# CESM-SCM
Single Column Atmosphere Model (SCAM)

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On behalf of the SCAM development team

Gettelman, A., Truesdale, J. E., Bacmeister, J. T., Caldwell, P. M., Neale, R. B., Bogenschutz, P. A., & Simpson, I. R. (2019) , The Single Column Atmosphere Model version 6 (SCAM6): Not a SCAM but a tool for model evaluation and development, JAMES, 11. https://doi.org/10.1029/2018MS001578

Features/Structure

ARM-SGP

SCAM6 ~ CAM6
(Cloud Fraction)
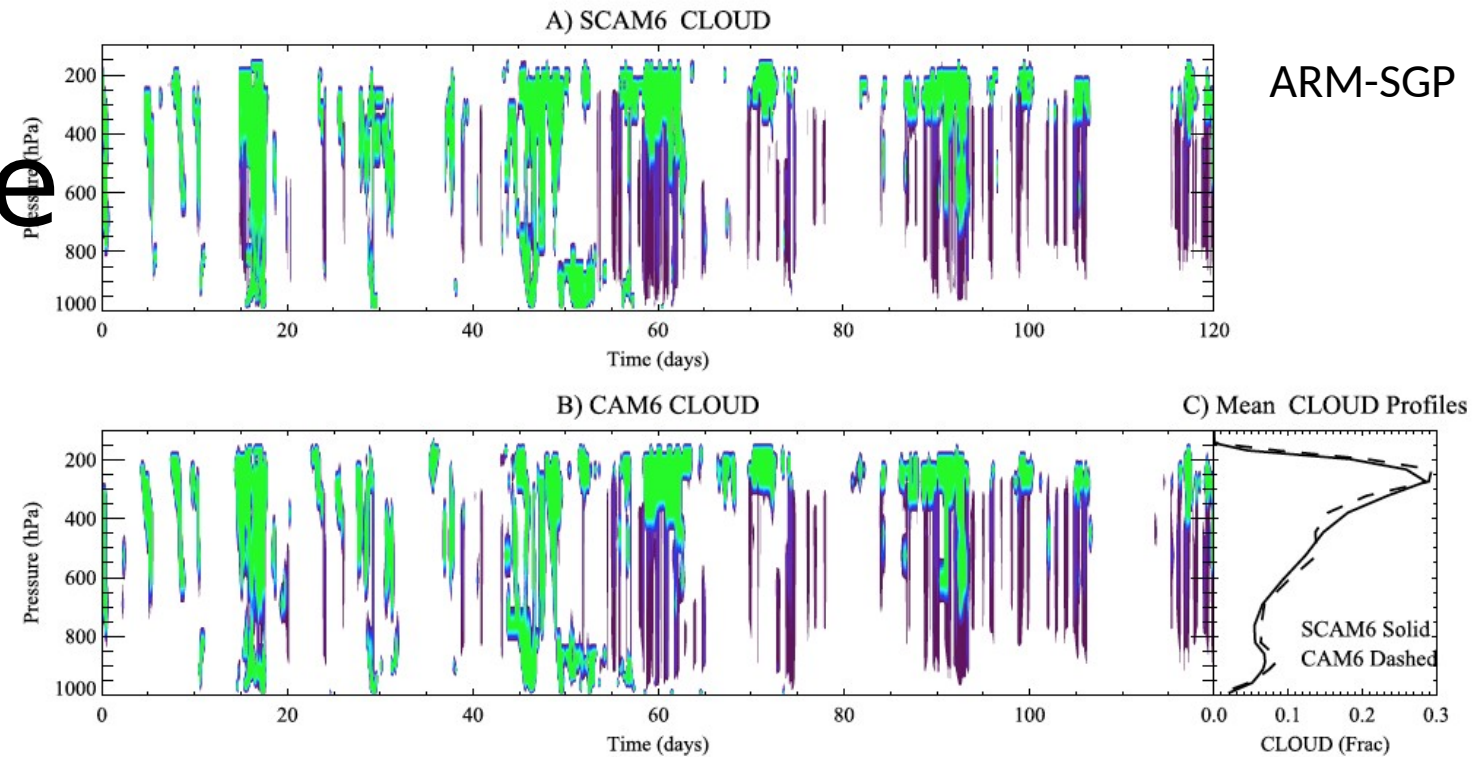
- Exact code used in GCM: SCM a Flag in the ESM build process
  - Good tool for model development
  - Can generate forcing with any configuration of the full model (simplified ⇆ complex)
- Not BFB with full model: slight differences in dynamical forcing
- Runs with land model (single point). Slab/Mixed Layer Ocean nearly done.
- Output: CF-like netCDF file (proper time indexing, etc)
- SCM runs in a Docker container through jupyter
- Several active users/developers (NCAR + community): tends to be 'project' driven
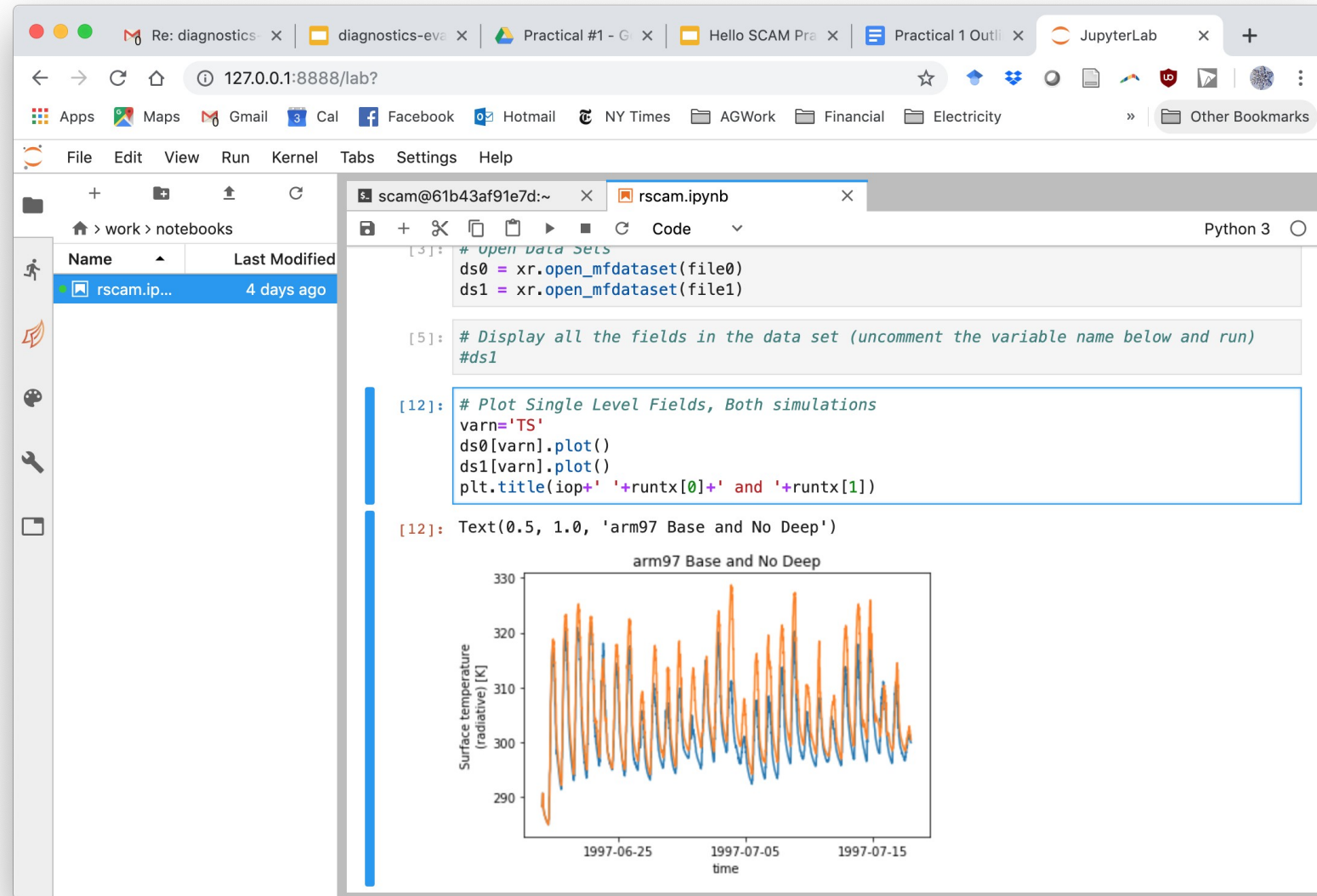
An ESM in a container, using an SCM…
Search: 'CAM6 Tutorial'

- Docker container version of CESM2

- Install on Mac, Linux & Windows

- Configured for SCM (SCAM6)

- Runs full CESM code locally

  - *Jupyter Lab* Interactive Development Environment

  - Build, compile, run

  - Scripts and analysis code

- Comes with tutorial exercises

http://www.cesm.ucar.edu/models/cesm2/atmosphere/CAM6tutorial/

SCAM Use Cases

- Physics development and testing

- Physical exploration against observations for fixed sites
    - Use nudging for Aircraft, Satellites (moving platforms)

- Comparison to LES:
    - Starting to unify aspects of SCM/LES and observational analysis
    - Co-designed 'SAS' case (dry PBL over land with chemistry)

- Education: Tutorials/Demonstrations

SCAM Cases

In development: RCE

List of Single Column Atmosphere Model Intensive Observation Period Cases

Name	Long name	Lat	Lon	Date	Length	Reference	Type
arm95	ARM Southern Great Plains	36	263	Jul 1995	18	M. Zhang et al. (2016)	Land convection
arm97	ARM Southern Great Plains	36	263	Jun 1997	30	M. Zhang et al. (2016)	Land convection
atex	Atlantic Trade Wind Exp	15	345	Feb 1969	2	Augstein et al. (1973)	Shallow cumulus
bomex	Barbados Ocean and Met Exp	15	300	Jun 1969	5	Holland and Rasmusson (1973)	Shallow cumulus
cgilsS12	CFMIP-GASS SCM/LES Intercomp	35	235	Jul 1997	30	M. Zhang et al. (2013)	Stratus
cgilsS11	CFMIP-GASS SCM/LES Intercomp	32	231	Jul 1997	30	M. Zhang et al. (2013)	Stratocumulus
cgilsS6	CFMIP-GASS SCM/LES Intercomp	17	211	Jul 1997	30	M. Zhang et al. (2013)	Shallow cumulus
dycomsRF02	Dynamics of Marine StratoCu	32	239	Jul 11 2001	2	Stevens et al. (2003)	Stratocumulus
dycomsRF01	Dynamics of Marine StratoCu	32	239	Jul 15 2001	2	Stevens et al. (2003)	Stratocumulus
gateIII	GATE Phase III	9	336	Aug 1974	20	Thompson et al. (1979)	Tropical convection
mpace	Mixed Phase Arctic Clouds Exp	71	206	Oct 2004	17	Verlinde et al. (2007)	Arctic
rico	Rain and Cumulus over Oceans	18	299	Dec 2004	3	Rauber et al. (2007)	Shallow cumulus
sparticus	Small Particles in Cirrus	37	263	Apr 2010	30	Mace et al. (2009)	Cirrus, convection
twp06	Tropical W. Pacific Convection	-12	131	Jan 2006	26	May et al. (2008)	Tropical convection
togaII	Tropical Ocean Global Atmosphere	-2	154	Dec 1992	21	Webster and Lukas (1992)	Tropical convection

Note. Length is given in days. ARM = Atmospheric Radiation Measurement; GASS = Global Atmospheric System Studies; SCM = Single Column Model; LES = Large Eddy Simulation

Custom Cases

- Generate forcing easily from a GCM experiment

- Debugging (but not BFB)

- Detailed comparisons to observations
    - any time and place with nudging
    - usually do this by interpolating analysis/model data to CAM vertical levels

Future work

- RCE Case

- Parameterization of the large scale circulation

- Further development of near surface obs networks for flux co-variances to inform SCMs/LES

Initial Comments on Proposal

- Forcing: We would likely write a script to convert proposed format to what our model needs as a forcing file
  - Could a jupyter notebook be provided that reads in the file?
  - That would help model groups deal with it (we can write an output component)
  - Could collect code to convert…
  - We ship output forcing with the code, so could include cases in subsequent releases
- Output:
  - SCAM uses CESM2 (ESM) I/O structures
  - Our output would continue to be our 'CF like' output: CF compliant time variables, but without standard names (historical and shorter internal names)
  - We have scripts to convert to standard names if desired (not on the fly)
- General comment: what is the intent of a common forcing?
  - For someone to run 5 SCMs themselves?
  - Or just to share cases to different communities?