



Australian Government

Geoscience Australia



Geoscience in the Cloud

Dr Carina Kemp

Director, Scientific Data

Co-authors: Laura Stanford, James Kingsmill & Tom Butler

The Cloud Enablement Team

Geoscience Australia

Geoscience Australia (GA)

Nation's trusted advisor on the geology and geography of Australia

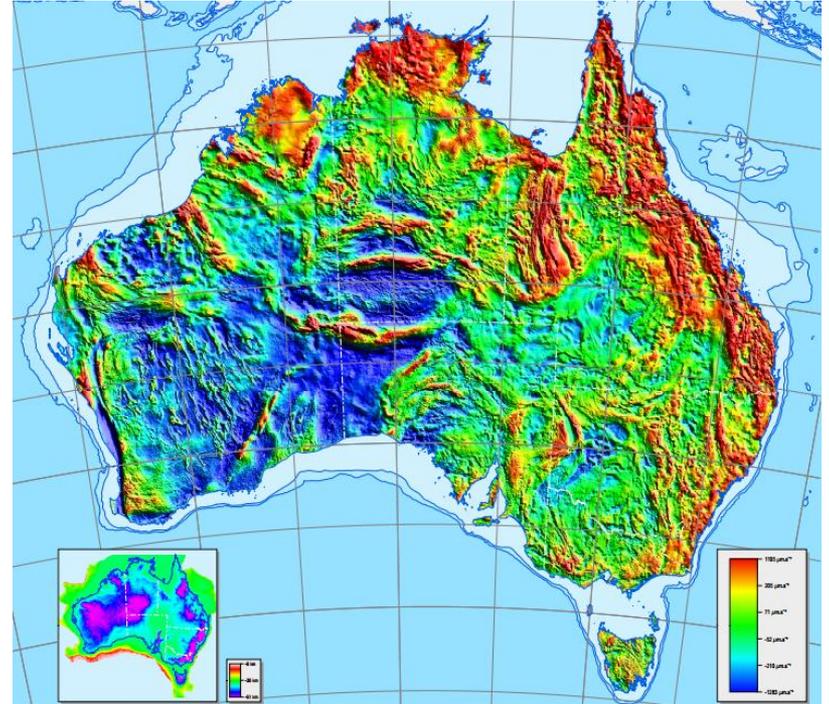


Geoscience Australia (GA)

The GA Science Principles:

<http://www.ga.gov.au/about/corporate-documents/science-principles>

- Relevance to Government
- Collaborative science
- Quality science
- Transparent science
- Communicated science
- Sustained science capability



‘A Framework for eResearch to enable Science’ <http://www.ga.gov.au/metadata-gateway/metadata/record/101106>

Digital Science is driving change at GA

- Scientific information is expected to be available on-demand.
- Scientific questions are becoming increasingly complex.
- Scientific data is growing exponentially.
- Digital technologies have reached unprecedented capabilities.

Geoscience Australia Digital Science Strategy 2016-2018

1. Access the right mix of skills
2. Establish an agile way of working
3. Improve planning and program delivery processes
4. Establish a quantitative science platform
5. Formalise Digital Science leadership

Cloud: the journey so far

On premise:

- Limited scalability
- Vanilla
- Specialised teams

Cloud provider:

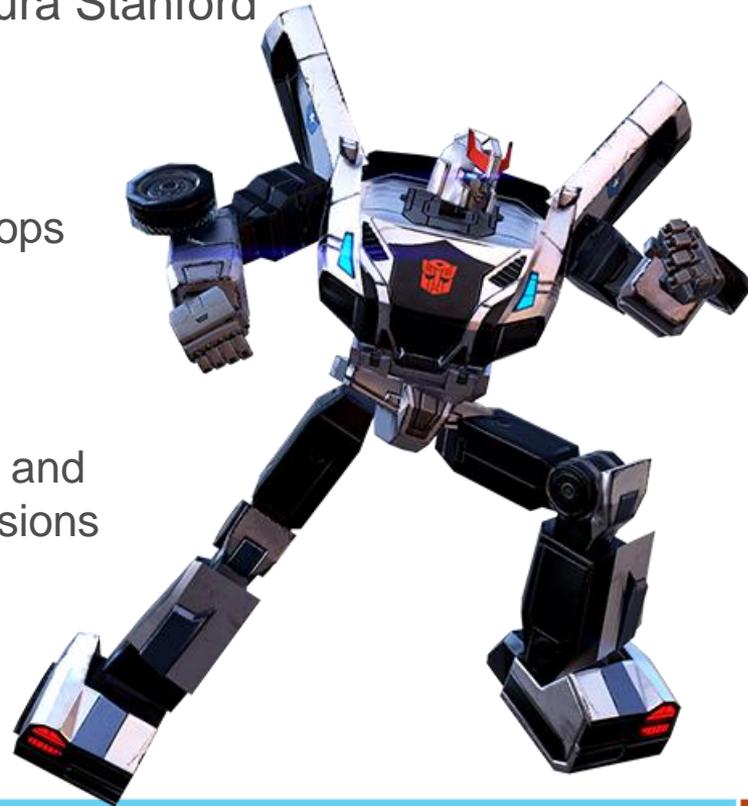
- Scalable
- Reliable
- Customisable
- Quick time to production



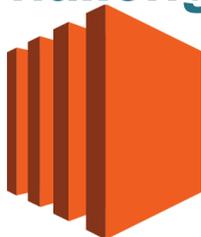
Cloud Enablement Team (Autobots)

James Kingsmill, Tom Butler & Laura Stanford

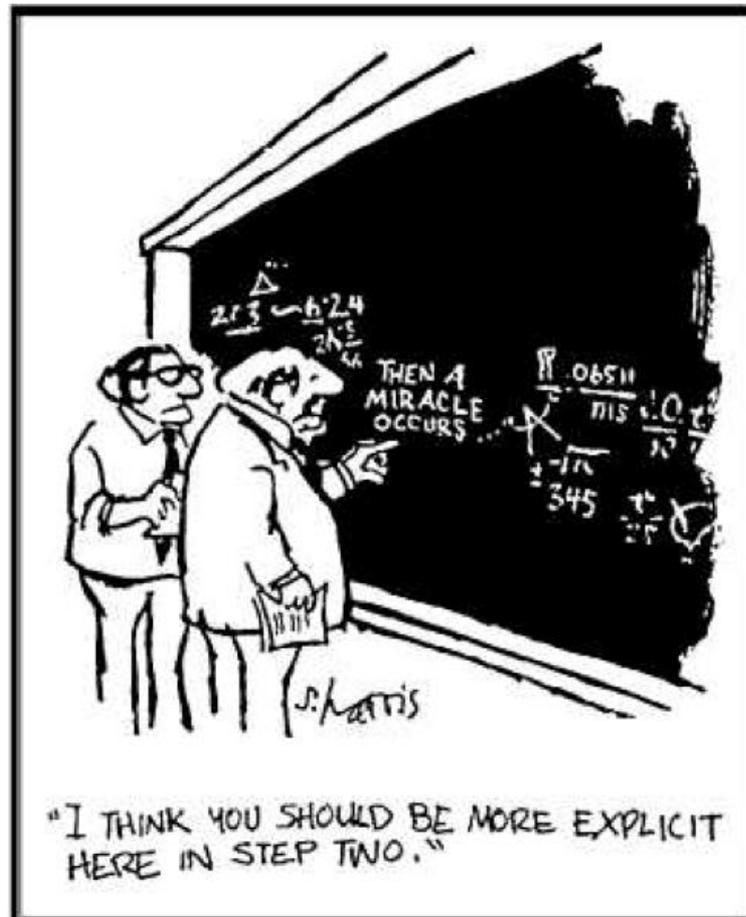
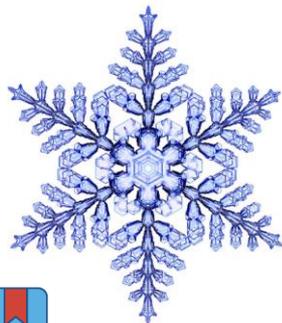
- Collaboration on projects
- Technical advice and workshops
- Automation and patterns
- Cloud governance
- Support GA developer teams and Scientists in the Science Divisions



Challenges...



Amazon EC2

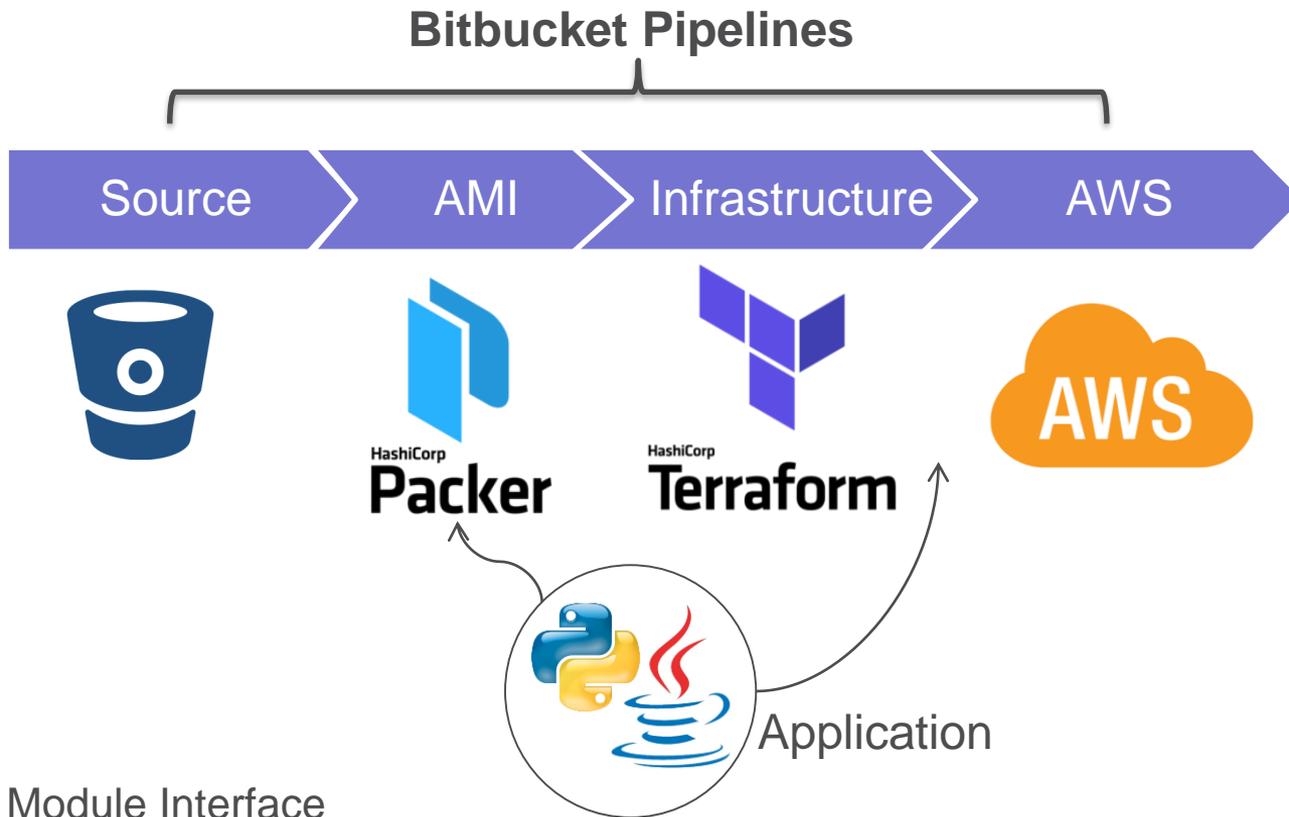


Infracode: Infrastructure as Code

- Source control
- Configurations
- Divide into reusable modules
- Infrastructure patterns & examples
- Code reviews
- Automated testing
- Continuous delivery and deployment



Pipeline



AMI : Amazon Module Interface

Server Patterns

Example builds for common usages

Security heavily baked into AMIs.

Automated tests

Repository

- [</> buildbox](#)
- [</> codedeploy](#)
- [</> Docker](#)
- [</> jumpbox](#)
- [</> shibboleth](#)
- [</> simple-webserver](#)
- [</> tomcat-packer](#)



HashiCorp
Packer

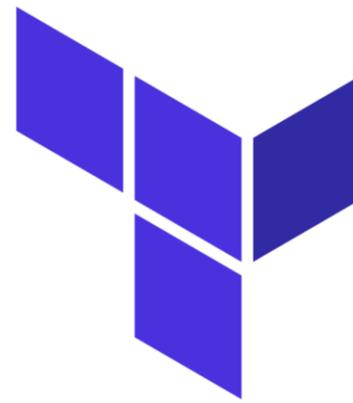
```
2  "variables": {
3    "aws_access_key": "{{env `AWS_ACCESS_KEY`}}",
4    "aws_secret_key": "{{env `AWS_SECRET_KEY`}}",
5  },
6  "builders": [
7    {
8      "type": "amazon-ec2",
9      "region": "ap-southeast-2",
10     "source_ami": "ami-4d3b062e",
11     "instance_type": "t2.medium",
12     "ssh_username": "ubuntu",
13     "iam_instance_profile": "fuseki-jena",
14     "ami_name": "Fuseki/Jena Webserver {{timestamp}}",
15     "associate_public_ip_address": true,
16     "tags": {
17       "application": "fuseki-packer",
18       "version": "current"
19     }
20   }
21 ],
22 "provisioners": [
23   {
24     "type": "file",
25     "source": "config",
26     "destination": "/tmp"
27   },
28   {
29     "type": "shell",
30     "script": "scripts/pre-install.sh"
31   }
32 ]
```

Terraform

Infrastructure as code:

- Codifies APIs into declarative configuration files
- Modular
- Platform agnostic
- Allows state locking

Example architecture:



```
41 module "public" {
42   source      = "modules/public_layer"
43   region     = "${var.region}"
44   availability_zones = "${var.availability_zones}"
45   stack_name = "${var.stack_name}"
46   environment = "${var.environment}"
47   owner      = "${var.owner}"
48   key_name   = "${var.key_name}"
49   enable_jumpbox = true
50   nat_gw_count = "1"
51   vpc_id     = "${module.shared.vpc_id}"
52   igw_id     = "${module.shared.igw_id}"
53
54   listeners {
55     "instance_port" = "80"
56     "instance_protocol" = "HTTP"
57     "lb_port" = "80"
58     "lb_protocol" = "HTTP"
59   }
60 }
```

Available at: <https://bitbucket.org/account/user/geoscienceaustralia/projects/TF>

Bitbucket pipelines

GeoscienceAustralia / ... / Pipelines

Pipeline #25 ALPHA



Successful

Rerun



18 min 25 sec • a month ago



geoscienceaustralia/autobots-terraform



Push by [Tom Butler](#)

[View configuration](#)

Commit



90705a2

ASG Health check bugfix, ASG was setting health check to be EC2 which resulted in some undesirable effects thanks - @scelton



[integration](#)

Logs

Download raw

Build + Add a service or database

- > Build setup 4s ✓
- > export TF_VAR_environment=test <1s ✓
- > terraform init -backend-config="key=\$TF_VAR_stack_name-\$TF_VAR_env... 1s ✓
- > terraform apply 9m 25s ✓
- > cd tests <1s ✓
- > bundle install 3s ✓
- > bundle exec rake spec 28s ✓
- > cd ../ <1s ✓
- > terraform destroy -force 7m 38s ✓

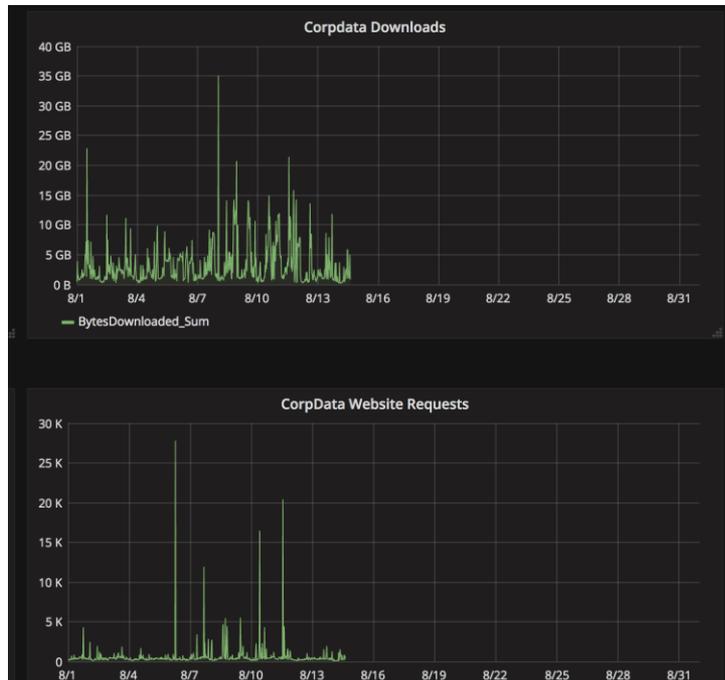
Monitoring & Logging



- Cloud Trail
- Account logs
- Security logs
- CloudWatch

Security

- AMIs have security baked in
- Security well architected into our examples
- SSO functionality
- Central account access – Organisations



Cost Management

- Cloudbility – to monitor costs on AWS
 - Views for each area
 - Allows quick responses to issues
- Lambda Scripts:
 - To shut down dev/test servers overnight and on weekends
- Reserved instances used
 - RDS
 - EC2



Exemplars

Sentinel Hotspots

Secure | <https://sentinel.ga.gov.au/#/>

Australian Government
Geoscience Australia

Sentinel Hotspots

Quick Links ▾ Populated search place 🔍 ?

Layers 🗄️ 0-2 hours 🕒 2-6 hours 🕒 6-24 hours 🕒 24-48 hour 🕒 48-72 hours

Measure 📏 Update ↻ Locate 📍 Identify 📄 Historical 🔍 Reset 🔄

500 km
500 mi

Geoscience Australia

Google

Hotspots Last Acquired: 2017-10-17 21:12 UTC Updated: 2017-10-17 21:57 UTC

Himawari-8 Mosaic Last Acquired: 2017-10-17 22:10 UTC Updated: 2017-10-17 22:31 UTC

Map data ©2017 Imagery ©2017 NASA, TerraMetrics Terms of Use

[CC BY](#) Copyright Disclaimer Privacy Accessibility Information Publication Scheme Freedom of Information [Contact us](#)



AUSCORS NTRIP Broadcaster

Geoscience Australia (GA) provides 1 Hz data streaming from our Global Navigation Satellite System (GNSS) stations throughout Australia, Antarctica and the Pacific. The data is distributed via the **AUSCORS Ntrip Broadcaster**. Access to the data is free, however a username and password is required. The real-time data is made available through an **RTCM** standard transmitted over the Internet using the **NTRIP** (Network Transport of RTCM via Internet Protocol).

To connect you will need:

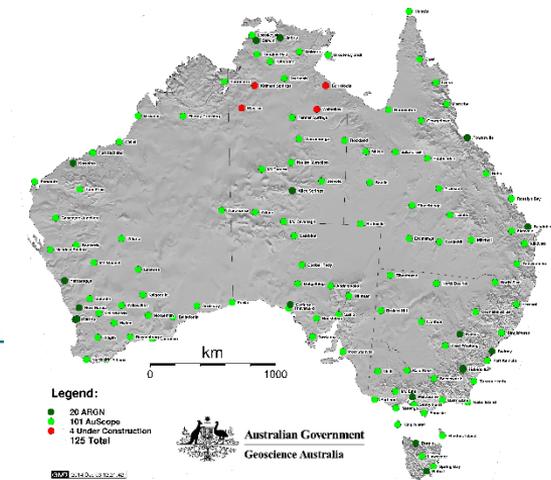
- Username and password,
- **NTRIP client** and internet access,
- Connection details.

Register for an Account

Connection Details

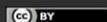
Host Domain auscors.ga.gov.au
Port 2101

Mountpoint Information



Operational:	JLCK Julia Creek	STHD Stoneheige
ALBY Albany	KALG Kalbarria	S1N1 Stony Point
ALSC Alice Springs	KARH Karatha	STON Sydney
ANGA Andamoola	KATI Kaitiaki	TWBO Twambo
ANRO Anson	KEB1 Koolberran	TRHD Traralgon
ARLB Arlburdy	KLK1 Kilkivan	TBOB Tibboobura
BDLE Bairdsdale	KOS1 King Island	TDT1 Tibbinilla
BDOC Balm Drack	KUL1 Koolberran	TOPE Toowoomba
BALA Ballabona	LAME Lamona	TOPE Toowoomba
BEGC Blackdown	LKVA Lismore	TOPE Toowoomba
BRNG Brungle	LARR Larrikin	TURO Tures Head
BDVL Breda	LURA Laura	WAGN Wagn
BRAN Bran	LOW1 Lowes	WAL1 Wall
MPO1 Boodardy	LAW1 Lowmead	WARA Warara
SULA Sula	LOHD Lord Howe Is	WBRG Warrumbungle
RNH1 Rinkari Hill	MAN1 Manero	WVWG West Wyalong
BRD1 Broome	MRA1 Maree	WLU1 Wiluna
BRDQ Bruckleboon	MRD1 Moree	YRNL Yarrabee
ENDY Bundaberg	MED1 Meehan Station	YARD Yarrabee
BURA Burnes	MOR1 Melbourne	YEL1 Yellavine
BRF2 Burnie	MCIL Mitchell	YELA Yebra
CEDE Cedara	MTC1 Mt Cavanagh	
CHIS1 Christmas Island	MDO1 Mt Dandenong	
DODD Dooen Island	MFM1 Mt Fern	
COEN Coen	MIS1 Mt Isa	
COOD Coolah	MMA1 Mt Margaret	
COOL Coolah	MST1 Mt Sorens	
COON Coon	MAL1 Mt Alford	
CHGN Coonambouran	MAL1 Mt Alford	
DARW Darwin	NEBO Nebo	
DODD Douglas Daly	NTR1 Neerul Junction	
EDBY Edgemoor	NHR1 New Norcia	
ENGM Enngonia	NHL1 North Hill	
ESPA Esperance	NOR1 Norfolk Island	
UCLA Eucla	NAT1 Northampton	
EMET Emerald	NHR1 North Hill	
FRDY Flinders Crossing	NRK1 North Gawler	
FLND Flinders Island	NEL1 North East	
GABO Gabo Island	NST1 North Star	
GASC Gascoyne Junction	PAK1 Parkes	
GSTN Georgetown	PER1 Perth	
GRDT Granite Eyrehill	PHL1 Port Hedland	
HEBE Hebe	PHL1 Port Hedland	
HIL1 Hilliers	PLD1 Portland	
HOB1 Hobart	PTEN Port Lincoln	
HNS1 Horta	PAV1 Parvaneh	
HUGH1 Hughenden	RNR1 Rannet Springs	
HYDR Hyde	RDL1 Rockdale	
IRBE Inverkeppin	RSBY Rossby Bay	
IRBE Inverkeppin	SAB1 Sables	
JAE1 Jervis	SPRY Spring Bay	

Exemplars



Exemplars

ANVGL Portal

www.anvgl.ga.gov.au/gmap.html

Australian Government
Geoscience Australia

Australian National
Virtual Geophysics Laboratory

Help Portal Submit Monitor Login

Any Text x
radiometric national Q
Spatial Bounds x
Keywords x
Available Services x
Gridded Data Services
Web Coverage Service
NetCDF Subset Service
OPeNDAP Service
Point/Line Data Services
Web Feature Service
Visualisation Services
Web Map Service
Publication Date x
Cell Size x
Line Spacing x
Search Results

Search Results		
radmap v3 2015 ratio thorium over potassium grid	18/11	⌵
radmap v3 2015 filtered terrestrial dose rate grid	18/11	⌵
radmap v3 2015 filtered ppm thorium grid	18/11	⌵
radmap v3 2015 ratio uranium squared over thorium grid	18/11	⌵
radmap v3 2015 ratio uranium over potassium grid	18/11	⌵
radmap v3 2015 ratio uranium over thorium grid	18/11	⌵
radmap v3 2015 unfiltered terrestrial dose rate grid	18/11	⌵
radmap v3 2015 unfiltered ppm thorium grid	18/11	⌵
radmap v3 2015 filtered pct potassium grid	18/11	⌵
radmap v3 2015 unfiltered pct potassium grid	18/11	⌵

Page 1

Geological Survey of Western Australia

EXPLORATION INCENTIVE SCHEME

Active Layers

- Radiometric thorium equivalent grid of Leonora, WA, 1991/92 s...
- radmap v3 2015 ratio uranium squared over thorium grid
- Isostatic Residual Gravity Anomaly Grid of Onshore Australia 2...

Base Layer

- Google Satellite
- Google Streets
- Google Physical
- Google Hybrid
- World Political Boundaries

Select Data

Google

Imagery ©2017 TerraMetrics | Terms of Use

Exemplars

The screenshot displays the AUSGIN Geoscience Portal interface. At the top, the browser address bar shows the URL `portal.geoscience.gov.au/gmap.html`. The main header features the AUSGIN logo and the text "AUSGIN Geoscience Portal".

On the left side, there is a navigation menu with the following sections:

- Add Data**: Includes a button for "Add 1:250K Geological Maps".
- Featured Data**: Includes buttons for "My Data" and "Search Data Catalog".
- Search**: A search input field with a magnifying glass icon.
- Data Categories**: A list of categories with item counts and expand/collapse icons:
 - Mines and Mining Activity (3 items)
 - Mineral Occurrences and Resources (3 items)
 - Boreholes (2 items)
 - ASTER Maps (17 items)
 - Tenements (1 item)
 - Geological Provinces (21 items)
 - Geological Maps (5 items)
 - Topography and Infrastructure (8 items)
 - Restricted Areas (6 items)
 - National Geophysical Datasets (21 items)
 - Rock Properties (12 items)

The central map area shows a satellite view of Australia and surrounding regions. A vertical toolbar on the left of the map includes navigation controls (directional arrows, zoom in/out), a hand icon for panning, a magnifying glass for search, and an information icon. The Google logo is visible at the bottom left of the map.

On the right side, there is an "Active Layers" panel with a message: "No map layers currently loaded." Below this, the "Base Layer" section lists several options with radio buttons:

- Google Satellite (selected)
- Google Streets
- Google Physical
- Google Hybrid
- World Political Boundaries (white background)

At the bottom of the page, the footer contains the text "AUSGIN - Australian Geoscience Information Network" on the left and "Powered by AuScope" on the right. Small copyright notices for NASA, TerraMetrics, and AuScope are also present.

All the good things: empowerment

- Internal:
 - Empowering the Scientists
 - Empowering the Developers
 - Upskilling
 - Continuous Improvement
- External
 - Enabling access to GA's data
 - Meeting our stakeholder needs





Thank you

The Cloud Enablement Team

Laura.Stanford@ga.gov.au

James.Kingsmill@ga.gov.au

Tom.Butler@ga.gov.au

Available at: <https://bitbucket.org/account/user/geoscienceaustralia/projects/TF>

Phone: +61 2 6249 9228

Web: www.ga.gov.au

Email: carina.kemp@ga.gov.au

Address: Cnr Jerrabomberra Avenue and Hindmarsh Drive, Symonston ACT 2609

Postal Address: GPO Box 378, Canberra ACT 2601