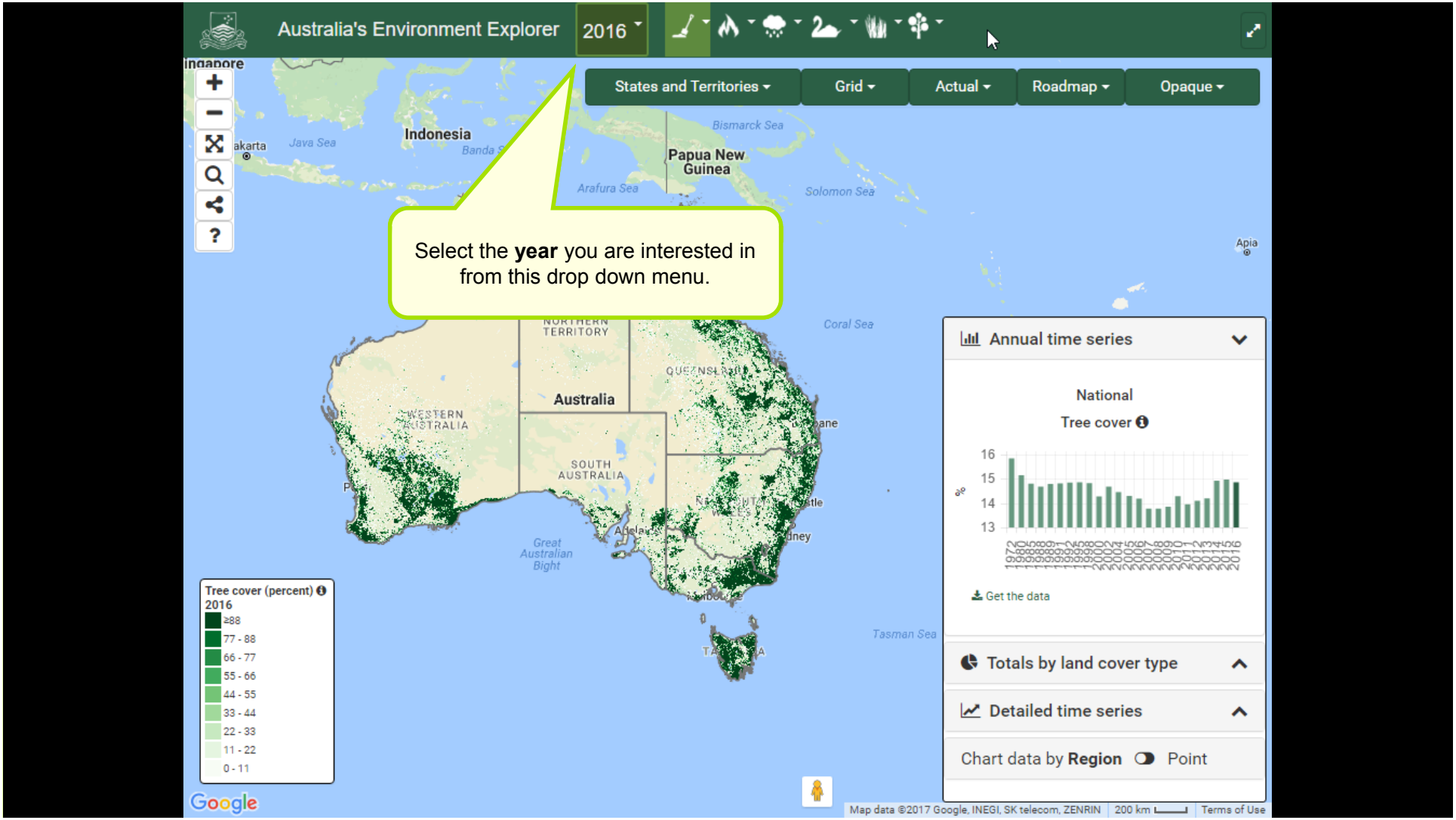



# Australia's Environment Explorer

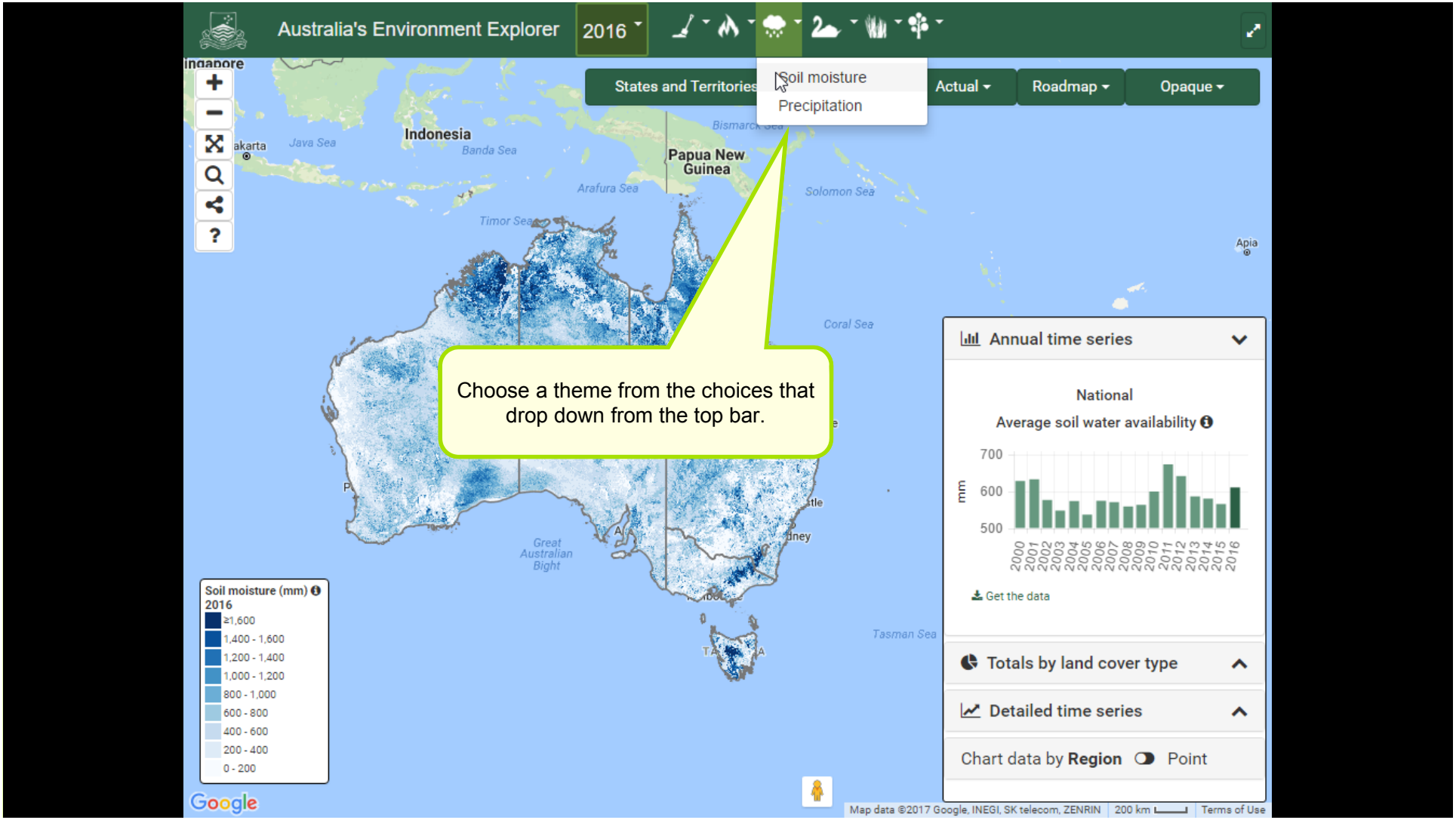
Below a few links to help you on your way:

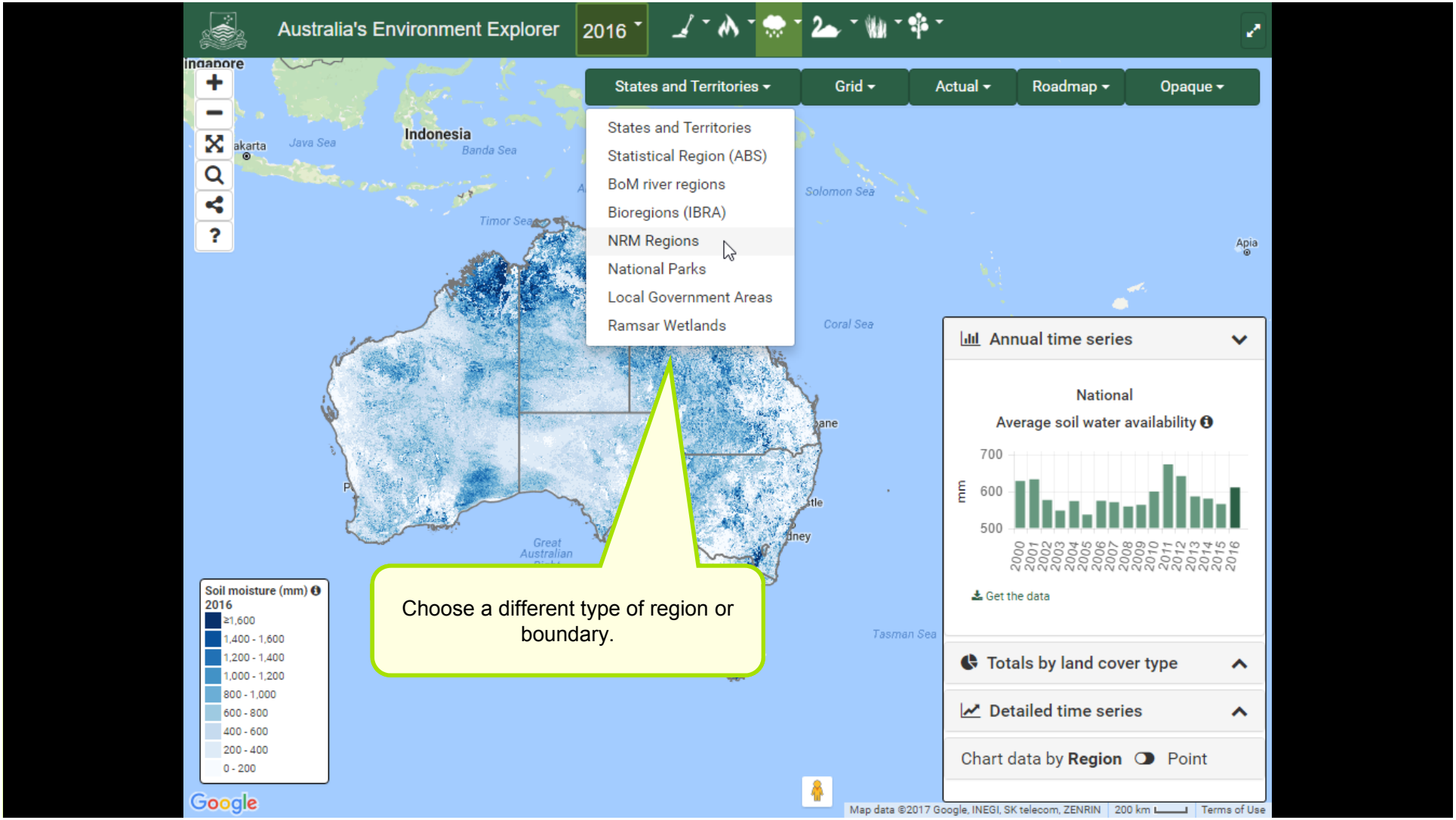
- How to use the Explorer
- Latest national summary report
- About this site
- Download data
- FAQ
- About us
- Contact us

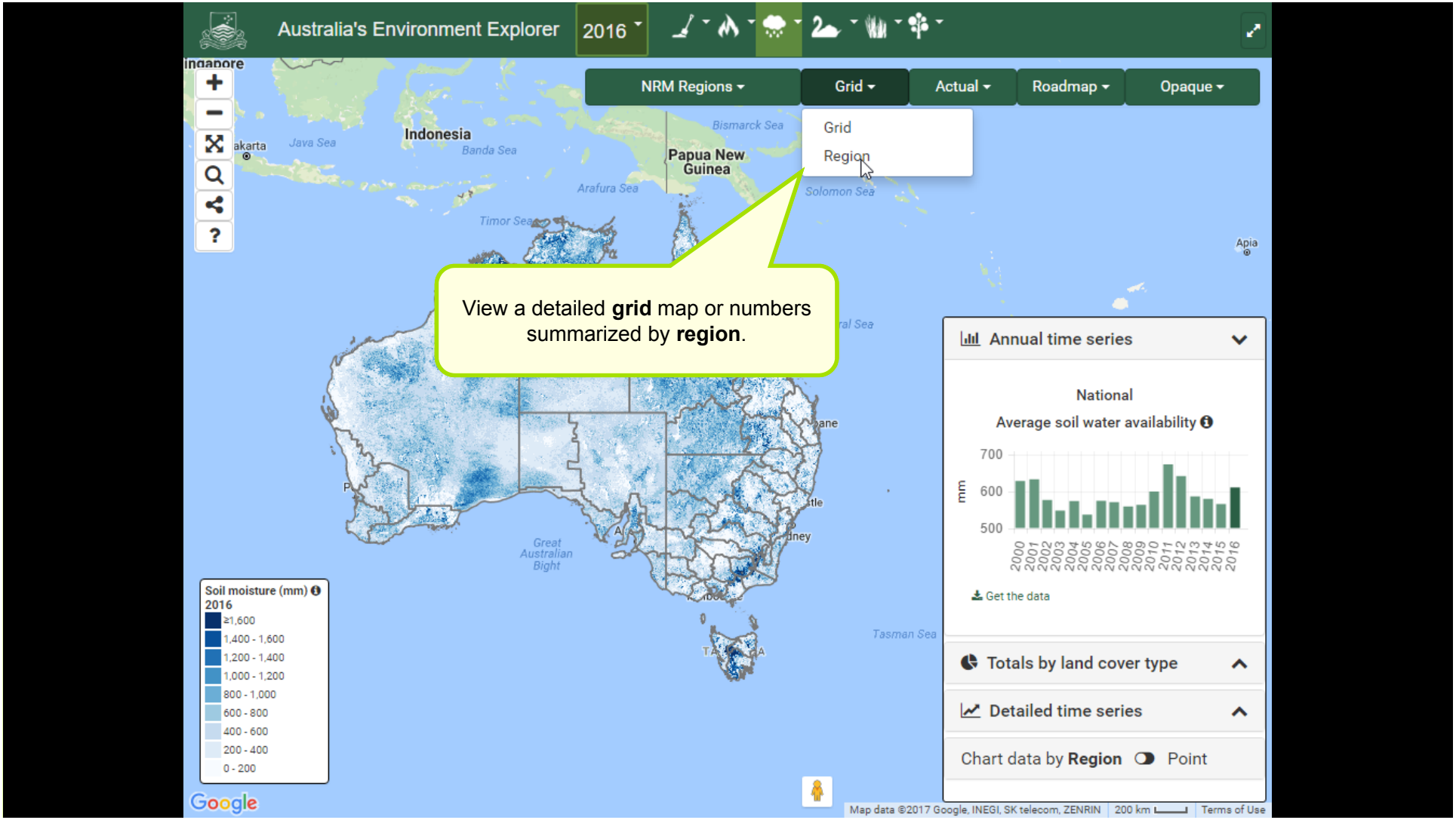
**Disclaimer:** The material provided on this website is experimental and derived through active research. The Australian National University does not have a legislated role in providing authoritative information. All information is made available on the understanding that it does not constitute professional advice. Before relying on the material in any important matter, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Links to other websites do not constitute an endorsement of

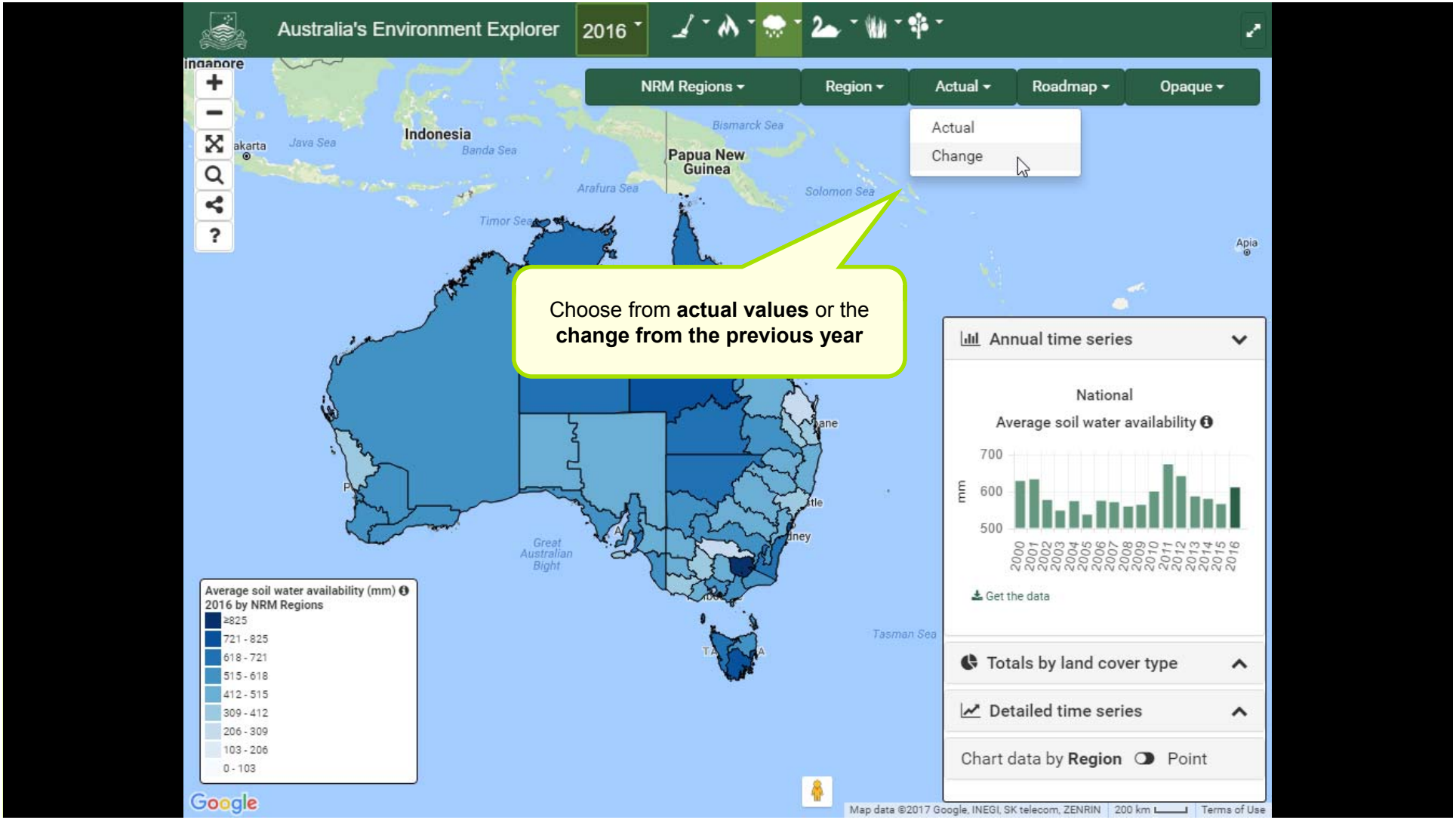

Australia's Environment Explorer
2016
States and Territories
Grid
Actual
Roadmap
Opaque
Select the **year** you are interested in from this drop down menu.
Indonesia
Papua New Guinea
Australia
Java Sea
Arafura Sea
Bismarck Sea
Solomon Sea
Coral Sea
Tasman Sea
Great Australian Bight
Apia
Annual time series
National
Tree cover
Get the data
Totals by land cover type
Detailed time series
Chart data by Region Point
Tree cover (percent)
2016
≥88
77 - 88
66 - 77
55 - 66
44 - 55
33 - 44
22 - 33
11 - 22
0 - 11
Google
Map data ©2017 Google, INEGI, SK telecom, ZENRIN
200 km
Terms of Use

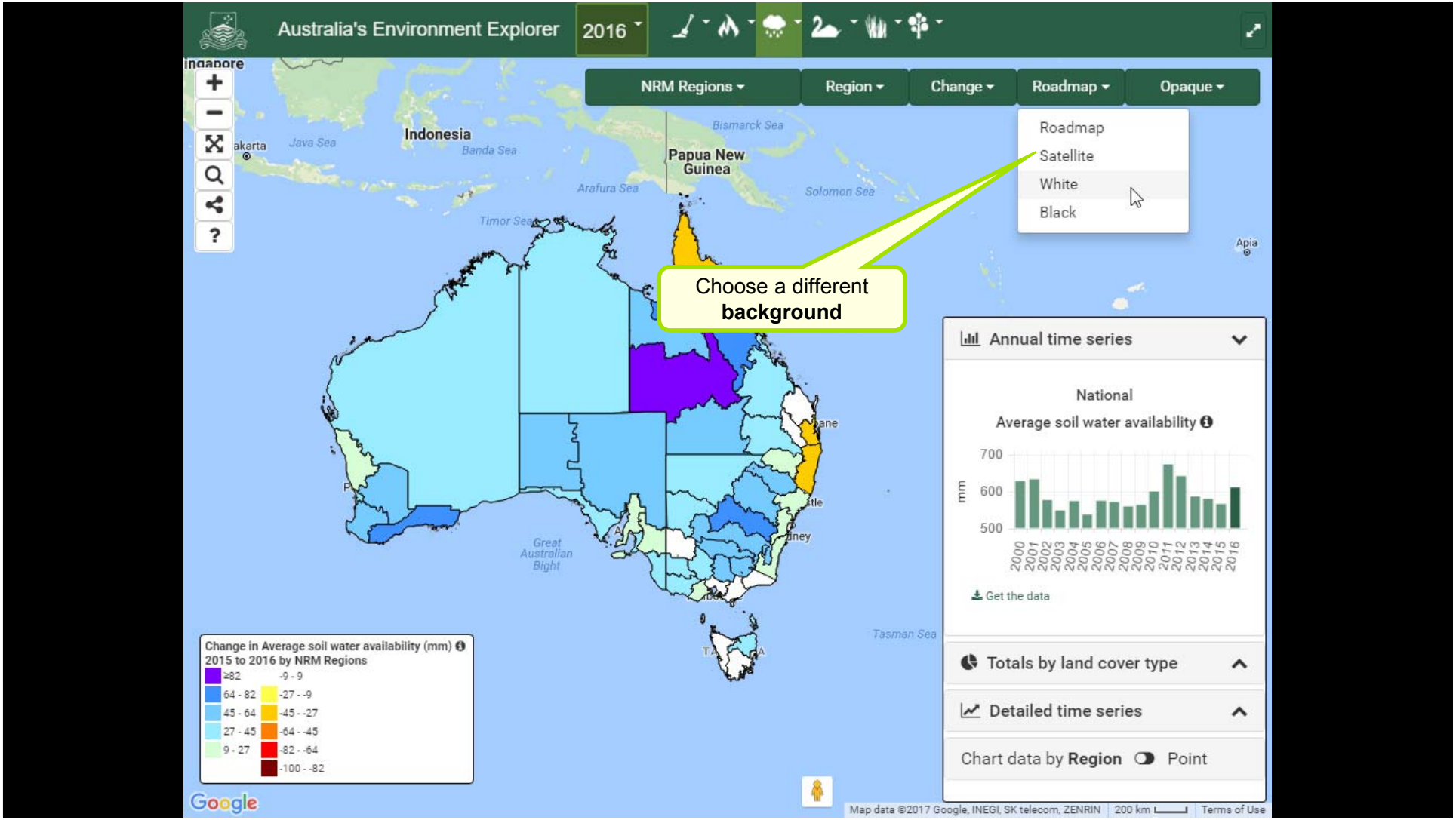
**AVD2** Albert Van Dijk, 18/02/2017

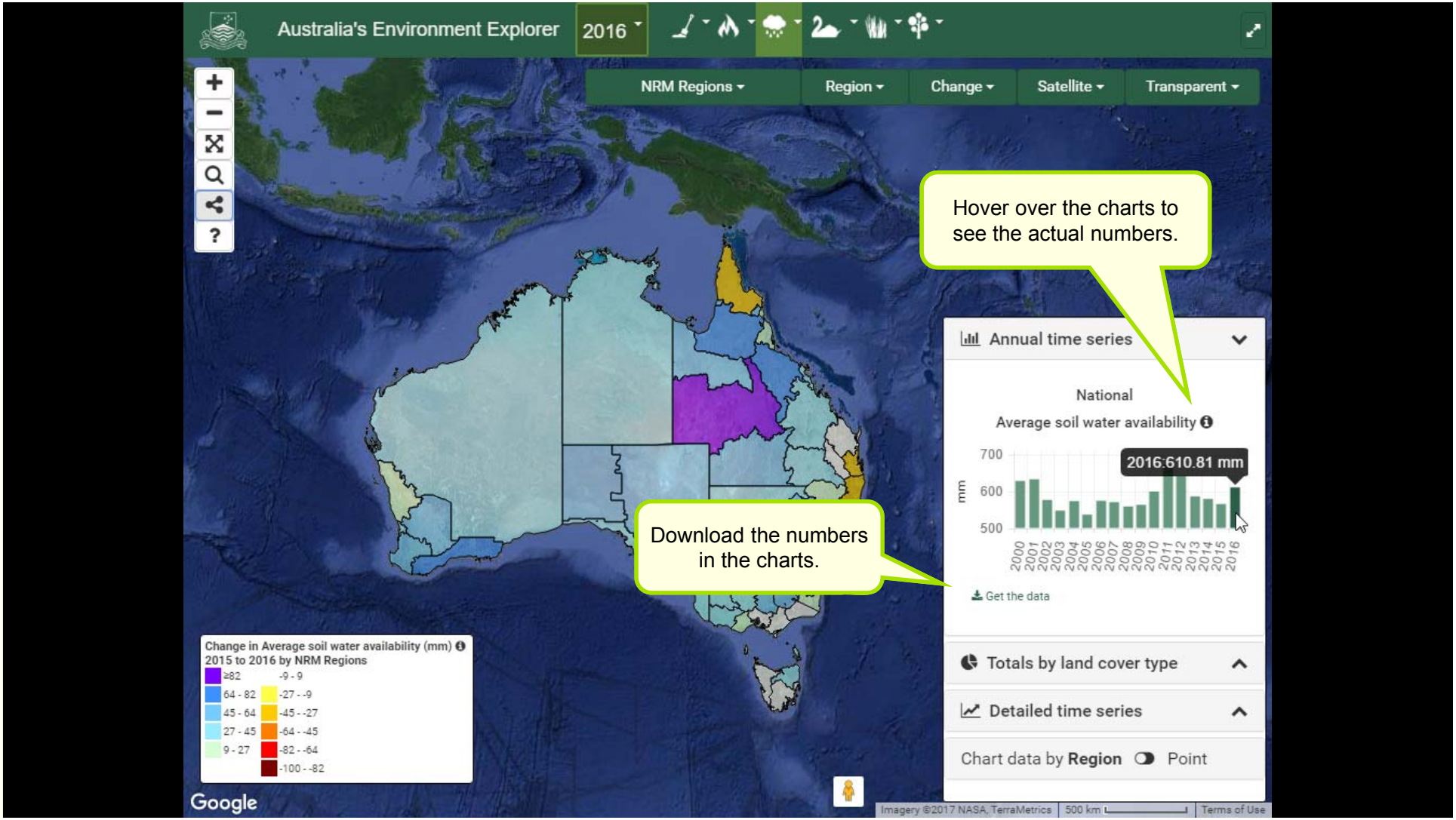

Australia's Environment Explorer
2016
Soil moisture
Precipitation
States and Territories
Actual
Roadmap
Opaque
Choose a theme from the choices that drop down from the top bar.
Annual time series
National
Average soil water availability
700
600
500
mm
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Get the data
Totals by land cover type
Detailed time series
Chart data by Region
Point
Soil moisture (mm)
2016
≥1,600
1,400 - 1,600
1,200 - 1,400
1,000 - 1,200
800 - 1,000
600 - 800
400 - 600
200 - 400
0 - 200
Indonesia
Papua New Guinea
Java Sea
Banda Sea
Arafura Sea
Timor Sea
Solomon Sea
Coral Sea
Great Australian Bight
Tasman Sea
Apia
Google
Map data ©2017 Google, INEGI, SK telecom, ZENRIN
200 km
Terms of Use

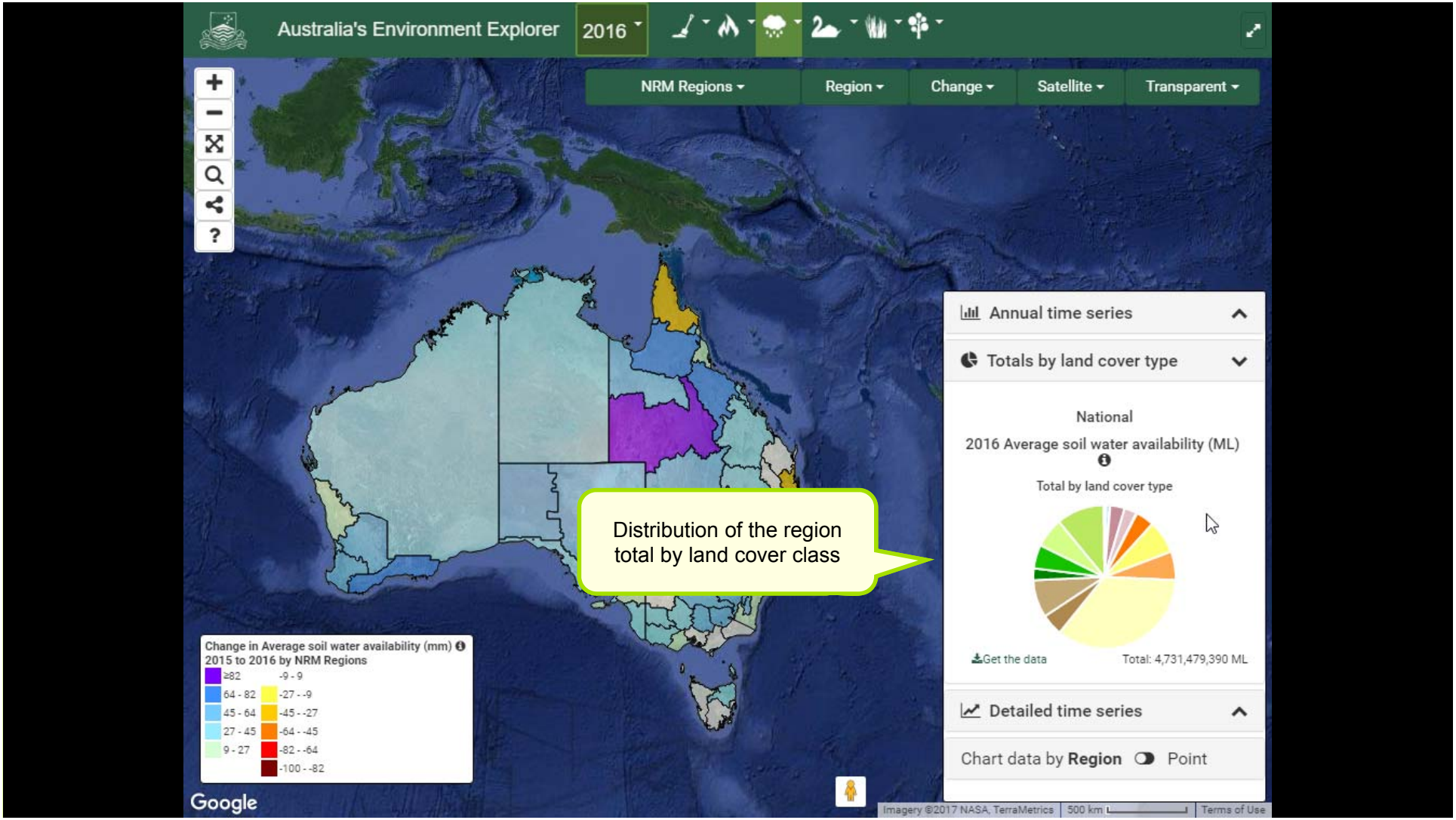

Australia's Environment Explorer
2016
States and Territories
Grid
Actual
Roadmap
Opaque
States and Territories
Statistical Region (ABS)
BoM river regions
Bioregions (IBRA)
NRM Regions
National Parks
Local Government Areas
Ramsar Wetlands
Indonesia
Java Sea
Banda Sea
Timor Sea
Solomon Sea
Coral Sea
Tasman Sea
Great Australian
Apia
Annual time series
National
Average soil water availability
700
600
500
mm
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Get the data
Totals by land cover type
Detailed time series
Chart data by Region
Point
Soil moisture (mm)
2016
≥1,600
1,400 - 1,600
1,200 - 1,400
1,000 - 1,200
800 - 1,000
600 - 800
400 - 600
200 - 400
0 - 200
Choose a different type of region or boundary.
Google
Map data ©2017 Google, INEGI, SK telecom, ZENRIN
200 km
Terms of Use

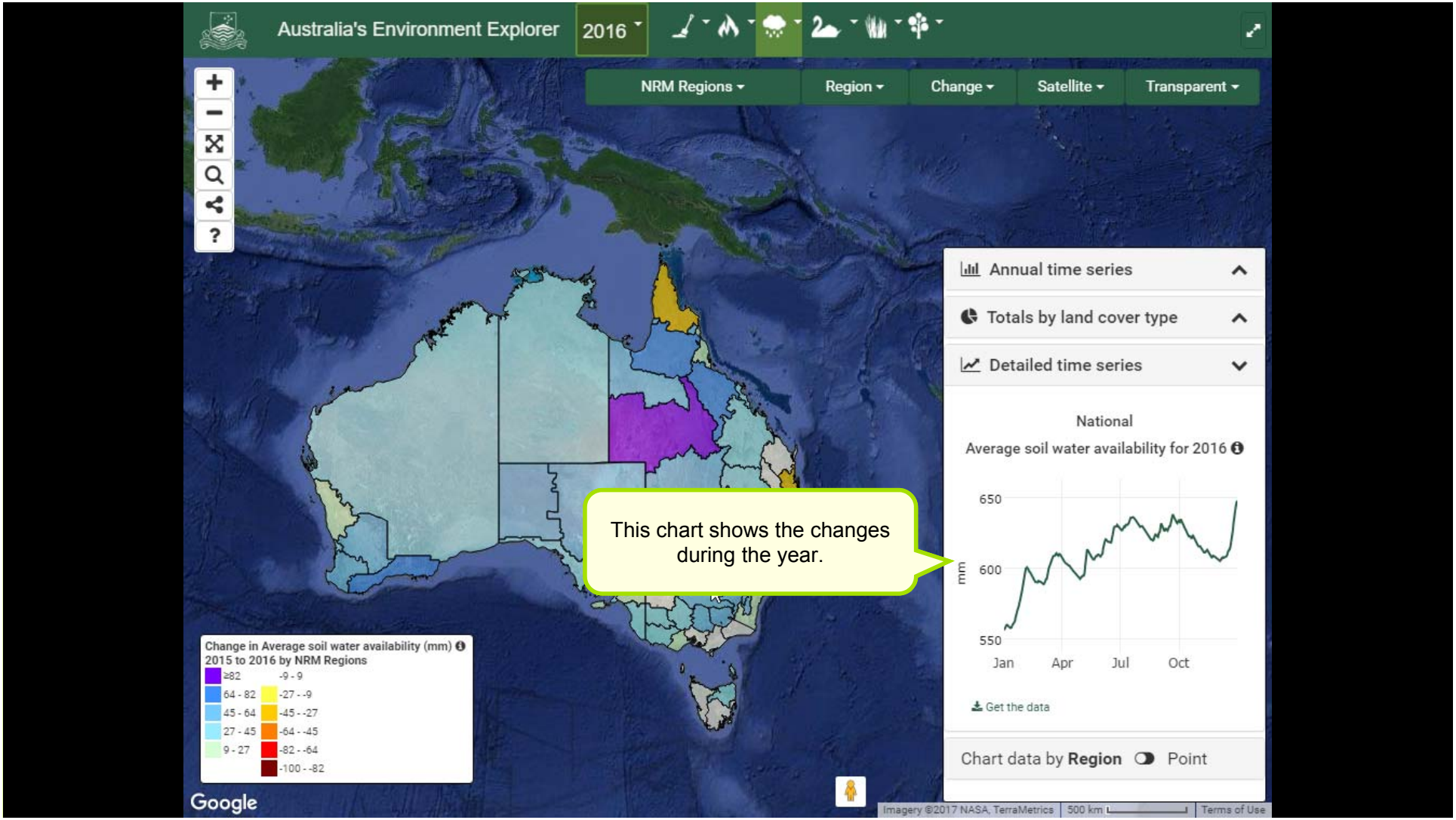

Australia's Environment Explorer
2016
NRM Regions
Grid
Actual
Roadmap
Opaque
Grid
Region
View a detailed **grid** map or numbers summarized by **region**.
Annual time series
National
Average soil water availability
700
600
500
mm
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Get the data
Totals by land cover type
Detailed time series
Chart data by Region Point
Soil moisture (mm)
2016
≥1,600
1,400 - 1,600
1,200 - 1,400
1,000 - 1,200
800 - 1,000
600 - 800
400 - 600
200 - 400
0 - 200
Indonesia
Papua New Guinea
Java Sea
Banda Sea
Arafura Sea
Timor Sea
Bismarck Sea
Solomon Sea
Tasman Sea
Great Australian Bight
Apia
Google
Map data ©2017 Google, INEGI, SK telecom, ZENRIN
200 km
Terms of Use

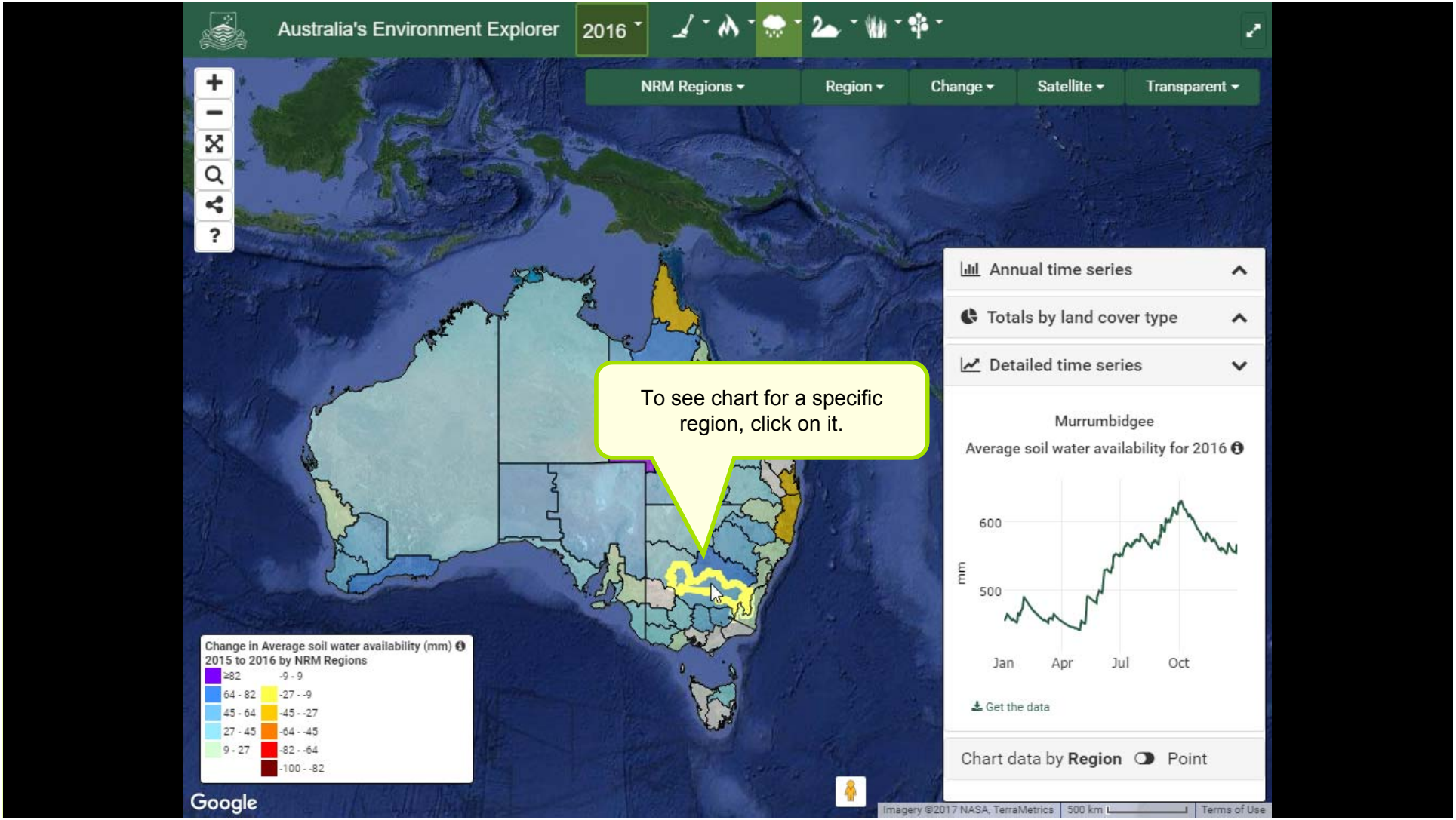

Australia's Environment Explorer
2016
NRM Regions
Region
Actual
Roadmap
Opaque
Actual
Change
Choose from **actual values** or the **change from the previous year**
Annual time series
National
Average soil water availability
700
600
500
mm
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Get the data
Totals by land cover type
Detailed time series
Chart data by Region Point
Average soil water availability (mm) 2016 by NRM Regions
≥825
721 - 825
618 - 721
515 - 618
412 - 515
309 - 412
206 - 309
103 - 206
0 - 103
Indonesia
Papua New Guinea
Java Sea
Banda Sea
Arafura Sea
Timor Sea
Bismarck Sea
Solomon Sea
Great Australian Bight
Tasman Sea
Apia
Google
Map data ©2017 Google, INEGI, SK telecom, ZENRIN
200 km
Terms of Use


Australia's Environment Explorer
2016
NRM Regions
Region
Change
Roadmap
Opaque
Roadmap
Satellite
White
Black
Choose a different **background**
Annual time series
National
Average soil water availability
700
600
500
mm
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
Get the data
Totals by land cover type
Detailed time series
Chart data by Region Point
Change in Average soil water availability (mm)
2015 to 2016 by NRM Regions
≥82
64 - 82
45 - 64
27 - 45
9 - 27
-9 - 9
-27 - -9
-45 - -27
-64 - -45
-82 - -64
-100 - -82
Indonesia
Papua New Guinea
Java Sea
Banda Sea
Arafura Sea
Timor Sea
Bismarck Sea
Solomon Sea
Great Australian Bight
Tasman Sea
Google
Map data ©2017 Google, INEGI, SK telecom, ZENRIN
200 km
Terms of Use

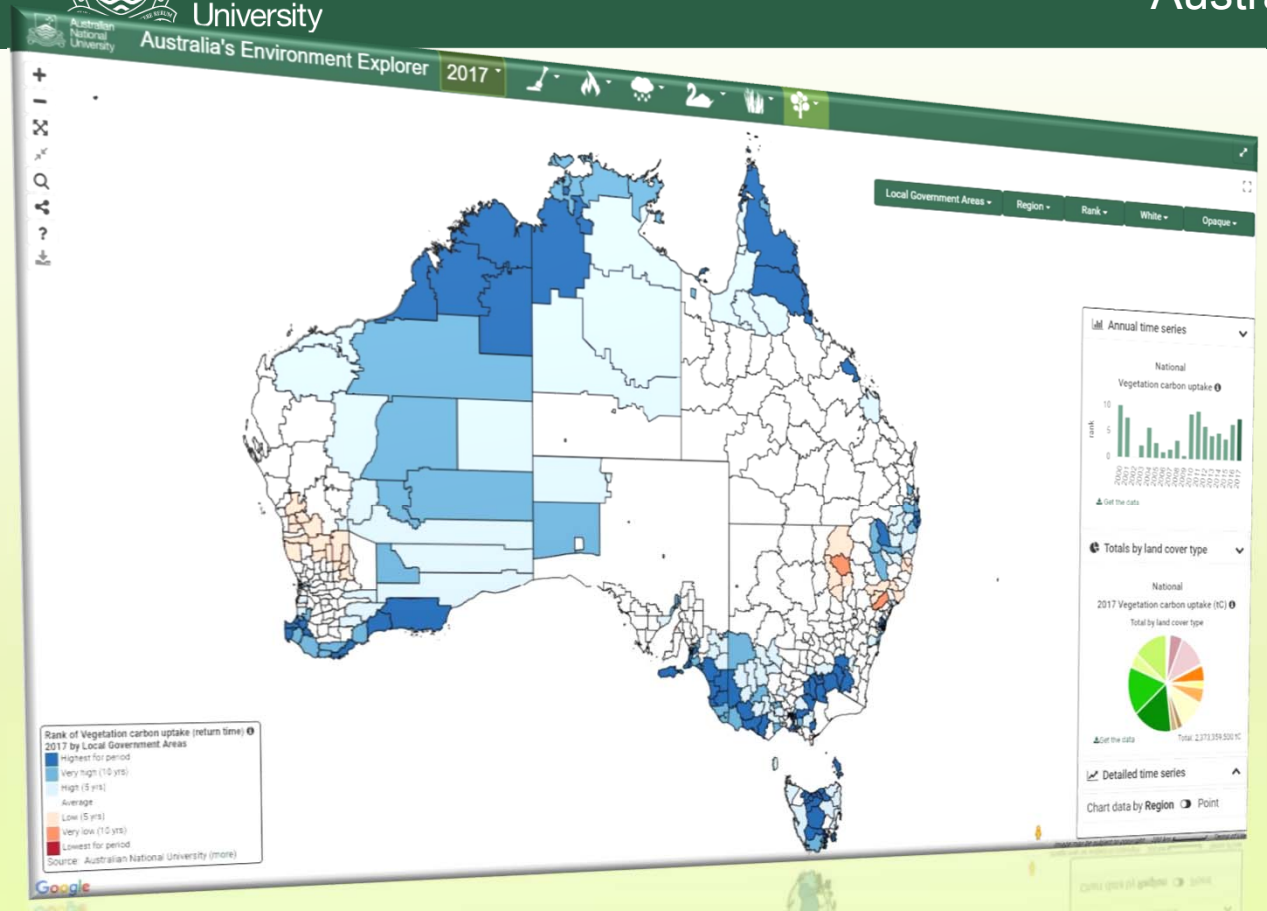

Australia's Environment Explorer
2016
NRM Regions
Region
Change
Satellite
Transparent
Hover over the charts to see the actual numbers.
Download the numbers in the charts.
Annual time series
National
Average soil water availability
2016:610.81 mm
700
600
500
mm
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Get the data
Totals by land cover type
Detailed time series
Chart data by Region
Point
Change in Average soil water availability (mm)
2015 to 2016 by NRM Regions
≥82
64 - 82
45 - 64
27 - 45
9 - 27
-9 - 9
-27 - -9
-45 - -27
-64 - -45
-82 - -64
-100 - -82
Google
Imagery ©2017 NASA, TerraMetrics
500 km
Terms of Use


Australia's Environment Explorer
2016
NRM Regions
Region
Change
Satellite
Transparent
Annual time series
Totals by land cover type
National
2016 Average soil water availability (ML)
Total by land cover type
Get the data
Total: 4,731,479,390 ML
Detailed time series
Chart data by Region Point
Distribution of the region total by land cover class
Change in Average soil water availability (mm)
2015 to 2016 by NRM Regions
≥82
64 - 82
45 - 64
27 - 45
9 - 27
-9 - 9
-27 - -9
-45 - -27
-64 - -45
-82 - -64
-100 - -82
Google
Imagery ©2017 NASA, TerraMetrics
500 km
Terms of Use


Australia's Environment Explorer
2016
NRM Regions
Region
Change
Satellite
Transparent
Annual time series
Totals by land cover type
Detailed time series
National
Average soil water availability for 2016
650
600
550
mm
Jan
Apr
Jul
Oct
Get the data
This chart shows the changes during the year.
Chart data by Region
Point
Change in Average soil water availability (mm)
2015 to 2016 by NRM Regions
≥82
64 - 82
45 - 64
27 - 45
9 - 27
-9 - 9
-27 - -9
-45 - -27
-64 - -45
-82 - -64
-100 - -82
Google
Imagery ©2017 NASA, TerraMetrics
500 km
Terms of Use


Australia's Environment Explorer
2016
NRM Regions
Region
Change
Satellite
Transparent
To see chart for a specific region, click on it.
Annual time series
Totals by land cover type
Detailed time series
Murrumbidgee
Average soil water availability for 2016
600
500
mm
Jan
Apr
Jul
Oct
Get the data
Chart data by Region
Point
Change in Average soil water availability (mm)
2015 to 2016 by NRM Regions
≥82
64 - 82
45 - 64
27 - 45
9 - 27
-9 - 9
-27 - -9
-45 - -27
-64 - -45
-82 - -64
-100 - -82
Google
Imagery ©2017 NASA, TerraMetrics
500 km
Terms of Use

# Australia's Environment Explorer




**www.ausenv.online**

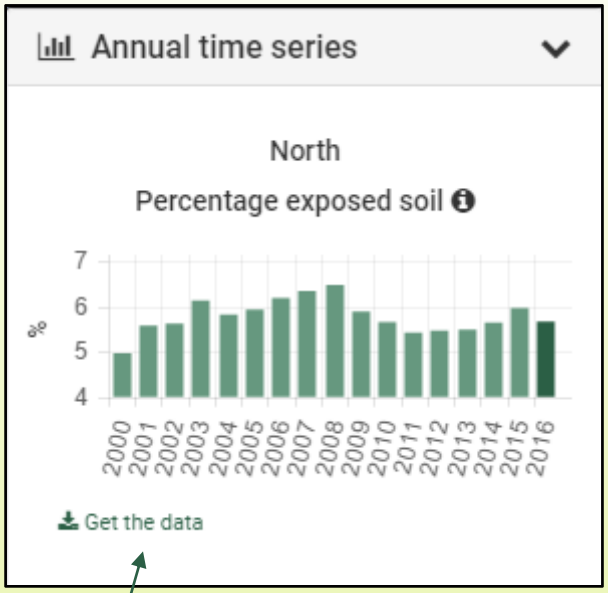
**April 2016 – yesterday**

- 3,759 unique users
- **707 return users**:
  - 34% Canberra
  - 90% Australia
  - 5.3 sessions per user
  - 6 min avg. session

# Some known users of *ausenv.online*

- Researchers & graduate students
- Catchment Management Authorities
- Natural Resource Management bodies
- Local governments
- Consulting firm
- Schools

There is no registration, so presumably there are some others we do not know of.




Direct csv file downloads appear popular

# Underlying data

All data is public facing and can be downloaded or accessed through OpenDAP

This would have been very expensive only a few years ago!

Some feasibility factors:

- Producers freely share their data
- Many products and primary data are in (fairly) well-managed collections on the NCI, allowing efficient processing.
- NCI data and WMS hosting
- OpenDAP, Google Maps etc.
- Sharing ethos in web IT

| Layer | Producer | Production system | Primary inputs |
|---|---|---|---|
| Tree cover | DoEE* | NCAS | Landsat |
| Land cover | GA* | DLCD | MODIS |
| Fire intensity | GA | Sentinel Hotspots | MODIS, AVHRR,.. |
| Fire occurrence | GA | Sentinel Hotspots | MODIS, AVHRR,.. |
| Precipitation | ANU | OzWALD | GPM, BoM grids |
| Soil moisture | ANU | OzWALD | various |
| Inundation | CSIRO/ANU | Open Water Likelihood | MODIS |
| Runoff | ANU | OzWALD | various |
| River flows | ANU | OzWALD | various |
| Exposed soil | CSIRO | Fractional cover | MODIS |
| Vegetation leaf area | NASA | MODIS LAI | MODIS |
| Vegetation carbon uptake | ANU | OzWALD | various |
| Fire carbon emissions | ECMWF | GFAS | various |

* Extended to the most recent year by ANU using machine learning

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# Some remaining challenges

**Urgent data needs**:

- better quality land use/cover change mapping
- spatial habitat and biodiversity change data

**Conceptual challenges**:

- Climate variability vs. underlying trends

**Communication challenges**:

- Appropriate choice of headline indicators
- Representing complexity (e.g., regional vs national trends)

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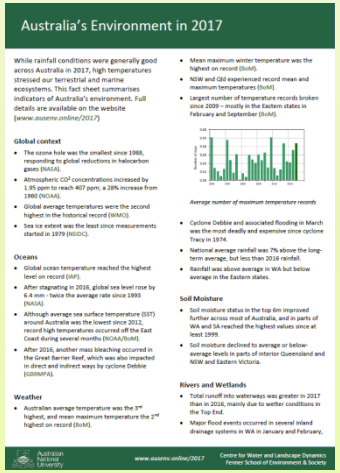
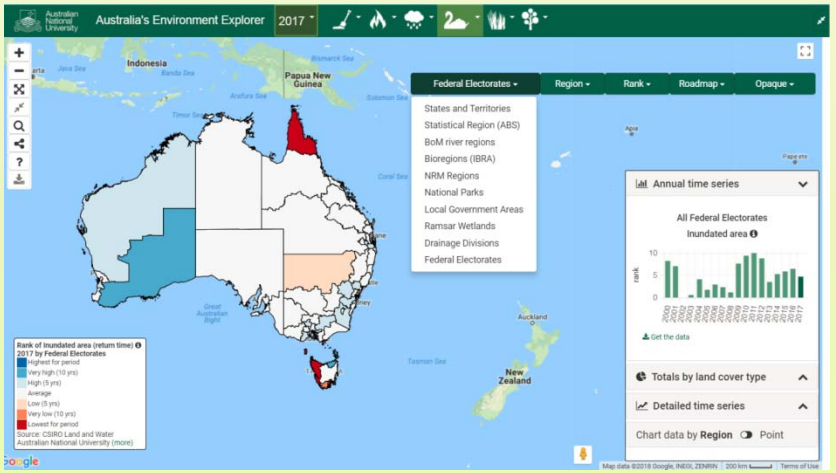
For more information, visit *Australia's Environment* online:

*www.ausenv.online/2017*