

Creating an environment for innovation

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Innovation

“the act of starting something for the first time”

“What we need to do to complete internationally, solve important research problems and deliver useful outcomes ”

Outline

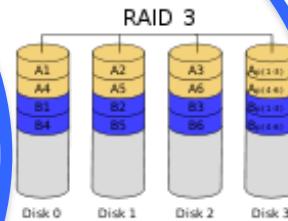
- Experience from Climate System Science
- Examples from land surface science
- Lessons learned

Climate Science has 3 problems:

Computational
demand



Data
demands

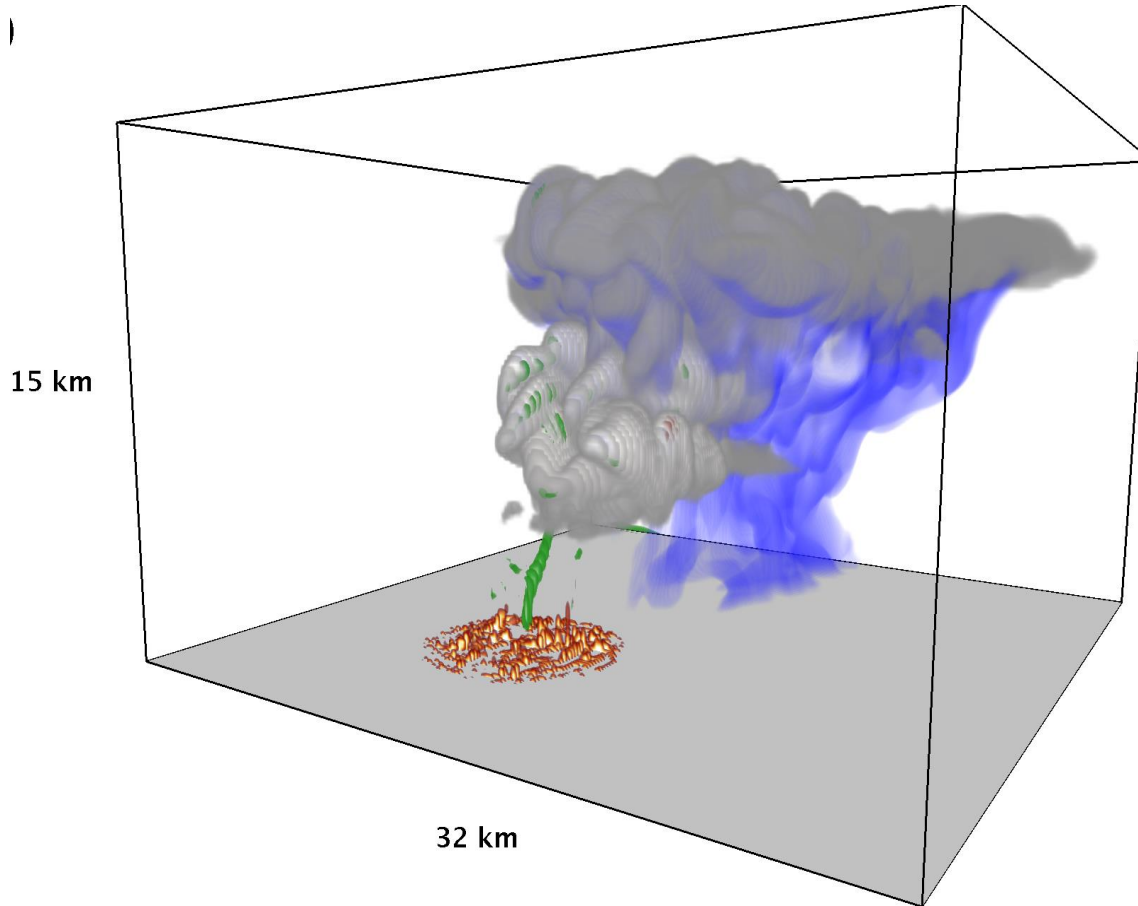


Technical
demands



Computer cost of our codes

Resolution is not a luxury...



The data problem

6th assessment
2020

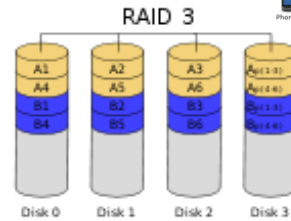
5th assessment
2013

4th assessment
2007

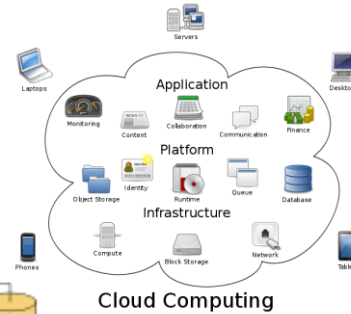
3rd assessment
2001



50 gigabytes



35 terabytes



20 petabytes



?? exabytes

Outcomes!

ACCESS

- A collaborative tool
- Under svn
- Co-supported
- CoE/BoM/CSIRO PhDs
- Shared research(ers)

CMIP-5

- A collaborative data set
- Co-supported
- Shared analyses
- CoE/BoM/CSIRO PhDs
- Shared research(ers)

NCI is our CERN, or SKA

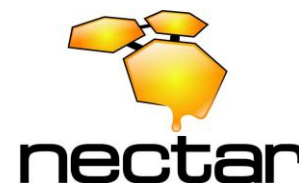
NCI drives collaboration
and efficiencies

NCI enables
transformative science



Major challenges

- Managing ~1 million lines of code requires:
 - Version and release control
 - Software standards
 - Benchmarking
 - Major cultural change
- Managing ~10 Pb data requires:
 - Version and release control
 - Format standards
 - Benchmarking
 - Discoverability, citation



Innovative environments

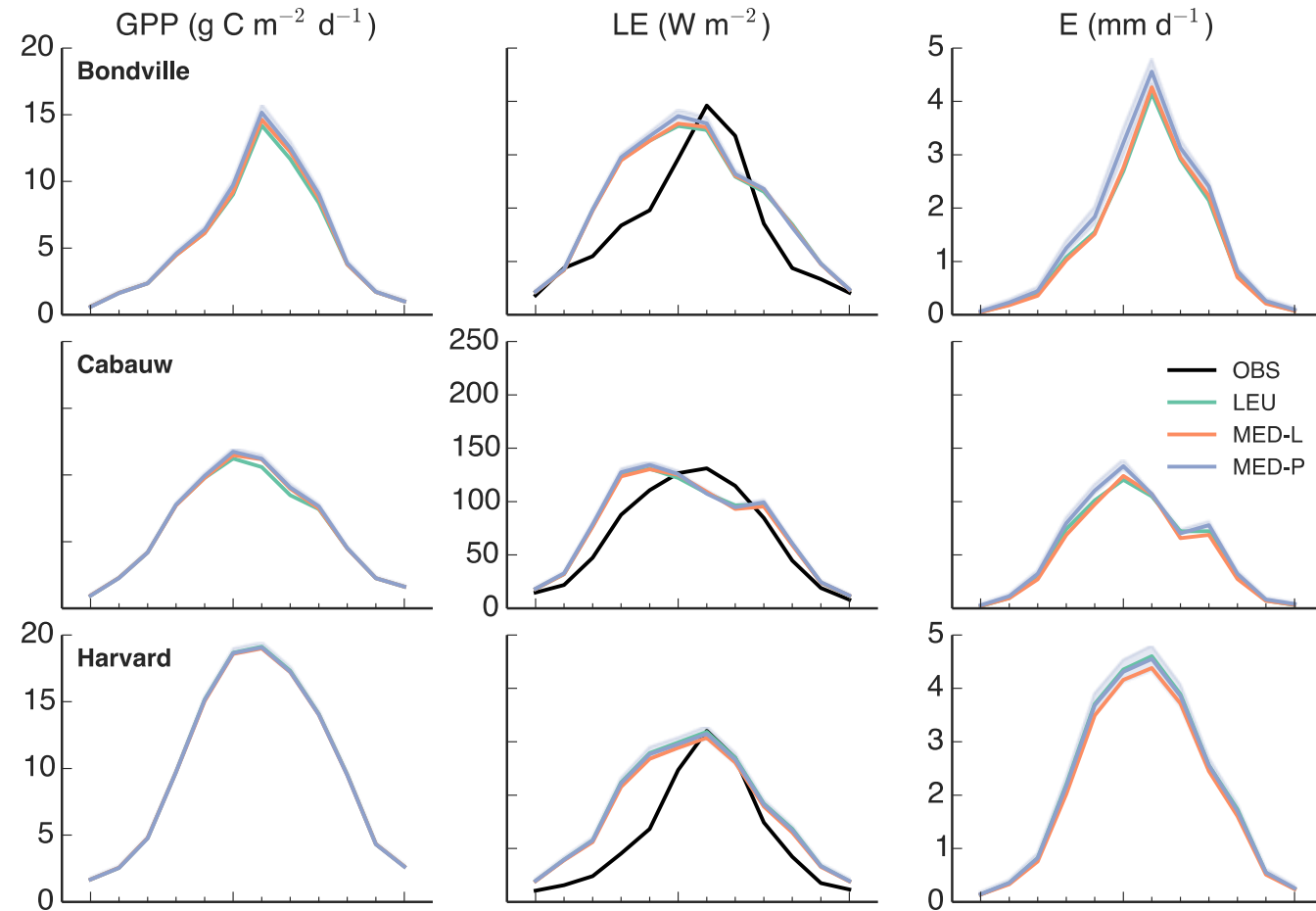
- Shared Science Teams
 - CSIRO, BoM, ARCCSS
- Science Technical Teams
 - CSIRO, BoM, ARCCSS
- Shared development environments
 - NCI, Git, svn, documentation, tools ...



Outline

- Experience from Climate System Science
- Examples from land surface science
 - An innovative environment for CABLE
- Lessons learned

CABLE at point scales, uncoupled



- At single sites
- Using PALS
- Using Fluxnet

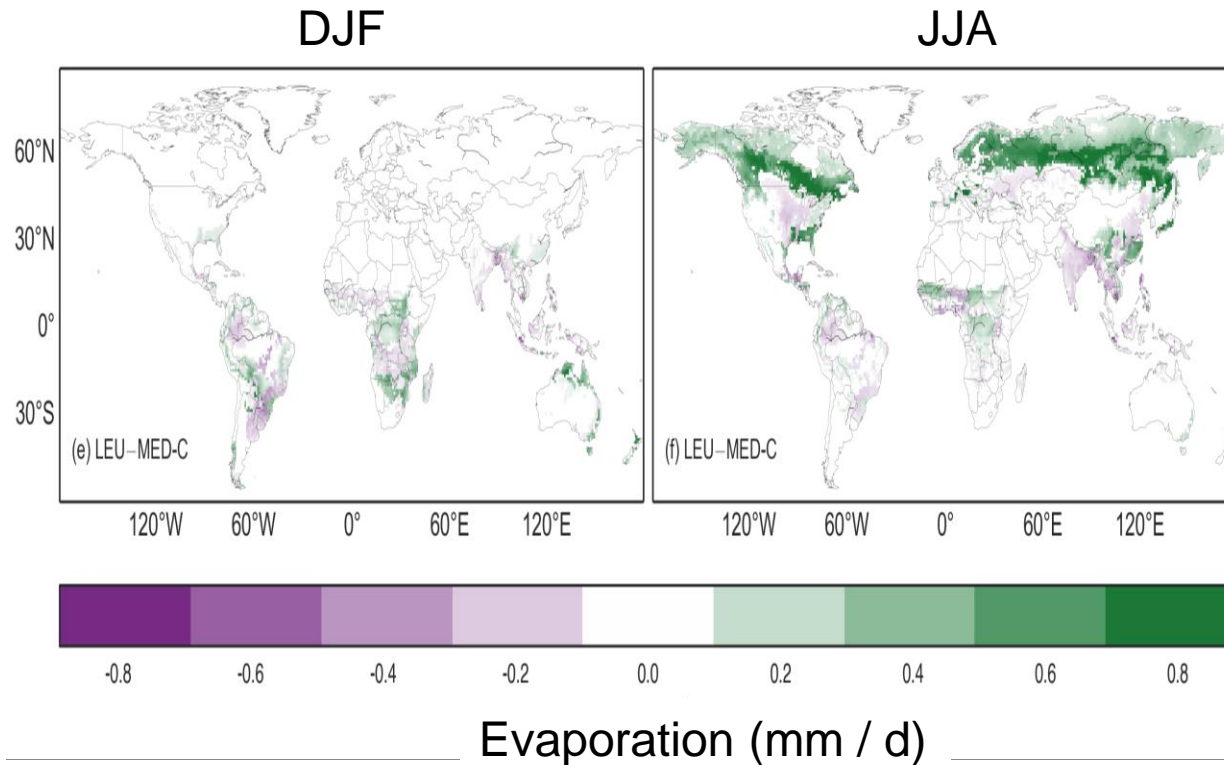
Single sites:

Necessary but
insufficient

<http://www.pals.unsw.edu.au>

De Kauwe et al. (2014), Geosci. Model Dev.
Discuss., 7, 6845-6891

CABLE at global scales, uncoupled



Global offline

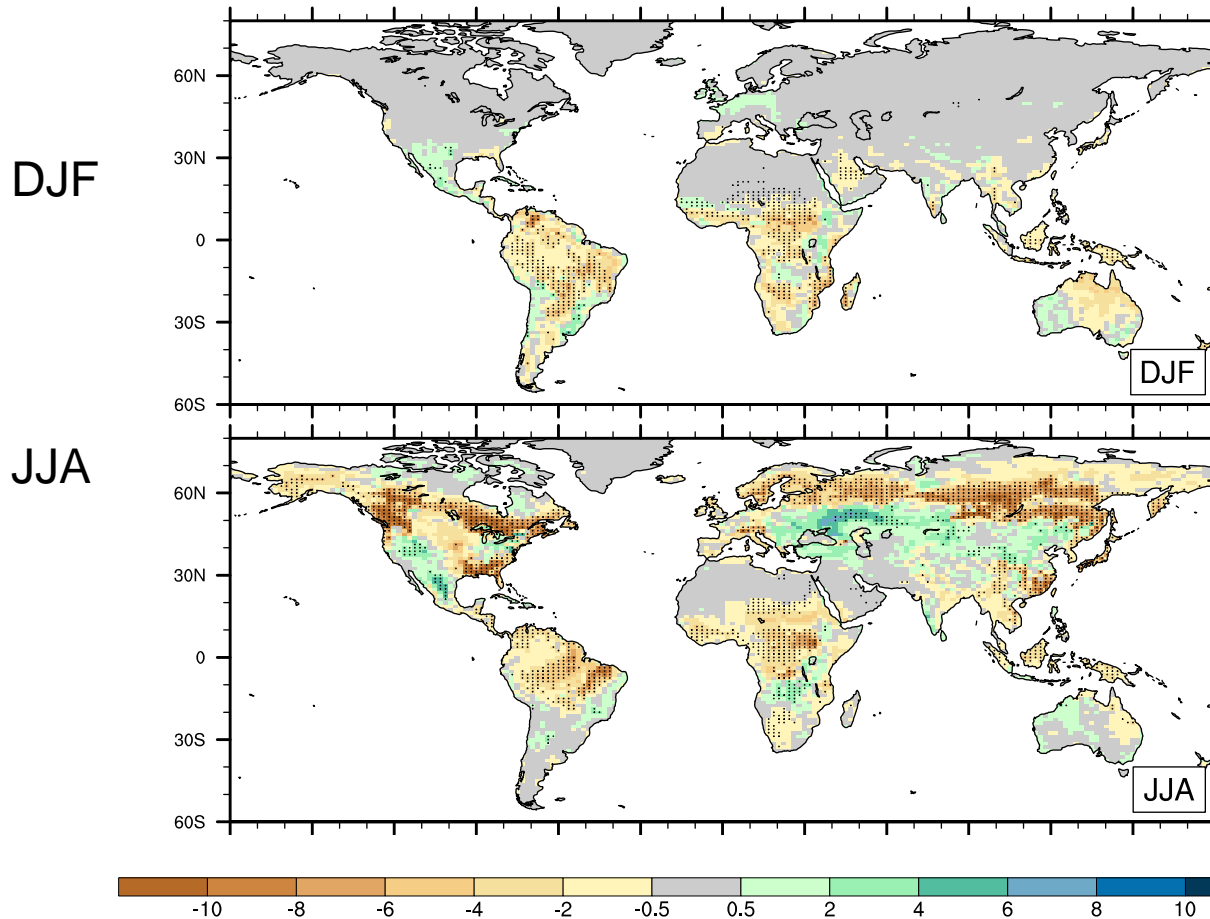
Using GSWP

Global offline:

**Necessary but
insufficient**

De Kauwe et al. (2014), Geosci. Model Dev.
Discuss., 7, 6845-6891

CABLE at global scales, in ACCESS



Global coupled:

Necessary but
insufficient

Kala et al. In prep.

An innovative CABLE laboratory

	Uncoupled	Coupled
Spatial scale	Global ✓	Global ✓
	Continental ✓	Continental
	Catchment ✓	Catchment
	Point ✓	Point X

- All with same versions of CABLE ? Emerging
- Point / coupled – ACCESS SCM emerging

An innovative CABLE laboratory

	Uncoupled	Coupled
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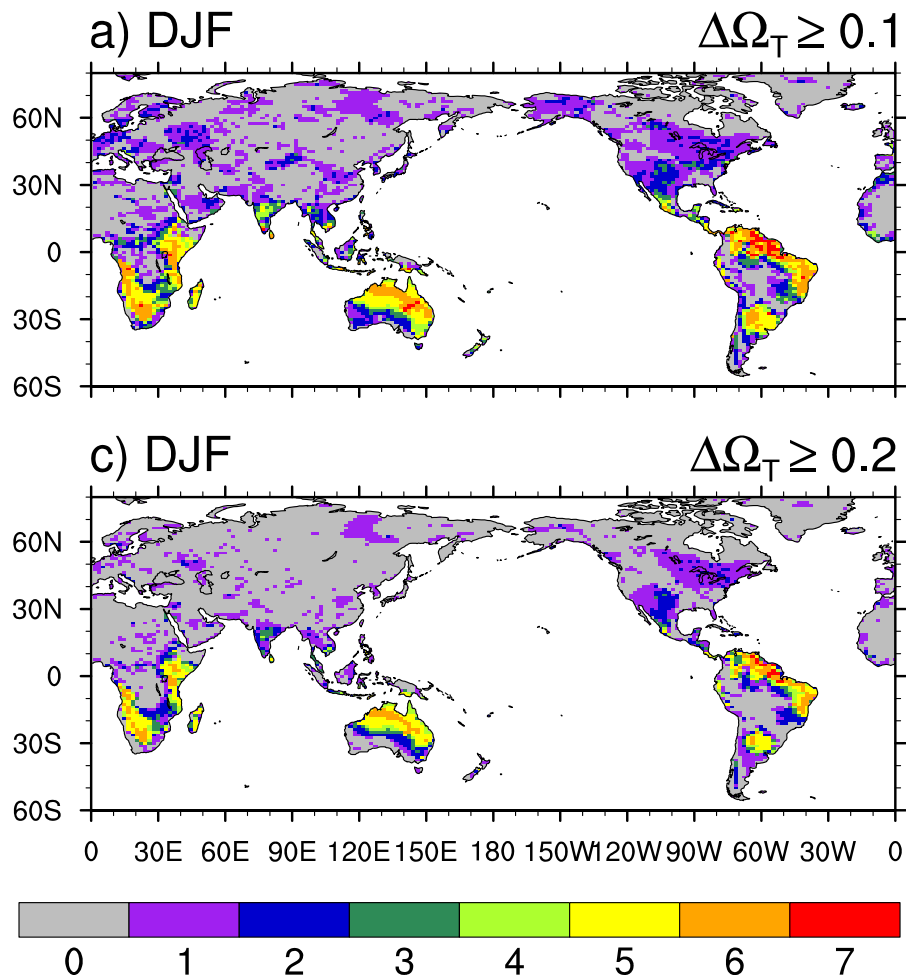
An innovative CABLE laboratory

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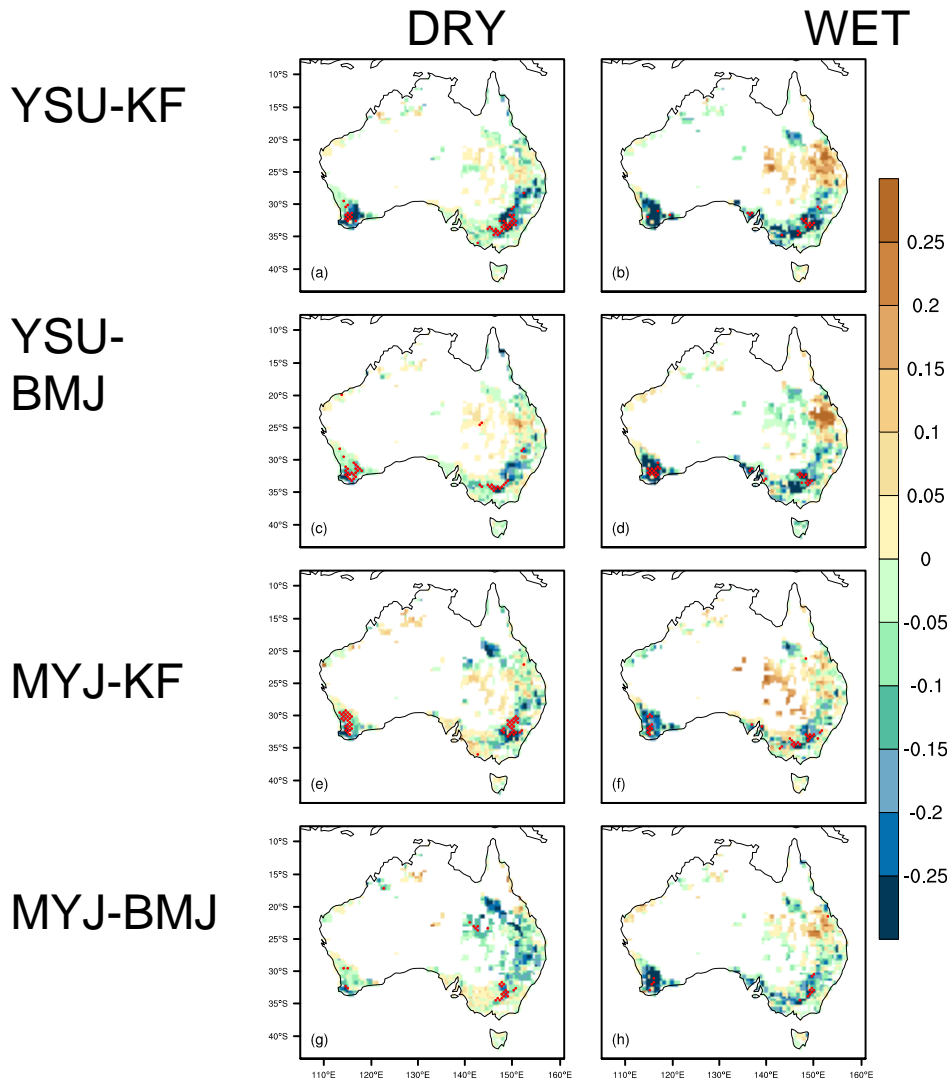
Land-atmosphere coupling metrics agreement

Coupling metrics agreement in DJF



- ACCESS-based
- GLACE-1
- GLACE-CMIP5
- 7 coupling metrics

$\Delta\Omega_{TMAX}$ (PRESENT minus NATIVE)



Impact of LULCC on maximum temperatures is dependent on choice of PBL and convection scheme

Outline

- Experience from Climate System Science
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Lessons learned – the need

- Organization
- Scale
- Collaboration
- Technical support
- Money
- Leadership
- Longer term perspective

Lessons learned - impediments

- Institutional competition
- “its easier for me if I ...”
- “the overheads are too high”
- “its hard to learn new ways to collaborate”
- Money
- ARC rules around collaboration
- ARC rules around software systems
- Profoundly different Uni, CSIRO, BoM culture



Lessons learned – ways forward

- A community will succeed if they:
 - Recognize individual needs in a culture of collaboration
 - Plan collaboratively
 - Appreciate cultural differences
 - Utilize 21st century tools and techniques
- I do not believe individual groups can now sustain capacities in our areas of science

Creating an environment for innovation [in water]

Water science needs a plan.

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