visualCaseGen

A GUI for CESM Simpler Models Framework

Alper Altuntas, Scott Bachman, Isla Simpson, Brian Dobbins,
Bill Sacks, Mariana Vertenstein, Gokhan Danabasoglu

NCAR
UCAR

June 16, 2021 - CESM Workshop SEWG Meeting

Overview

Goals:

- Streamline coupled, simple modeling within CESM.
- Enable hierarchical modeling: Provide a user-friendly modeling framework allowing users to adjust the model complexity.

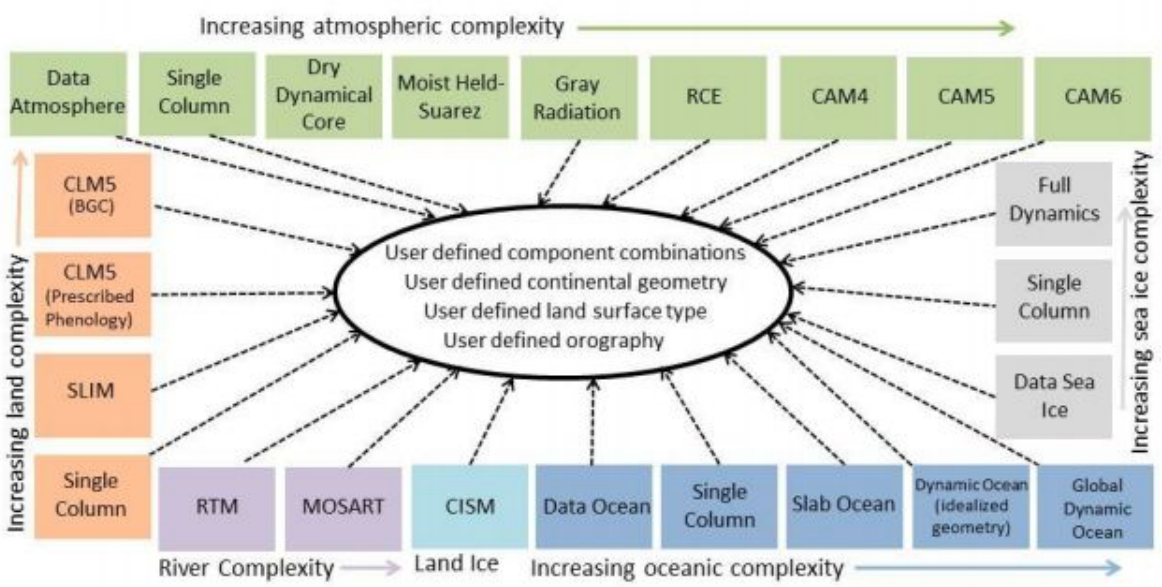
Tools:

- A new, relational metadata in CIME.
- A graphical user interface.
  * We also envision a broader utilization of these tools beyond simpler modeling.

Funded by an NSF CSSI award. (PIs: Bachman, Simpson)

A toolchain

- **query what's available:** Inform the users about available model options.
- **enable custom configurations:** Guide the users through many combinations of model configs that can be mixed and matched. Ensure consistency.



Bachman, Simpson, et al.

New metadata in CIME: config_comply.yml

Goal:

- Express relatively complex interdependencies and incompatibilities between different options (`OCN_GRID, COMP_ATM, DATM_MODE`, etc.)
- Concise and highly expressive syntax: support arbitrary expressions.

Infrastructure:

- File format: yaml
- Syntax: Python assertions including literals, operators, and CIME vars.
- Parser: a Python module integrated into CIME.
- Evaluator: a lightweight, purpose-built logic solver within the GUI.

config_comply.yml

```
- assert not ($COMP_ATM=="cam") or ($COMP_ICE !="dice"),
    "CAM cannot be coupled with Data ICE"

- assert not ($COMP_OCN=="mom") or ($COMP_LND != "slnd" or $COMP_ICE != "sice"),
    "LND or ICE must be present to hide MOM6 grid poles."

- assert not ($COMP_OCN in ["pop","mom"] and $COMP_ATM=="datm") or ($COMP_LND=="slnd"),
    "When MOM|POP is forced with DATM, LND must be stub."
```

visualCaseGen: A GUI for CESM Simpler Models Framework

Purpose:

- Guide the users through the process of creating CESM cases: choosing appropriate compsets and grids.

Infrastructure:

- Jupyter & ipywidgets: portable and widespread.
- The GUI will run on clusters, local machines, cloud, and web
- Python/Jupyter familiarity is not required.

Disclaimer:

- A prototype with some key features not yet finalized.

Live demo …

***see appendix for screenshots**

Remarks

Near-term goals:

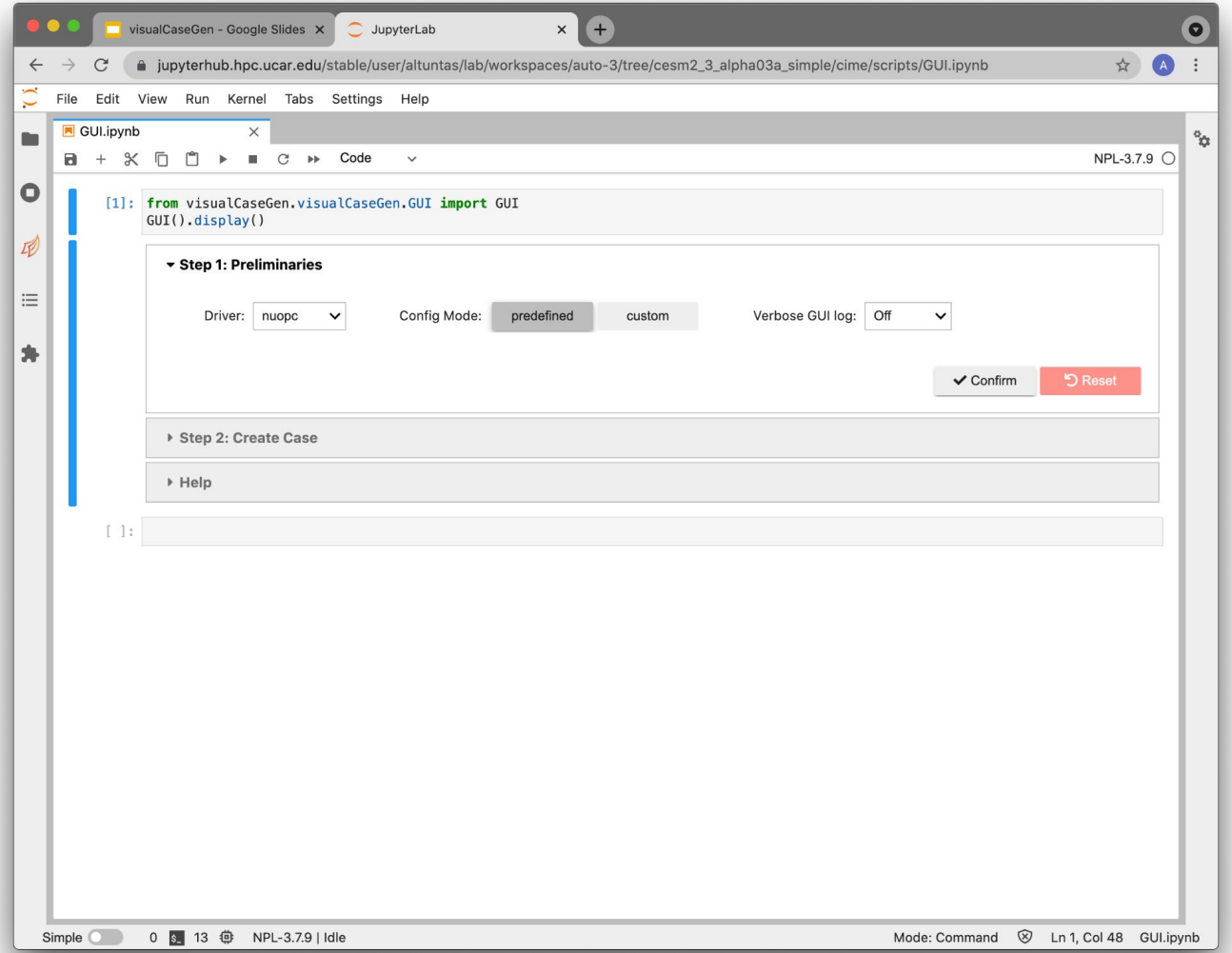
- Improve and expand metadata.
- More features, e.g., custom grids.
- More guidance. Compset names may still appear cryptic.
- Establish automated testing.
- Explore alternative logic solvers, e.g. SMT solvers.
- A stable release for early users.

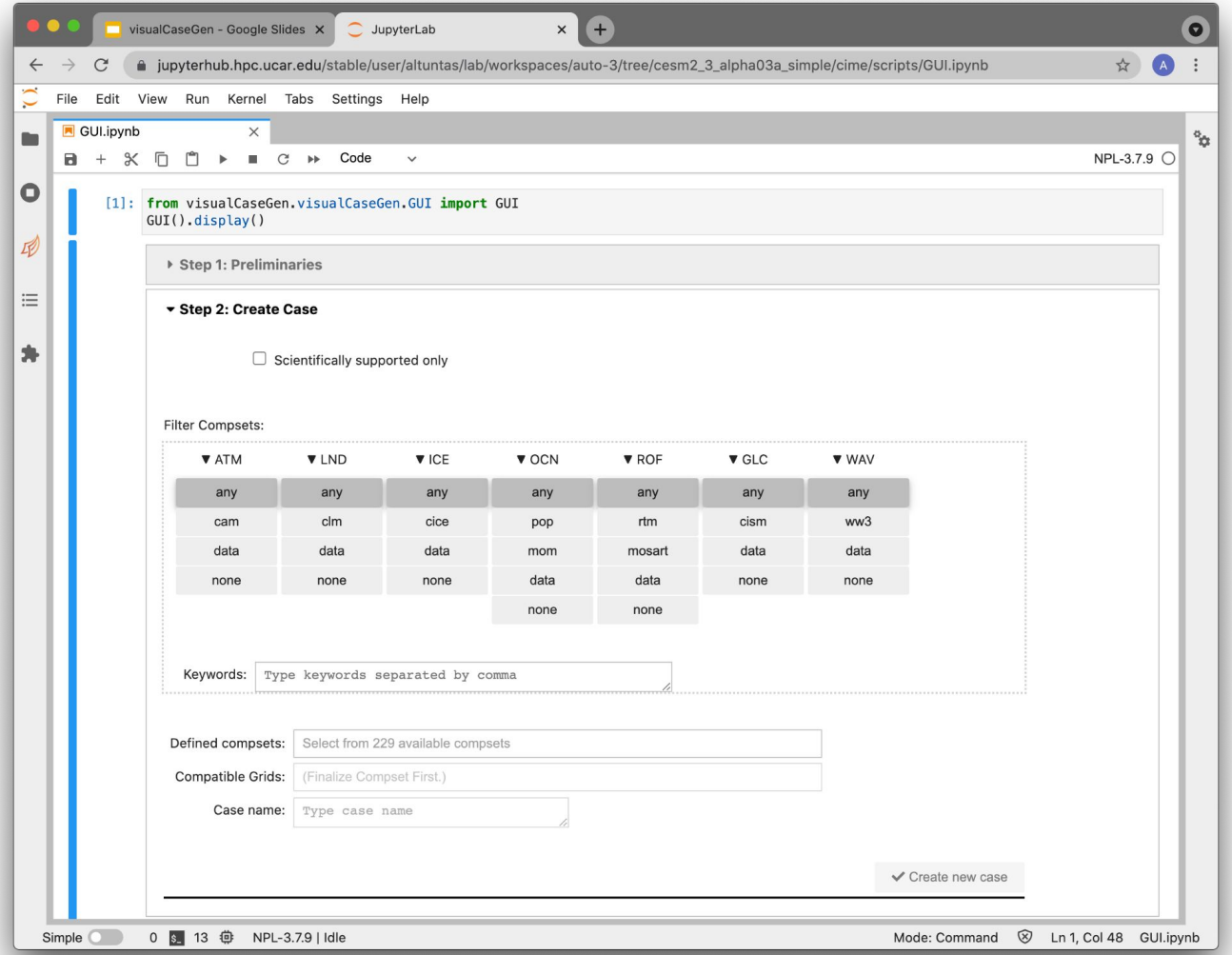
The tool is publicly available:

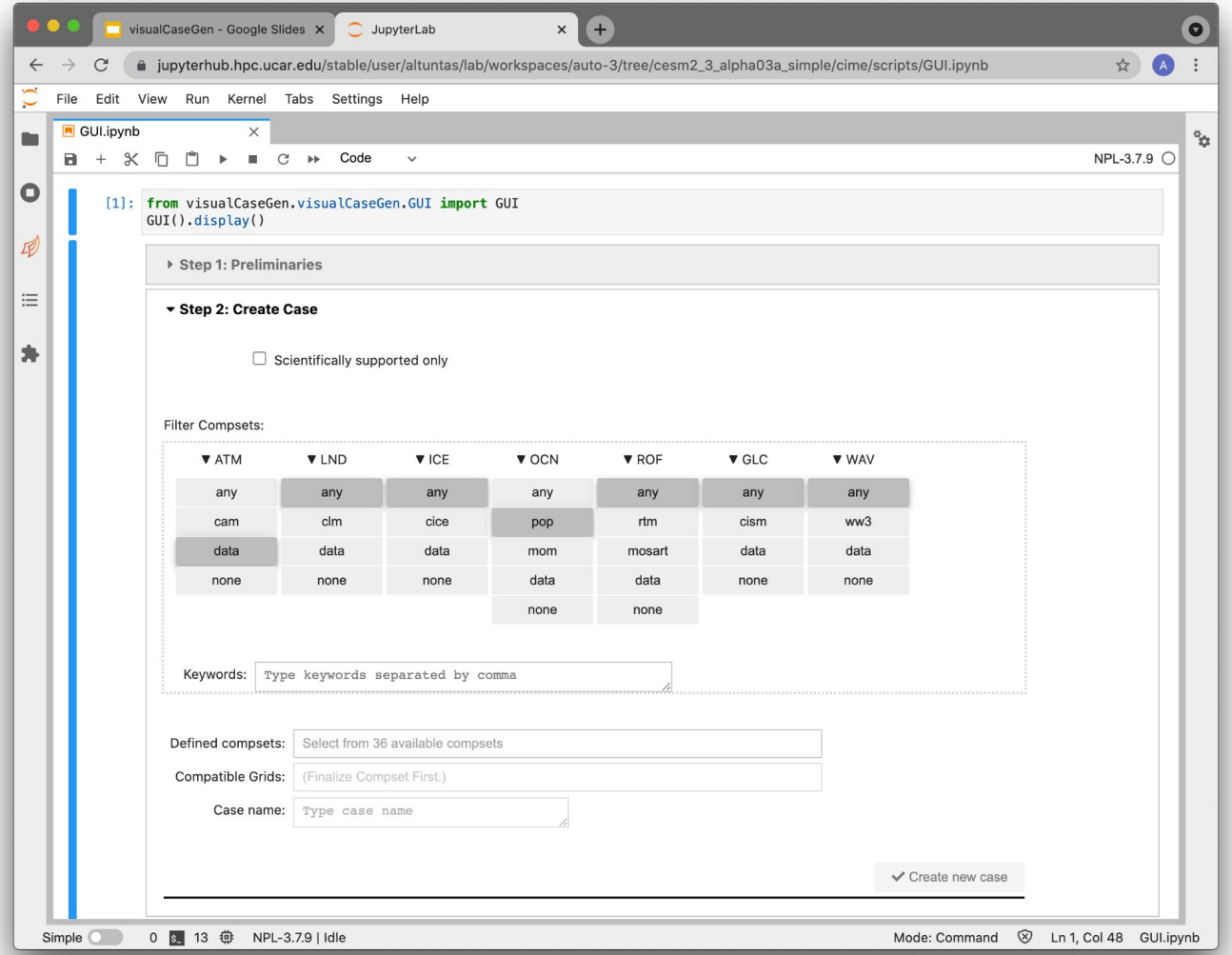
github.com/ESMCI/visualCaseGen

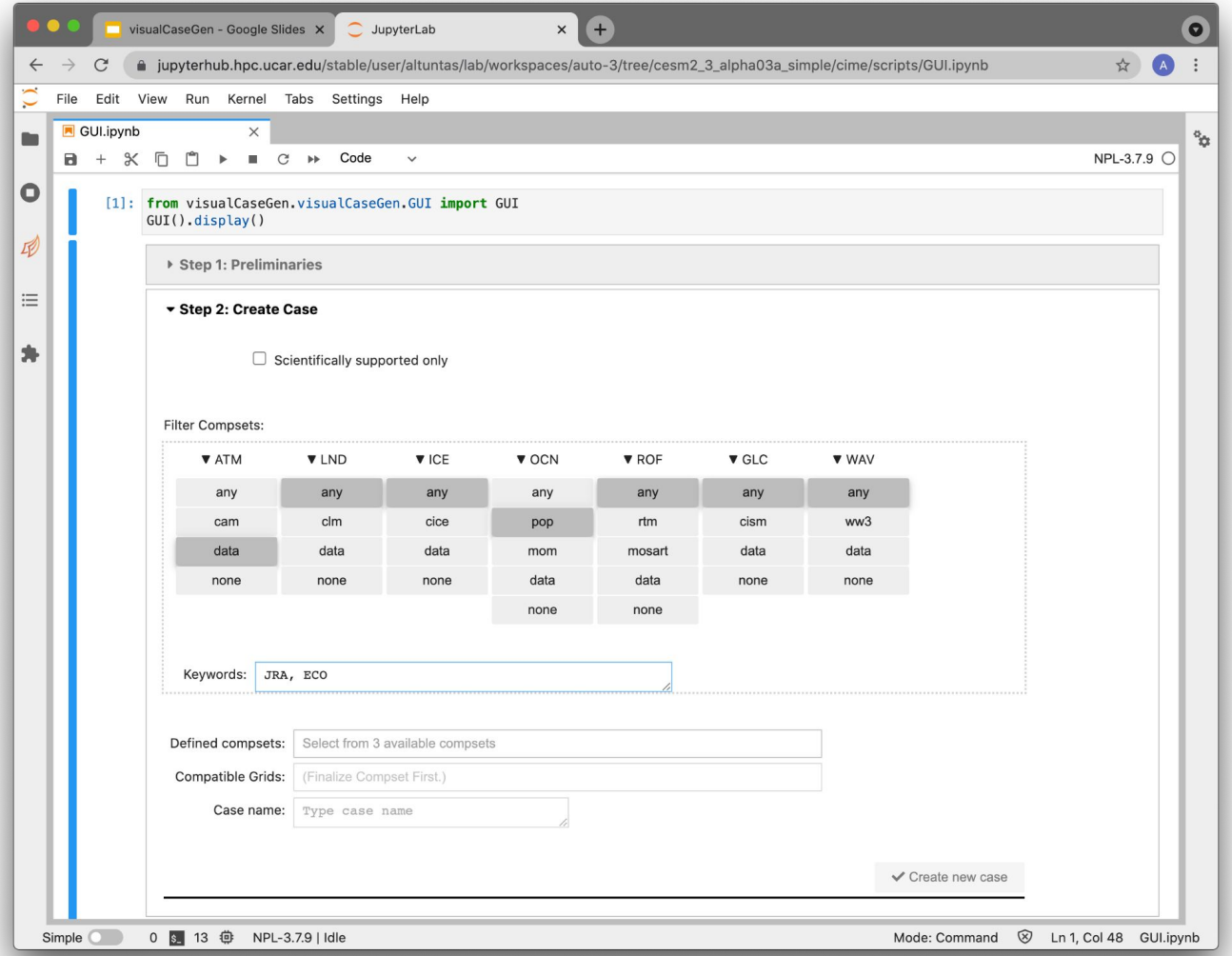
altuntas@ucar.edu

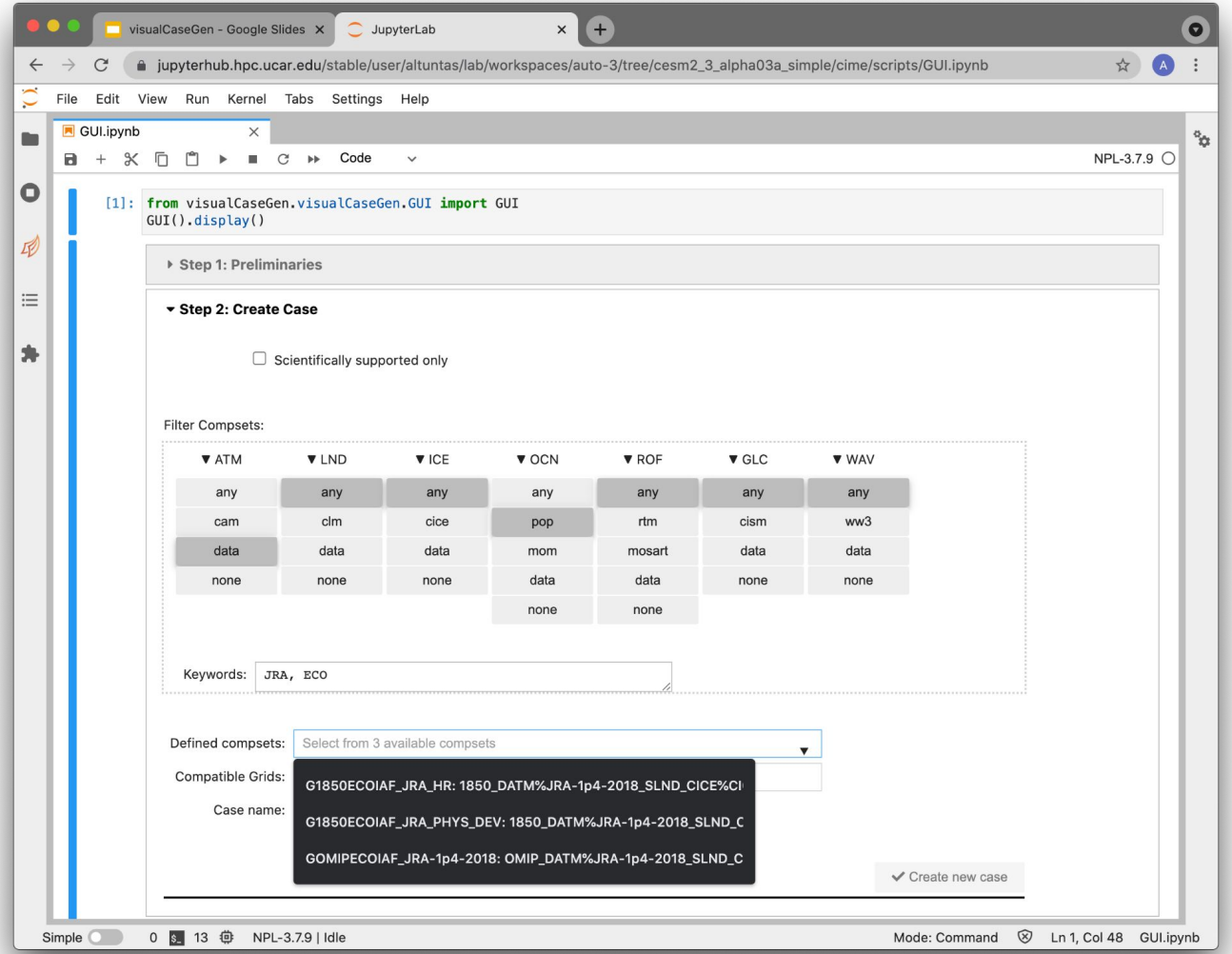
appendix

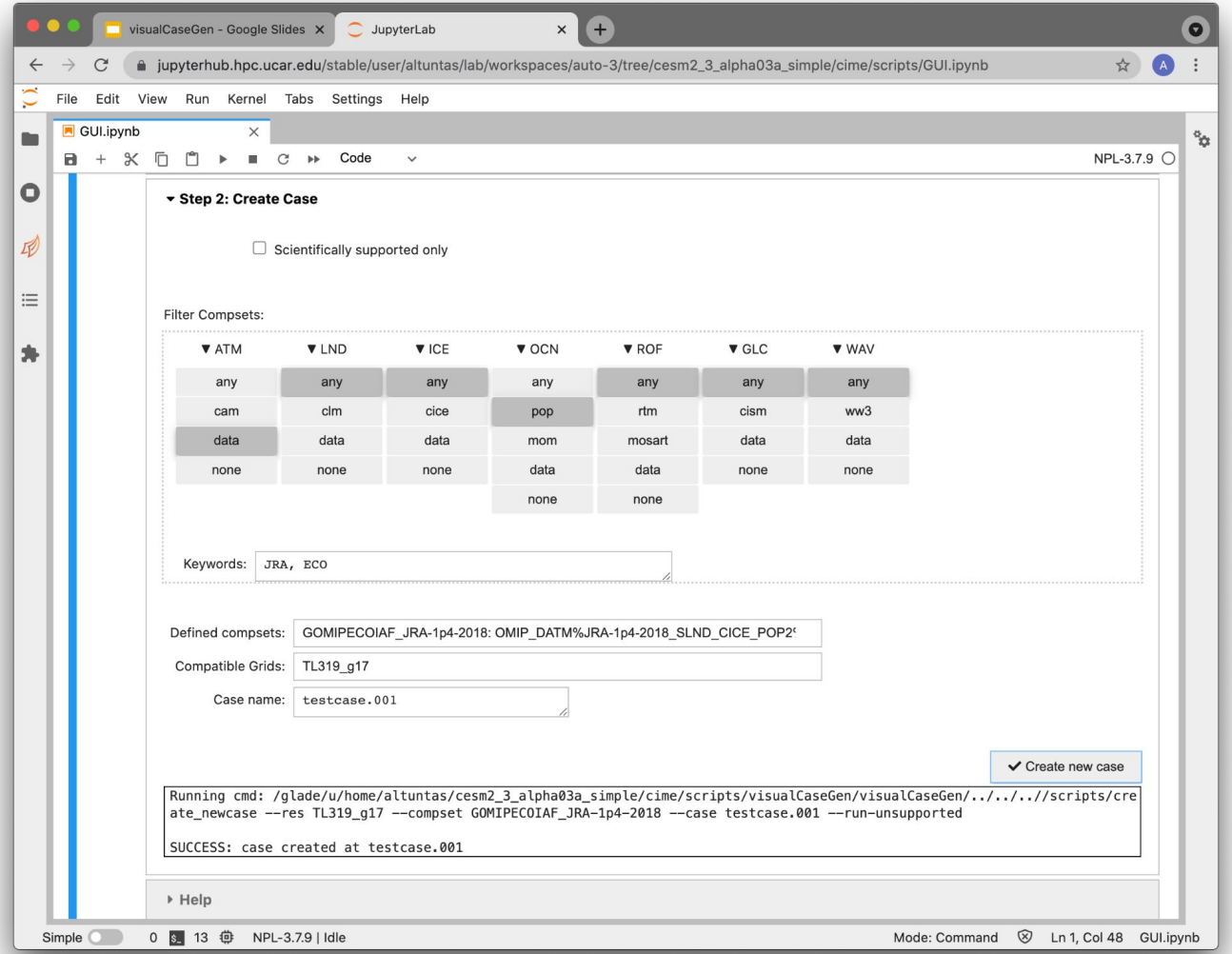

visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
[1]:
from visualCaseGen.visualCaseGen.GUI import GUI
GUI().display()
Step 1: Preliminaries
Driver: nuopc
Config Mode: predefined custom
Verbose GUI log: Off
Confirm
Reset
Step 2: Create Case
Help
[ ]:
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb

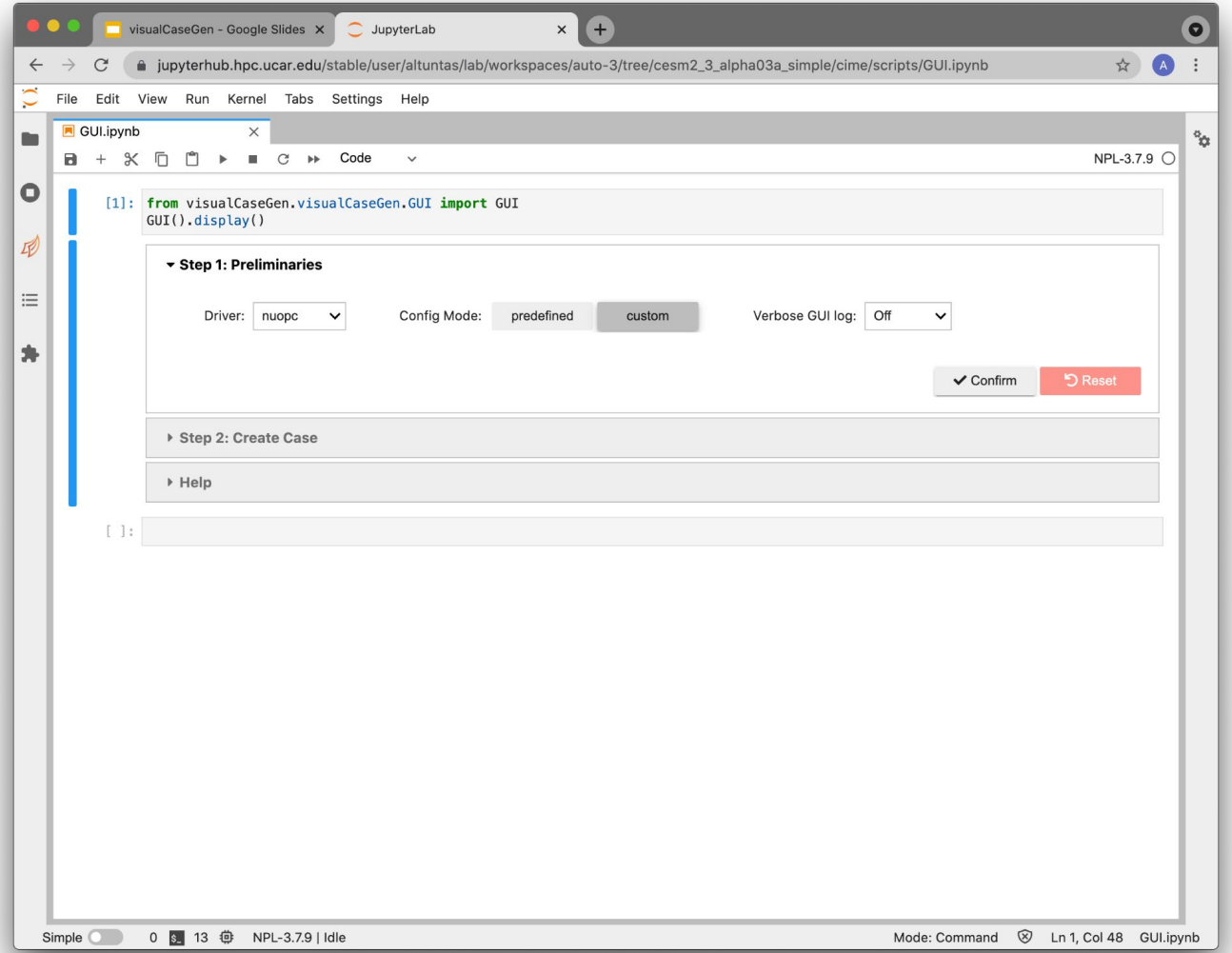

visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
[1]:
from visualCaseGen.visualCaseGen.GUI import GUI
GUI().display()
Step 1: Preliminaries
Step 2: Create Case
Scientifically supported only
Filter Compsets:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
any any any any any any any
cam clm cice pop rtm cism ww3
data data data mom mosart data data
none none none data data none none
none none
Keywords:
Type keywords separated by comma
Defined compsets:
Select from 229 available compsets
Compatible Grids:
(Finalize Compset First.)
Case name:
Type case name
Create new case
Simple
0 13
NPL-3.7.9 | Idle
Mode: Command
Ln 1, Col 48
GUI.ipynb

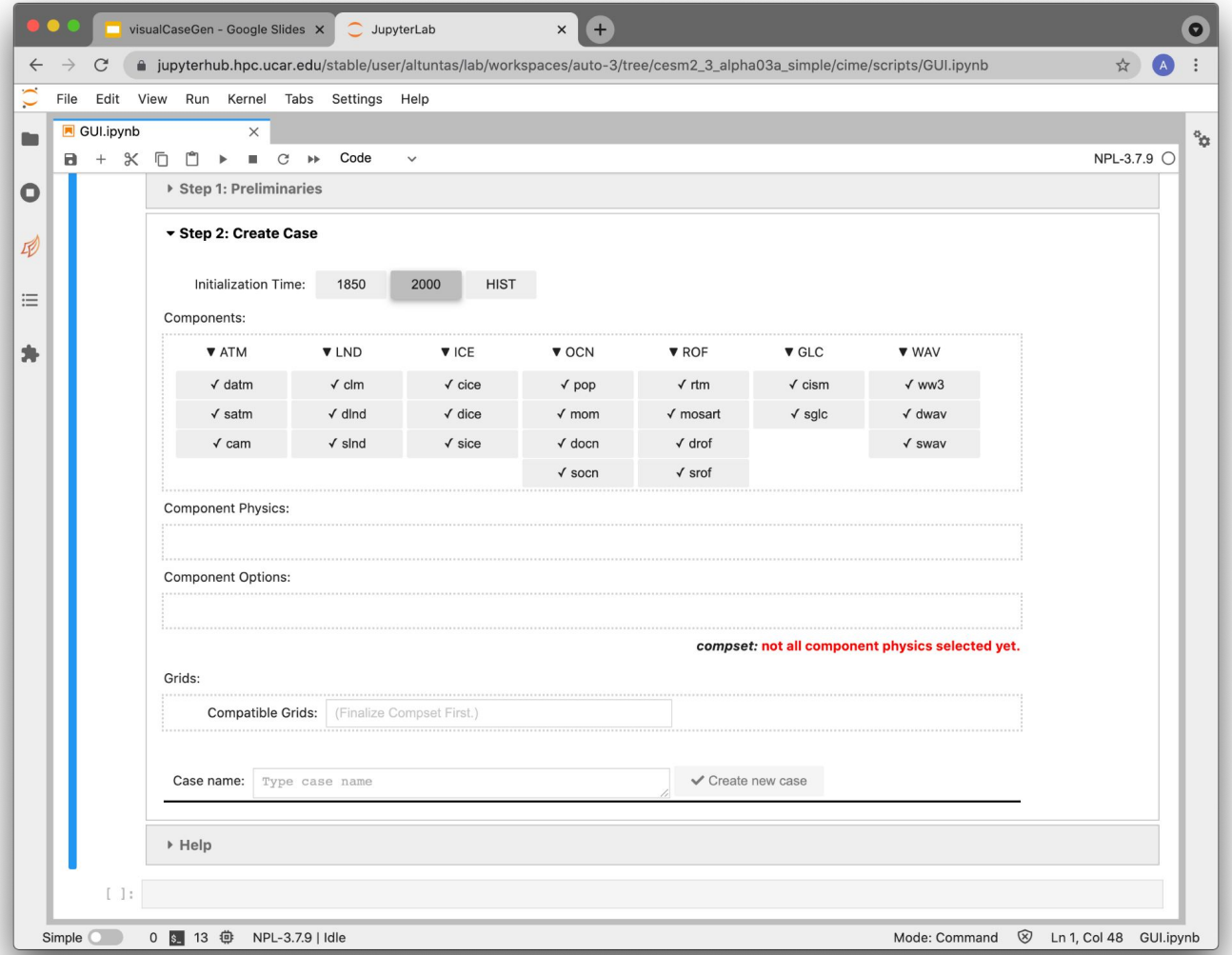

visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
[1]:
from visualCaseGen.visualCaseGen.GUI import GUI
GUI().display()
Step 1: Preliminaries
Step 2: Create Case
Scientifically supported only
Filter Compsets:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
any any any any any any any
cam clm cice pop rtm cism ww3
data data data mom mosart data data
none none none data data none none
none none
Keywords:
Type keywords separated by comma
Defined compsets:
Select from 36 available compsets
Compatible Grids:
(Finalize Compset First.)
Case name:
Type case name
Create new case
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb

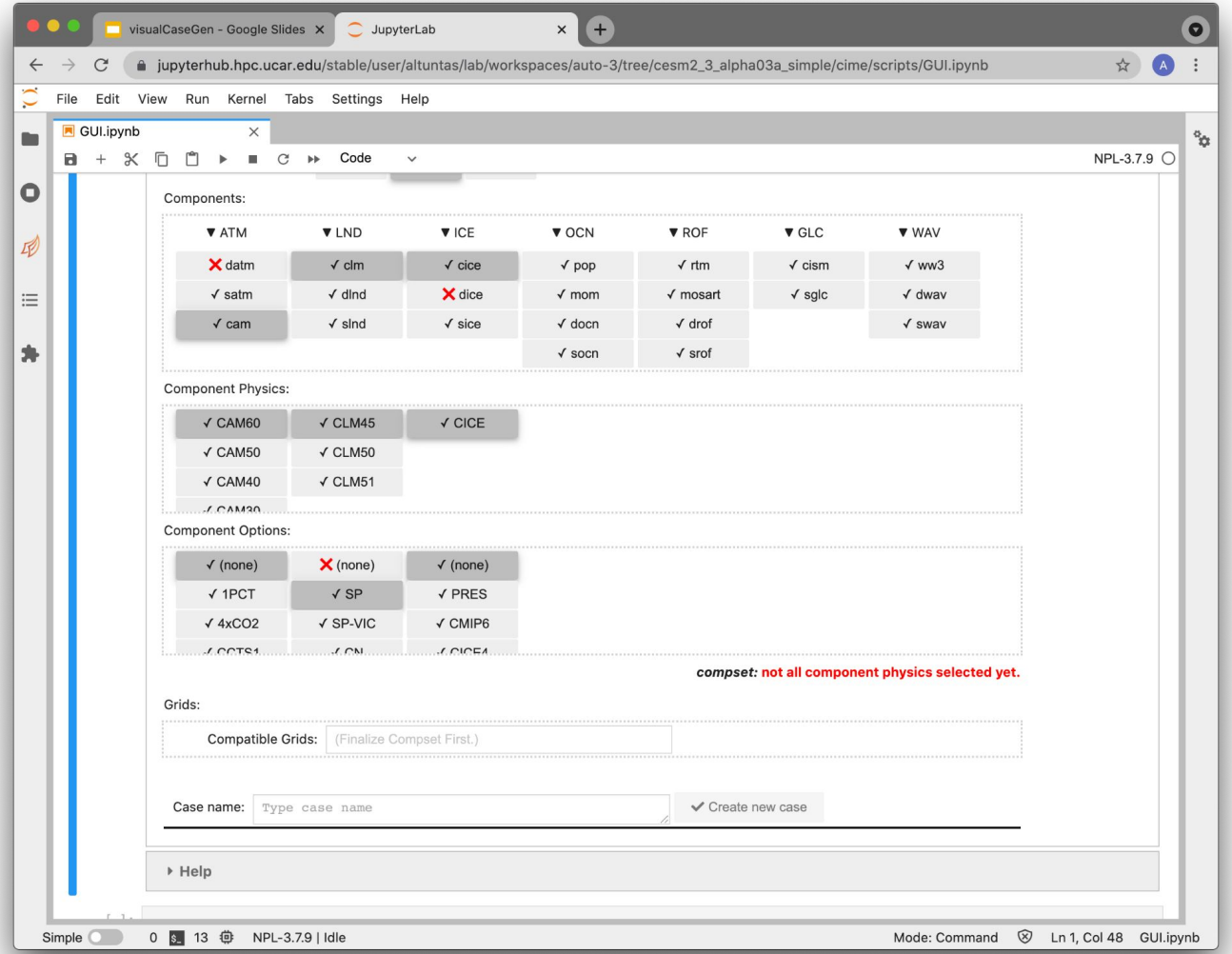

visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
[1]:
from visualCaseGen.visualCaseGen.GUI import GUI
GUI().display()
Step 1: Preliminaries
Step 2: Create Case
Scientifically supported only
Filter Compsets:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
any any any any any any any
cam clm cice pop rtm cism ww3
data data data mom mosart data data
none none none data data none none
none none
Keywords: JRA, ECO
Defined compsets: Select from 3 available compsets
Compatible Grids: (Finalize Compset First.)
Case name: Type case name
Create new case
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb

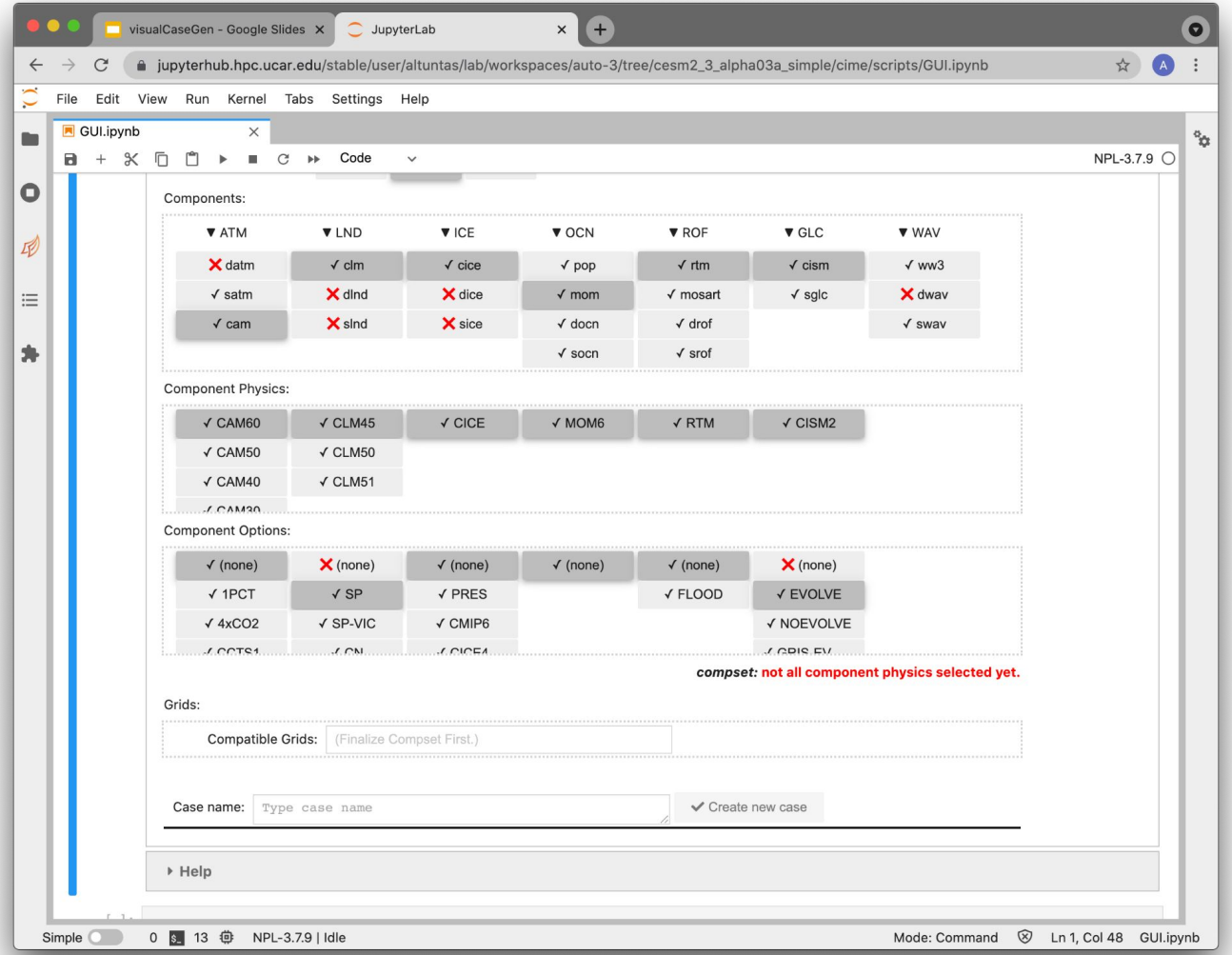

visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
[1]:
from visualCaseGen.visualCaseGen.GUI import GUI
GUI().display()
Step 1: Preliminaries
Step 2: Create Case
Scientifically supported only
Filter Compsets:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
any any any any any any any
cam clm cice pop rtm cism ww3
data data data mom mosart data data
none none none data data none none
none none
Keywords: JRA, ECO
Defined compsets: Select from 3 available compsets
Compatible Grids:
Case name:
G1850ECOIAF_JRA_HR: 1850_DATM%JRA-1p4-2018_SLND_CICE%CI
G1850ECOIAF_JRA_PHYS_DEV: 1850_DATM%JRA-1p4-2018_SLND_C
GOMIPECOIAF_JRA-1p4-2018: OMIP_DATM%JRA-1p4-2018_SLND_C
Create new case
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb

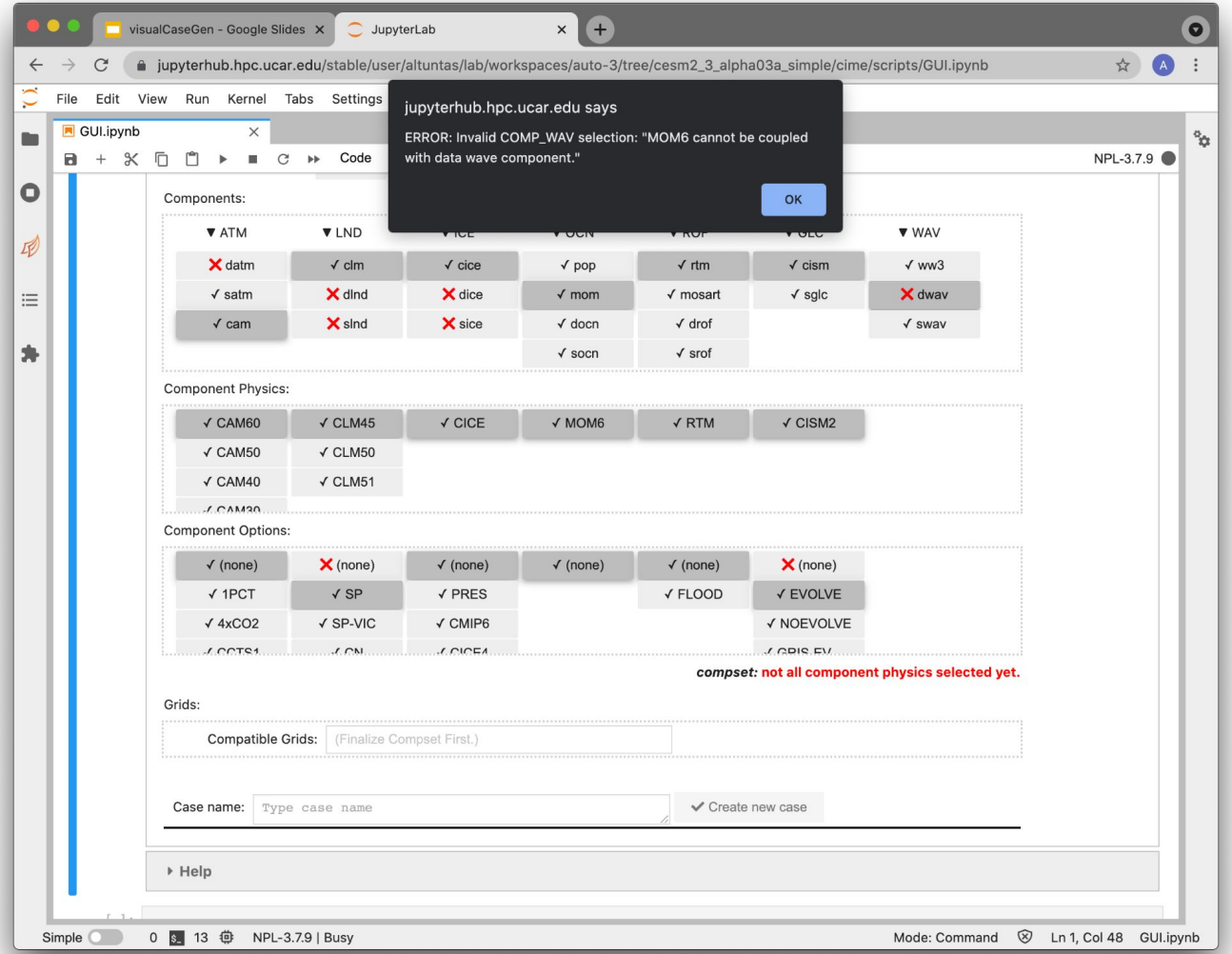

visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
Step 2: Create Case
Scientifically supported only
Filter Compsets:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
any any any any any any any
cam clm cice pop rtm cism ww3
data data data mom mosart data data
none none none data data none none
none none
Keywords: JRA, ECO
Defined compsets: GOMIPECOIAF_JRA-1p4-2018: OMIP_DATM%JRA-1p4-2018_SLND_CICE_POP2
Compatible Grids: TL319_g17
Case name: testcase.001
Create new case
Running cmd: /glade/u/home/altuntas/cesm2_3_alpha03a_simple/cime/scripts/visualCaseGen/visualCaseGen/../../..//scripts/create_newcase --res TL319_g17 --compset GOMIPECOIAF_JRA-1p4-2018 --case testcase.001 --run-unsupported
SUCCESS: case created at testcase.001
Help
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb

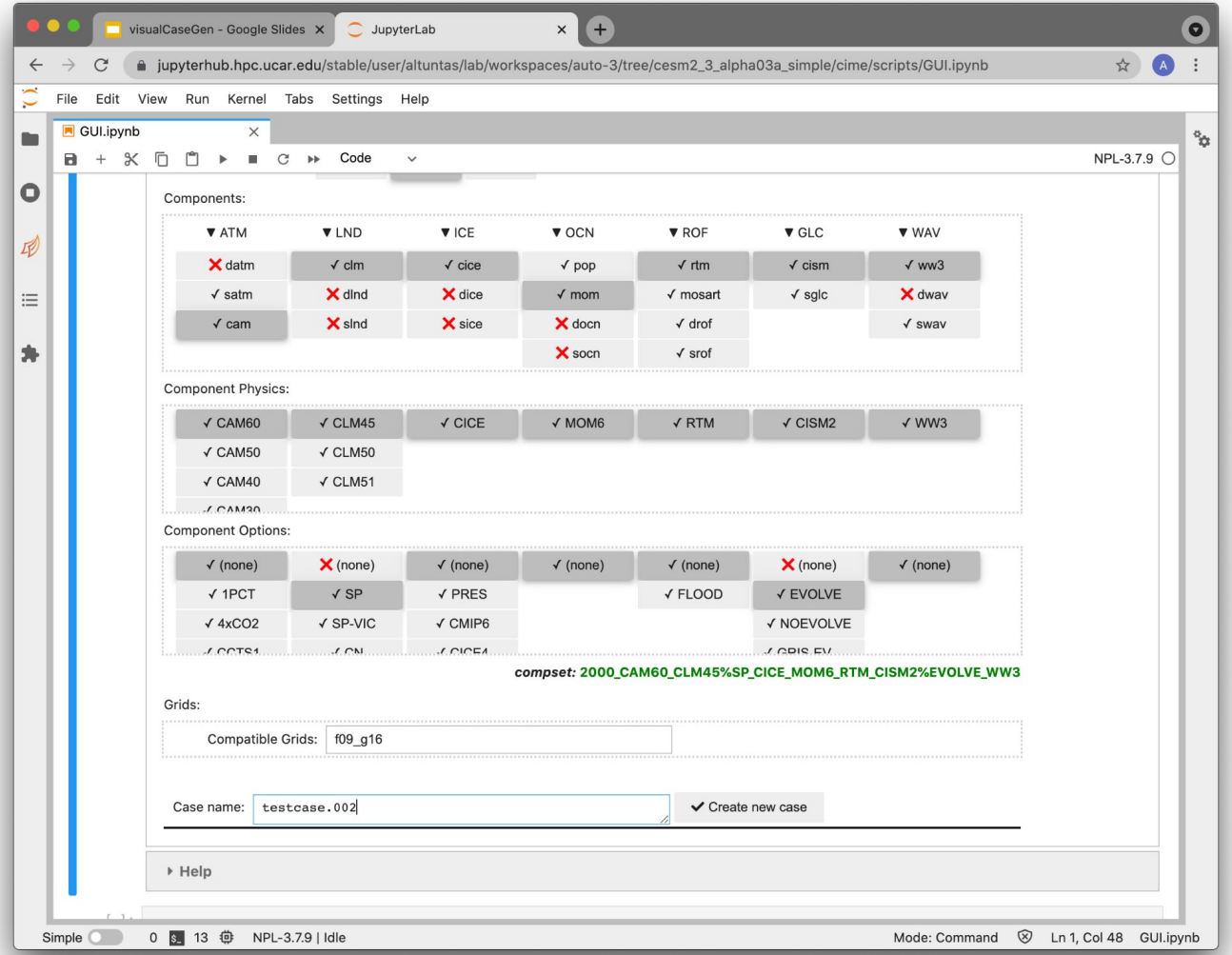

visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
[1]:
from visualCaseGen.visualCaseGen.GUI import GUI
GUI().display()
Step 1: Preliminaries
Driver: nuopc
Config Mode: predefined custom
Verbose GUI log: Off
Confirm
Reset
Step 2: Create Case
Help
[ ]:
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb


visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
Step 1: Preliminaries
Step 2: Create Case
Initialization Time: 1850 2000 HIST
Components:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
✓ datm ✓ clm ✓ cice ✓ pop ✓ rtm ✓ cism ✓ ww3
✓ satm ✓ dlnd ✓ dice ✓ mom ✓ mosart ✓ sglc ✓ dwav
✓ cam ✓ slnd ✓ sice ✓ docn ✓ drof ✓ swav
✓ socn ✓ srof
Component Physics:
Component Options:
compset: not all component physics selected yet.
Grids:
Compatible Grids: (Finalize Compset First.)
Case name: Type case name
✓ Create new case
Help
[ ]:
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb


visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
Components:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
✗ datm ✓ clm ✓ cice ✓ pop ✓ rtm ✓ cism ✓ ww3
✓ satm ✓ dlnd ✗ dice ✓ mom ✓ mosart ✓ sglc ✓ dwav
✓ cam ✓ slnd ✓ sice ✓ docn ✓ drof ✓ swav
✓ socn ✓ srof
Component Physics:
✓ CAM60 ✓ CLM45 ✓ CICE
✓ CAM50 ✓ CLM50
✓ CAM40 ✓ CLM51
Component Options:
✓ (none) ✗ (none) ✓ (none)
✓ 1PCT ✓ SP ✓ PRES
✓ 4xCO2 ✓ SP-VIC ✓ CMIP6
compset: not all component physics selected yet.
Grids:
Compatible Grids: (Finalize Compset First.)
Case name: Type case name
Create new case
Help
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb


visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
Components:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
✗ datm ✓ clm ✓ cice ✓ pop ✓ rtm ✓ cism ✓ ww3
✓ satm ✗ dlnd ✗ dice ✓ mom ✓ mosart ✓ sglc ✗ dwav
✓ cam ✗ slnd ✗ sice ✓ docn ✓ drof ✓ swav
✓ socn ✓ srof
Component Physics:
✓ CAM60 ✓ CLM45 ✓ CICE ✓ MOM6 ✓ RTM ✓ CISM2
✓ CAM50 ✓ CLM50
✓ CAM40 ✓ CLM51
Component Options:
✓ (none) ✗ (none) ✓ (none) ✓ (none) ✓ (none) ✗ (none)
✓ 1PCT ✓ SP ✓ PRES ✓ FLOOD ✓ EVOLVE
✓ 4xCO2 ✓ SP-VIC ✓ CMIP6 ✓ NOEVOLVE
compset: not all component physics selected yet.
Grids:
Compatible Grids: (Finalize Compset First.)
Case name: Type case name
✓ Create new case
Help
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb


visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings
jupyterhub.hpc.ucar.edu says
ERROR: Invalid COMP_WAV selection: "MOM6 cannot be coupled with data wave component."
OK
GUI.ipynb
Code
NPL-3.7.9
Components:
▼ ATM
▼ LND
▼ WAV
✗ datm
✓ clm
✓ cice
✓ pop
✓ rtm
✓ cism
✓ ww3
✓ satm
✗ dlnd
✗ dice
✓ mom
✓ mosart
✓ sglc
✗ dwav
✓ cam
✗ slnd
✗ sice
✓ docn
✓ drof
✓ swav
✓ socn
✓ srof
Component Physics:
✓ CAM60
✓ CLM45
✓ CICE
✓ MOM6
✓ RTM
✓ CISM2
✓ CAM50
✓ CLM50
✓ CAM40
✓ CLM51
Component Options:
✓ (none)
✗ (none)
✓ (none)
✓ (none)
✓ (none)
✗ (none)
✓ 1PCT
✓ SP
✓ PRES
✓ FLOOD
✓ EVOLVE
✓ 4xCO2
✓ SP-VIC
✓ CMIP6
✓ NOEVOLVE
compset: not all component physics selected yet.
Grids:
Compatible Grids:
(Finalize Compset First.)
Case name:
Type case name
✓ Create new case
Help
Simple
0
13
NPL-3.7.9 | Busy
Mode: Command
Ln 1, Col 48
GUI.ipynb


visualCaseGen - Google Slides
JupyterLab
jupyterhub.hpc.ucar.edu/stable/user/altuntas/lab/workspaces/auto-3/tree/cesm2_3_alpha03a_simple/cime/scripts/GUI.ipynb
File Edit View Run Kernel Tabs Settings Help
GUI.ipynb
Code
NPL-3.7.9
Components:
▼ ATM ▼ LND ▼ ICE ▼ OCN ▼ ROF ▼ GLC ▼ WAV
✗ datm ✓ clm ✓ cice ✓ pop ✓ rtm ✓ cism ✓ ww3
✓ satm ✗ dlnd ✗ dice ✓ mom ✓ mosart ✓ sglc ✗ dwav
✓ cam ✗ slnd ✗ sice ✗ docn ✓ drof ✓ swav
✗ socn ✓ srof
Component Physics:
✓ CAM60 ✓ CLM45 ✓ CICE ✓ MOM6 ✓ RTM ✓ CISM2 ✓ WW3
✓ CAM50 ✓ CLM50
✓ CAM40 ✓ CLM51
Component Options:
✓ (none) ✗ (none) ✓ (none) ✓ (none) ✓ (none) ✗ (none) ✓ (none)
✓ 1PCT ✓ SP ✓ PRES ✓ FLOOD ✓ EVOLVE
✓ 4xCO2 ✓ SP-VIC ✓ CMIP6 ✓ NOEVOLVE
compset: 2000_CAM60_CLM45%SP_CICE_MOM6_RTM_CISM2%EVOLVE_WW3
Grids:
Compatible Grids: f09_g16
Case name: testcase.002
✔ Create new case
Help
Simple 0 13 NPL-3.7.9 | Idle
Mode: Command Ln 1, Col 48 GUI.ipynb