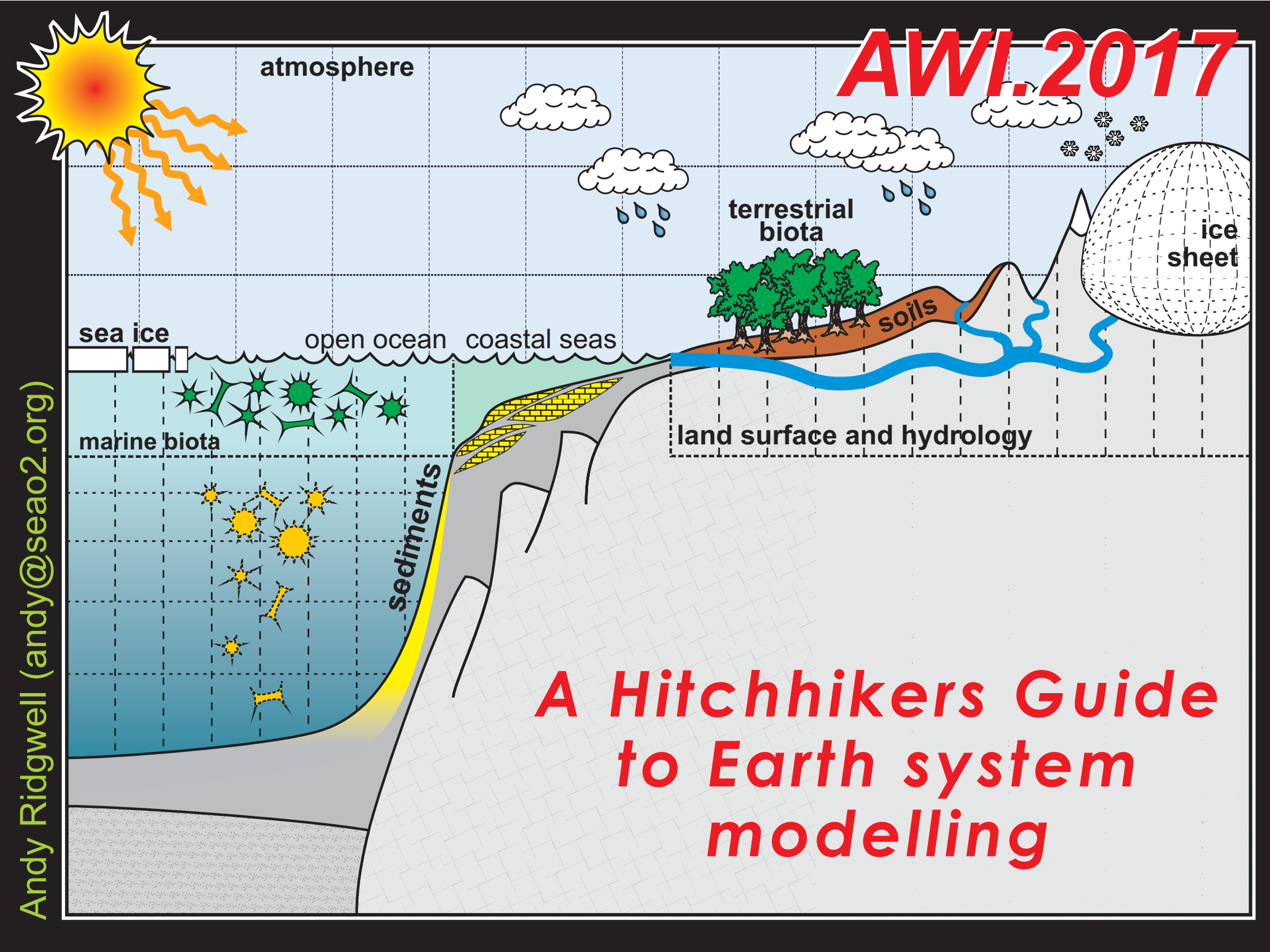
AWI.2017
atmosphere
terrestrial biota
ice sheet
soils
sea ice
open ocean
coastal seas
marine biota
sediments
land surface and hydrology
A Hitchhikers Guide to Earth system modelling
Andy Ridgwell (andy@seao2.org)

*c*GENIE WORKSHOP:

A Hitchhikers Guide to the Black Arts of Earth system modelling

(‘or why you should not want know what is in a sausage’)

13th – 14th Feb 2017; AWI

Day 1 – Earth system modelling for ‘newbies’

***Presentation (am)* – Course and methodology overview**

***Session* #0 *(am)* – Getting started**

Accessing the computing cluster; installing and compiling *c*GENIE; directory structure (‘where everything is’).

Command-line operation; how to submit jobs to a cluster queue. Use of ‘restart’ experiments and modelling methodologies.

Visualization of model output: time-series and time-slice (2D and 3D) output.

***Session* #1 *(pm)* – A ‘real’(!) experiment**

Setting up experiments: configuration files and setting parameter values.

Exploring Earth system dynamics: ‘Snowball Earth’ and climate feedback.

***Session* #2 *(pm)* – ‘Poking the climate beast’**

Applying perturbations and tracing ocean circulation.

Exploring the stability of the Atlantic meridional overturning circulation (‘AMOC’).

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A Hitchhikers Guide to the Black Arts of Earth system modelling

('or why you should not want know what is in a sausage')

13th – 14th Feb 2017; AWI

Day 2 – Getting your hands dirty with carbon

***Session* #3 *(am)* – Poking the carbon cycle**

CO_2 emissions and the spatial patterns of ocean acidification.

***Session* #4 *(pm)* – Engineering the carbon cycle**

Sensitivity of atmospheric pCO_2 and ocean acidification to changes in the ocean's biological pump and 'weathering'. Ocean carbon cycle geoengineering.

Andy's, like, whatever pages

cGENIE EMIC

mycgenie.seao2.org

GENIE project website (RIP)

got data?

Ocean observations [netCDF format file and on *c*GENIE grid]

got muffin?

Quick-start Guides:
(1) Bristol cluster
(2) generic linux
(3) Mac
(4) Windows
general:
READ-ME

got software?

linux netCDF 4.0 source code
Simple Windoz SSH client

mailing lists

CGENIE-DISCUSS
@GENIE_ESM

*c*GENIE resources: DOCUMENTATION

WARNING: Documentation in varying degrees of not updatedness ...
SEE: genie-docs SUBDIRECTORY FOR THE CURRENT .ps AND .pdf DOCUMENTATION BUILDS (as well as latex source)

(1) Current 'muffin' version of *c*GENIE:

- The soon-to-be infamous **Quick-start Guide** (also see platform-specific varient -- box on left) plus the all important and vital **READ-ME** that you inevitably will not read ....
- **User manual**, with details of the namelist parameters given in a seperate and shocking incomplete/outdated Table.
- Various model experiment **EXAMPLES**, including example model configurations, experimental designs, and associated namelist parameter descriptions.
- The *c*GENIE **HOW-TO** - potted explanations of how to get useful stuff done, e.g., spinning up deep-sea sediment distributions.

(2) Original *c*GENIE branch:

cGENIE (biogeochemistry focused) User manual.
Various model experiment EXAMPLES.
The *c*GENIE HOW-TO.
The soon-to-be infamous Quick-start Guide.

*c*GENIE resources: WORKSHOPS [CURRENT -- AWI.2015]

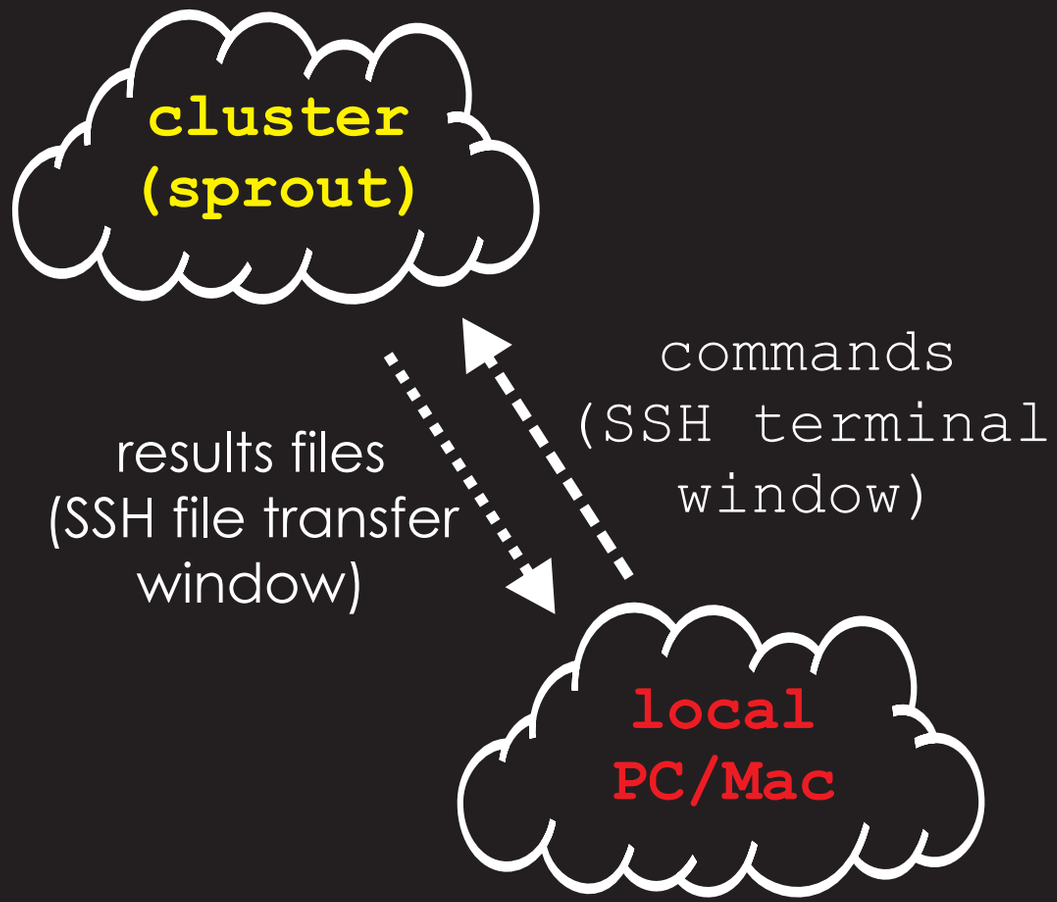
INFO:
Workshop outline.

Lab instructions:
Lesson #0 == cGENIE modelling basics
Lesson #1 == Snowball Earth + experiments in climate hysteresis.
Lesson #2 == Ocean circulation and overturning stability.

*c*GENIE resources: TEACHING LABS [OLD -- GEOGM1110 / GEOGM1404]

INFO: Course outline; non-intimidating linux 101 (MLP version).
Lab instructions: Session #0000 == cGENIE modelling basics + experiments in climate hysteresis // Session #0001 == Ocean circulation and overturning stability // Session #0100 == Fossil fuel CO_2 release and 'ocean acidification' plus a supplement summerizing ocean acidification relevant results variables, and both together in a revised Session #0100 document // Session #0101: GEOGM1110 == Engineering the carbon cycle (GEOGM1110) // Session #0101: GEOGM1404 == Engineering the carbon cycle (GEOGM1404).

Start (/stop) model experiments
Edit (configuration) files
(**SciTE**/other editor)
Visualize results (**Panoply**)

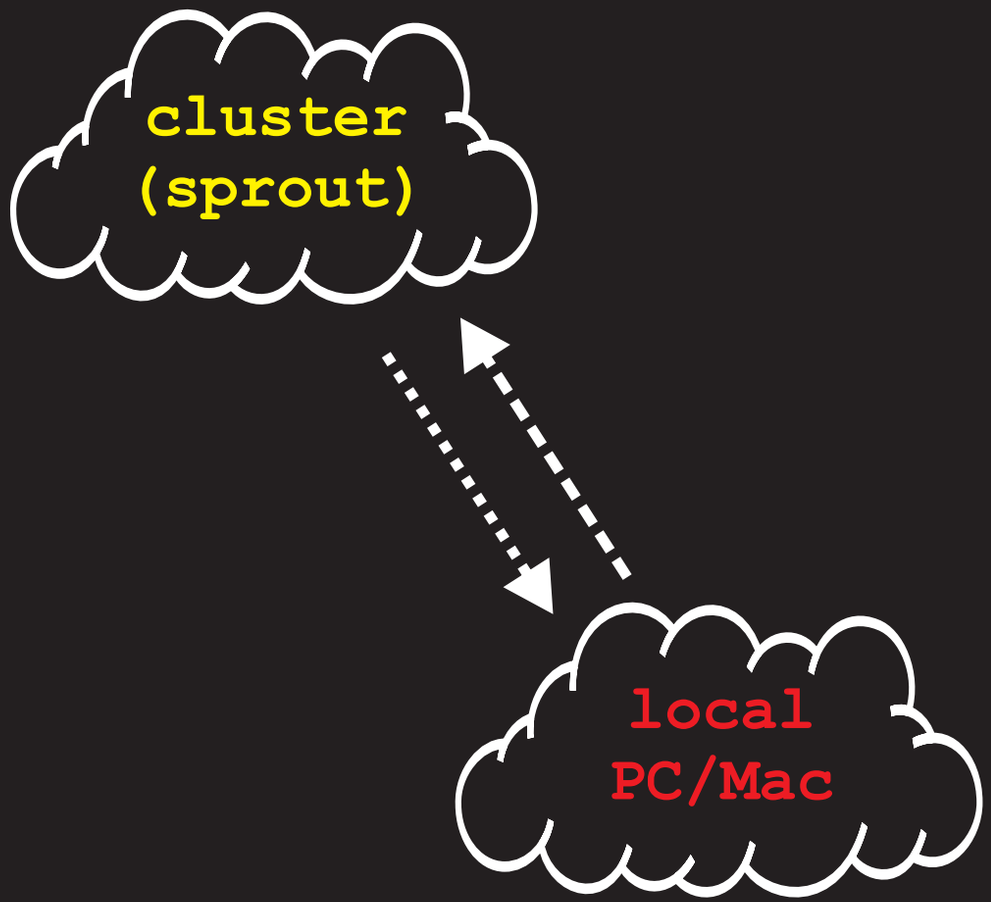

cluster
(sprout)
commands
(SSH terminal
window)
results files
(SSH file transfer
window)
local
PC/Mac

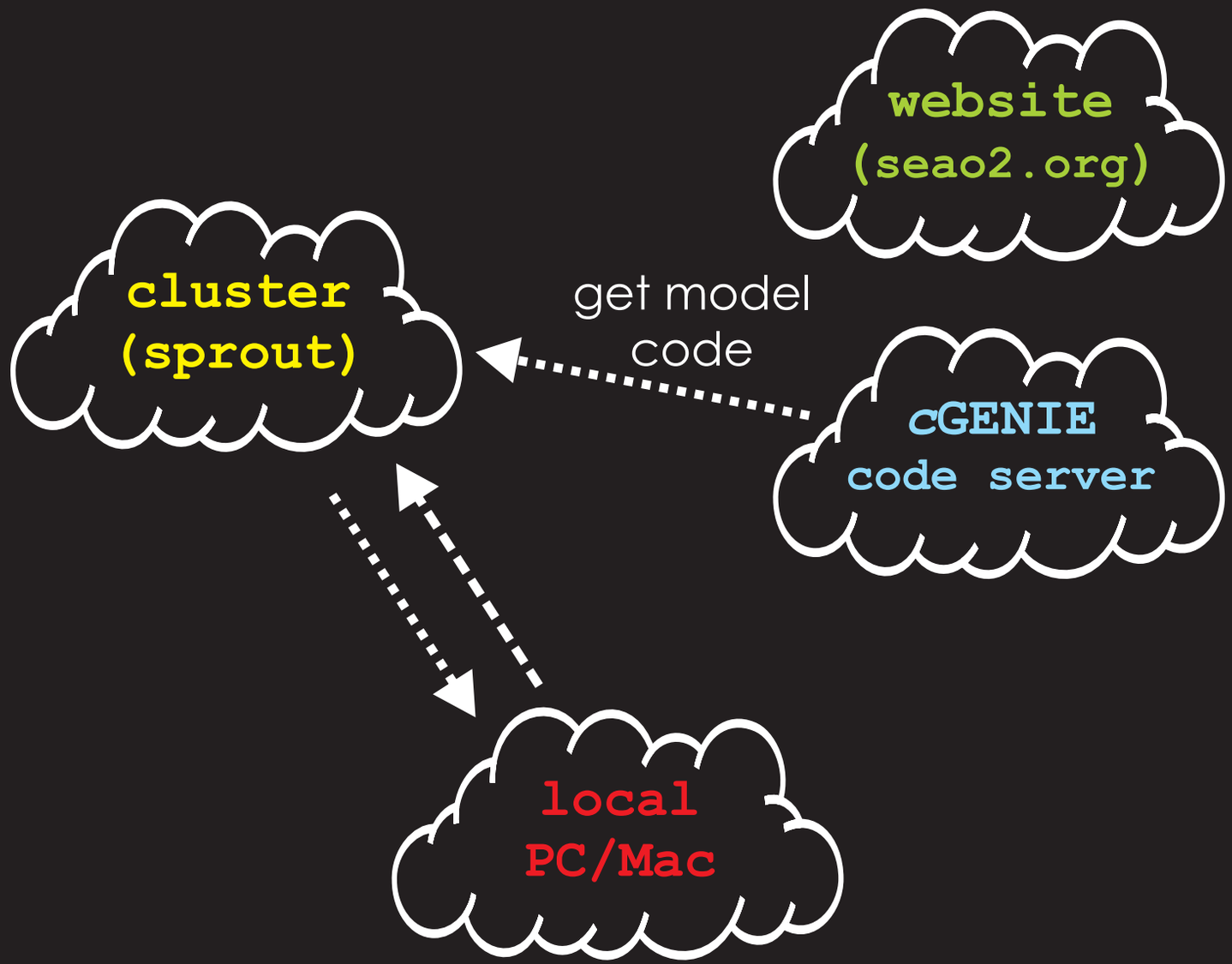
Works in groups of 2s / 3s

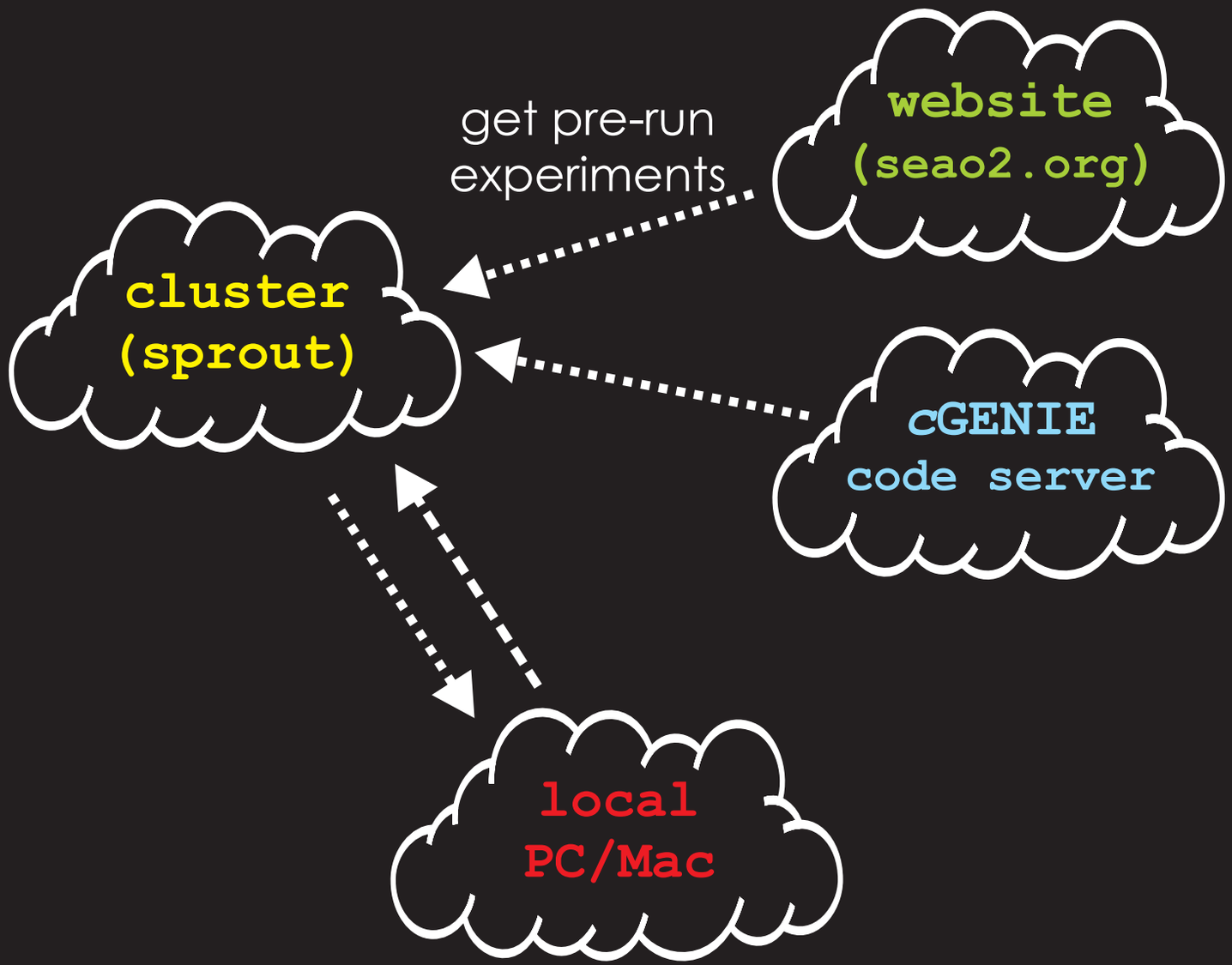
`sprout` cluster account names:

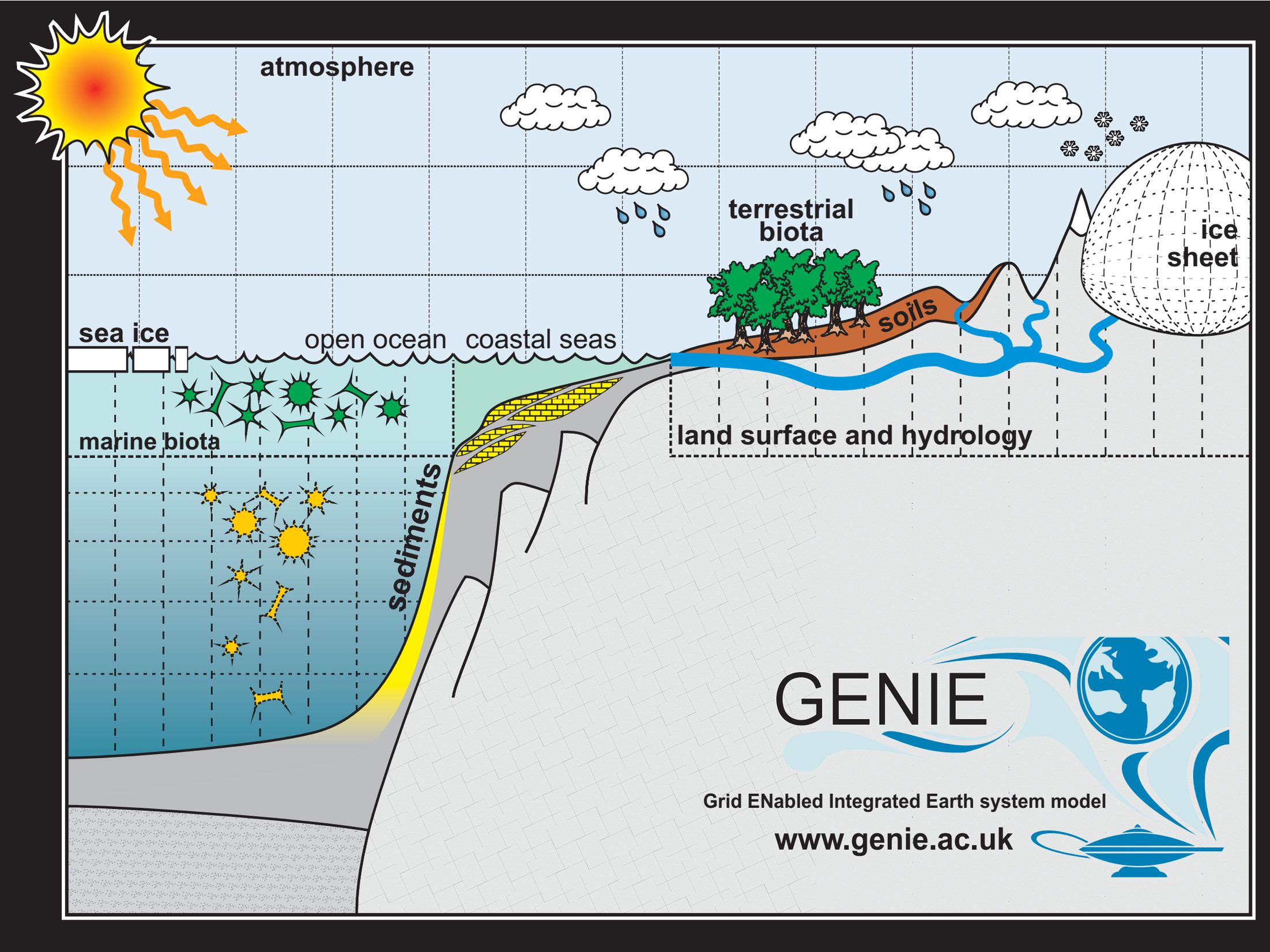
`cgenie_1, cgenie_2, cgenie_3,`
`cgenie_4, ... cgenie_9`

Password: `????????` (the same for all)




website
(seao2.org)
cluster
(sprout)
get model
code
cGENIE
code server
local
PC/Mac


website
(seao2.org)
get pre-run
experiments
cluster
(sprout)
cGENIE
code server
local
PC/Mac


atmosphere
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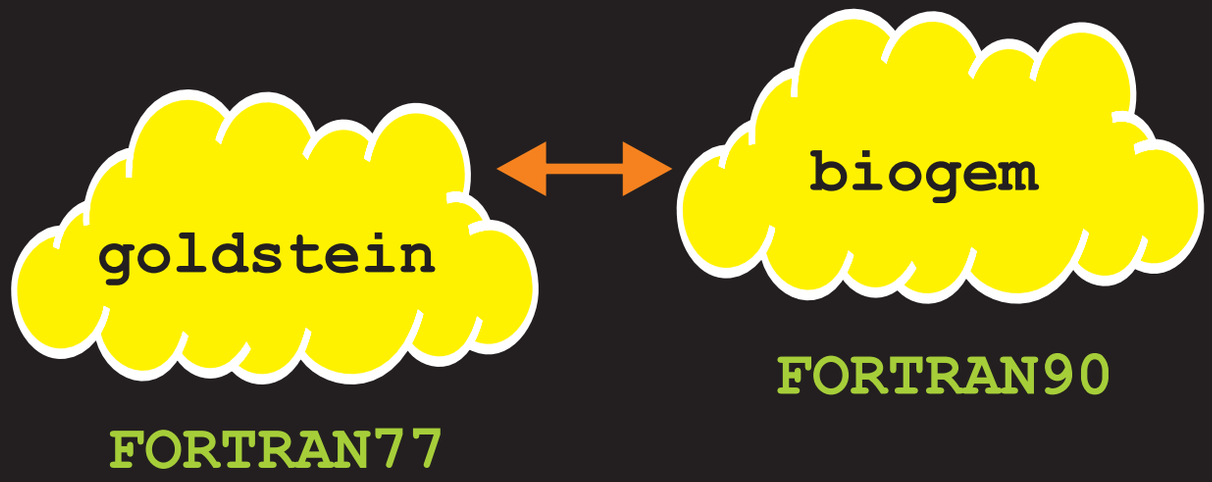
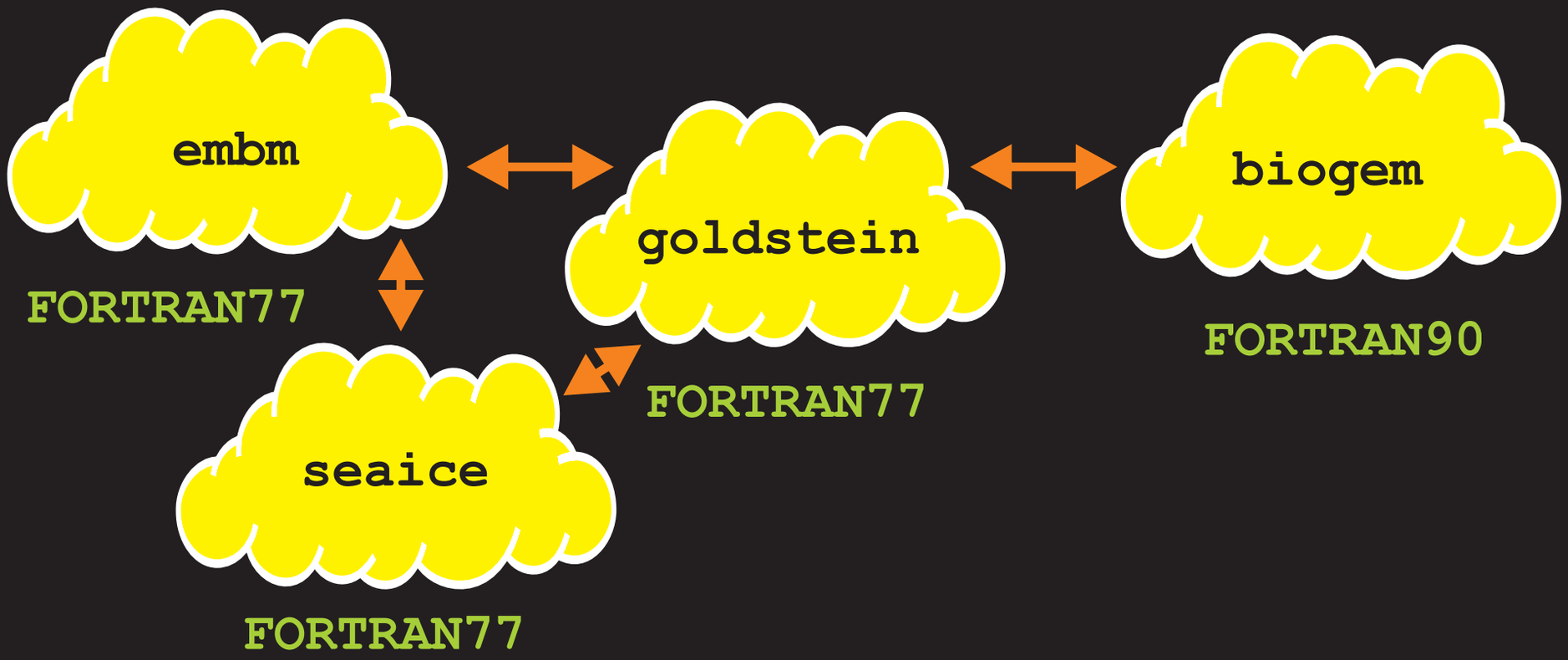
land surface and hydrology
GENIE
Grid ENabled Integrated Earth system model
www.genie.ac.uk

FORTRAN77

xxx ?



cb-goldstein



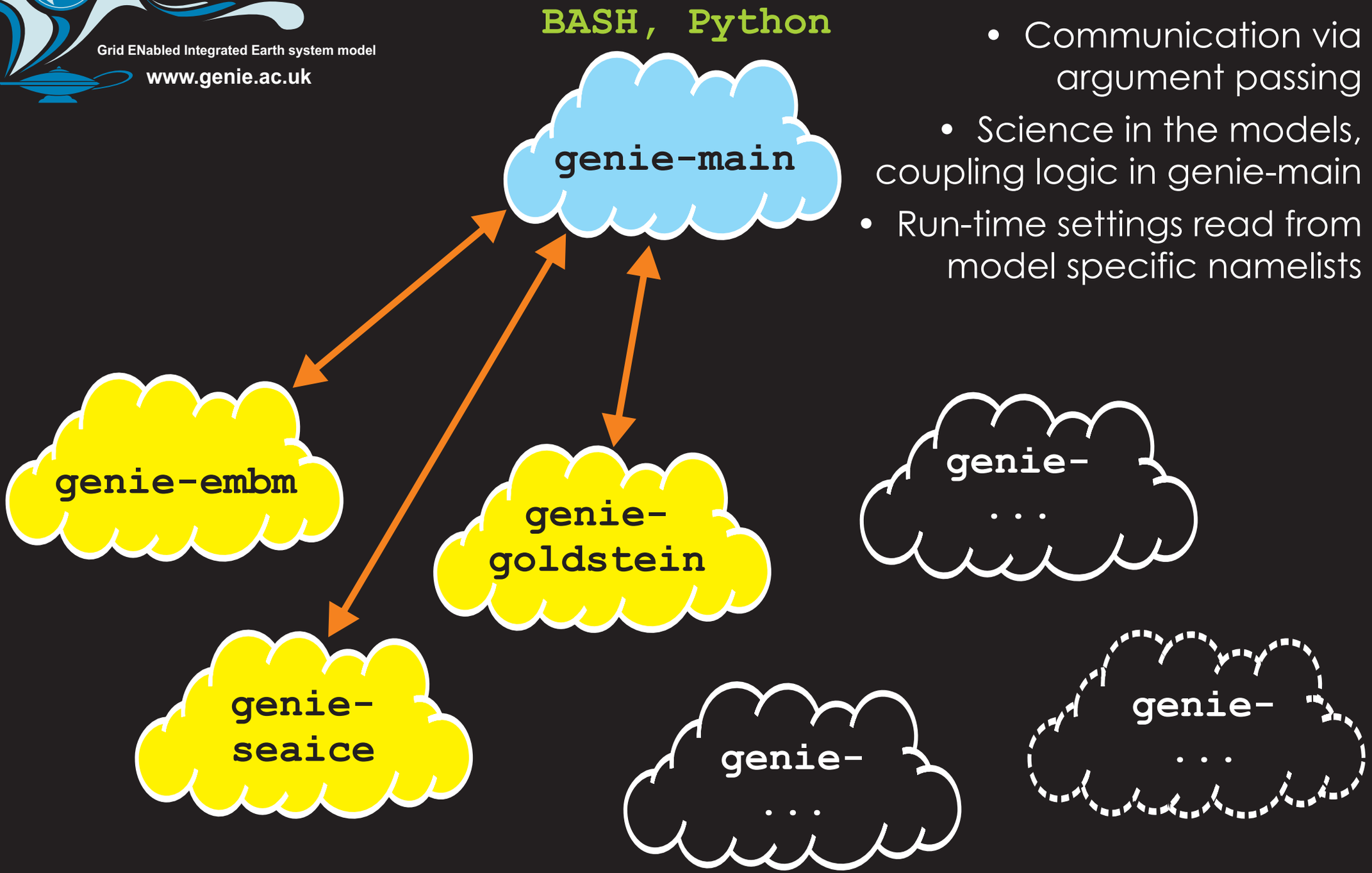
GENIE

Grid ENabled Integrated Earth system model

www.genie.ac.uk

Modular, Hierarchical

- Communication via argument passing
- Science in the models, coupling logic in genie-main
- Run-time settings read from model specific namelists



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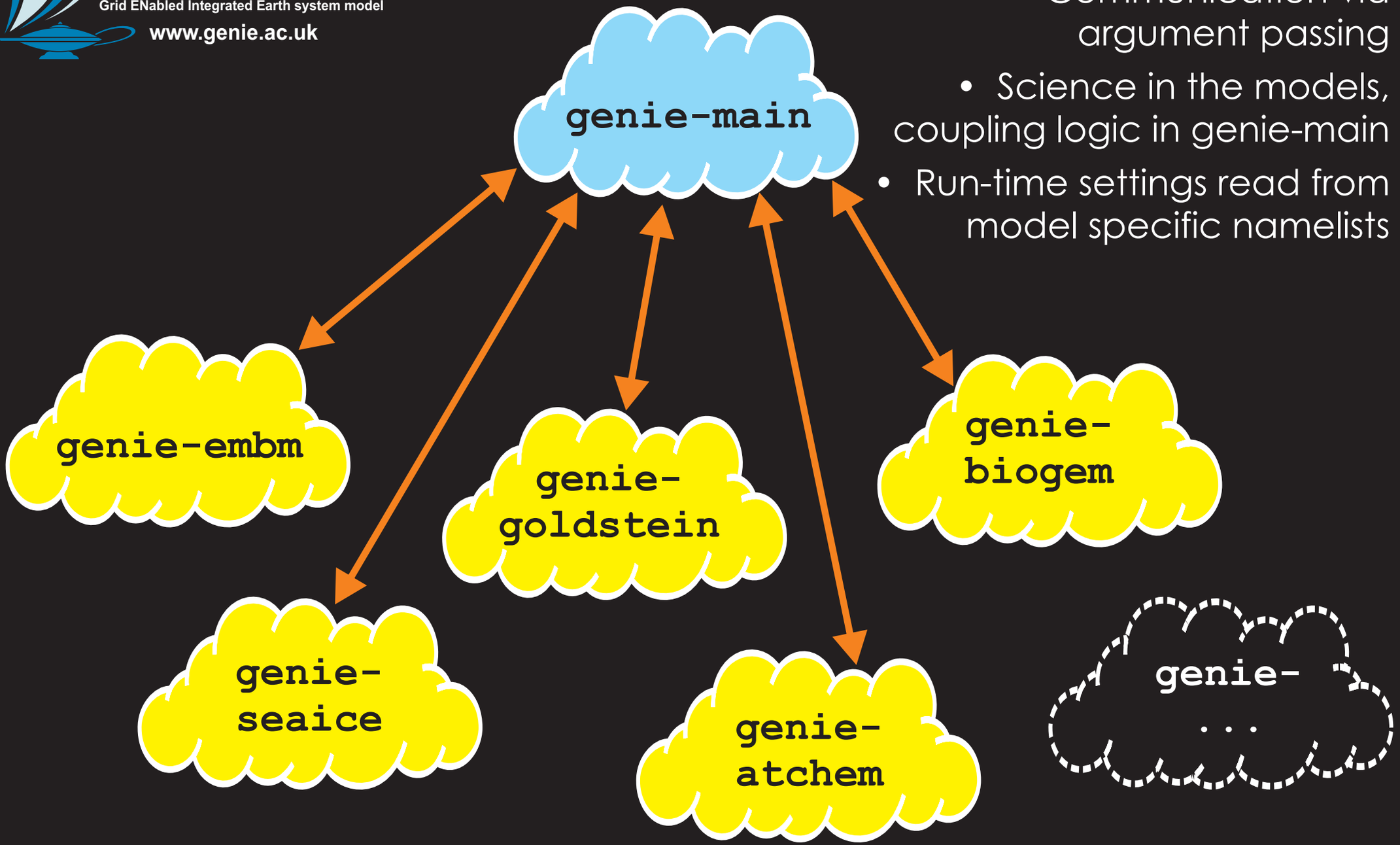
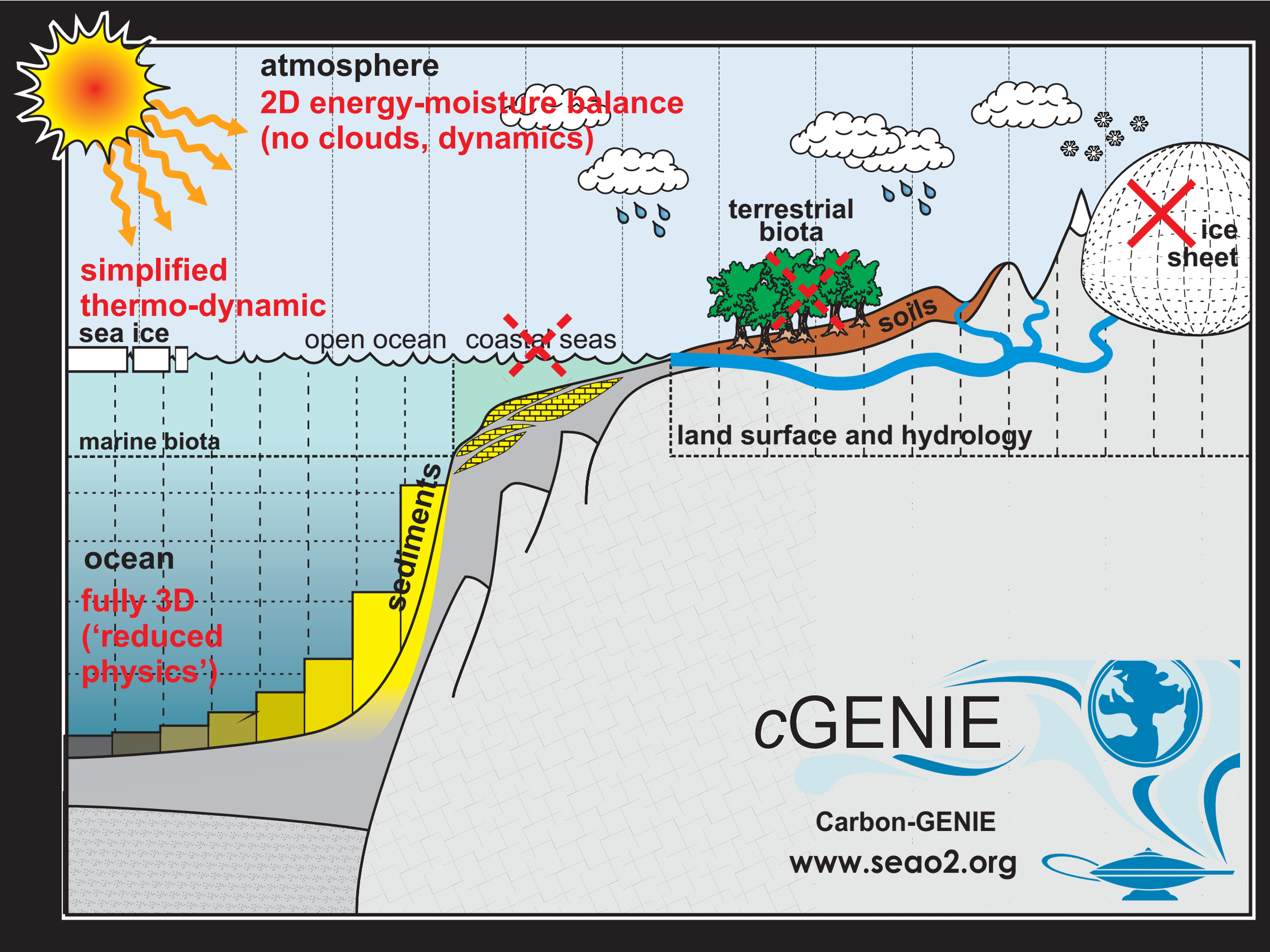
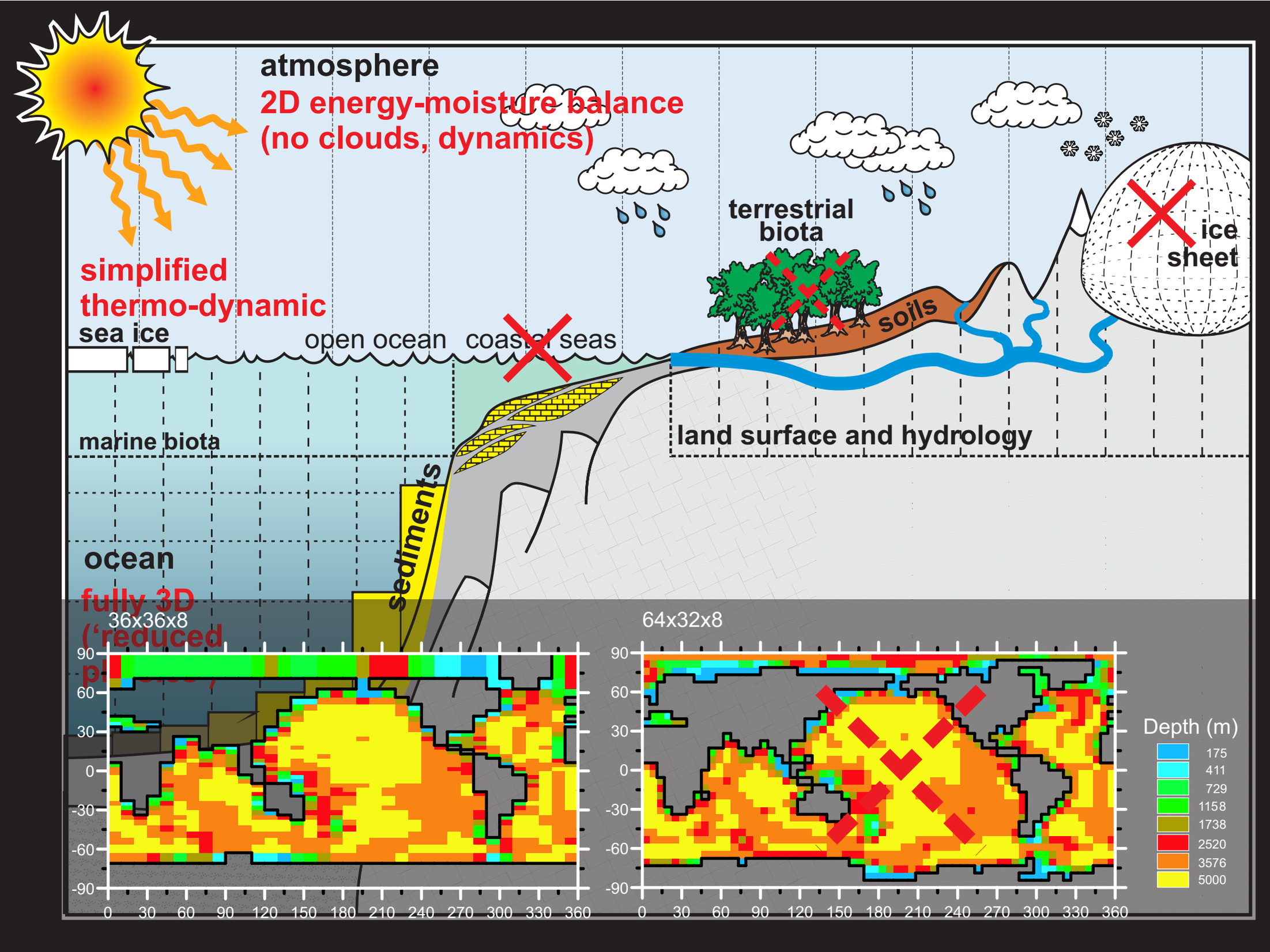



atmosphere
2D energy-moisture balance
(no clouds, dynamics)
terrestrial
biota
ice
sheet
simplified
thermo-dynamic
sea ice
open ocean
coastal seas
soils
land surface and hydrology
marine biota
sediments
ocean
fully 3D
('reduced
physics')
cGENIE
Carbon-GENIE
www.seao2.org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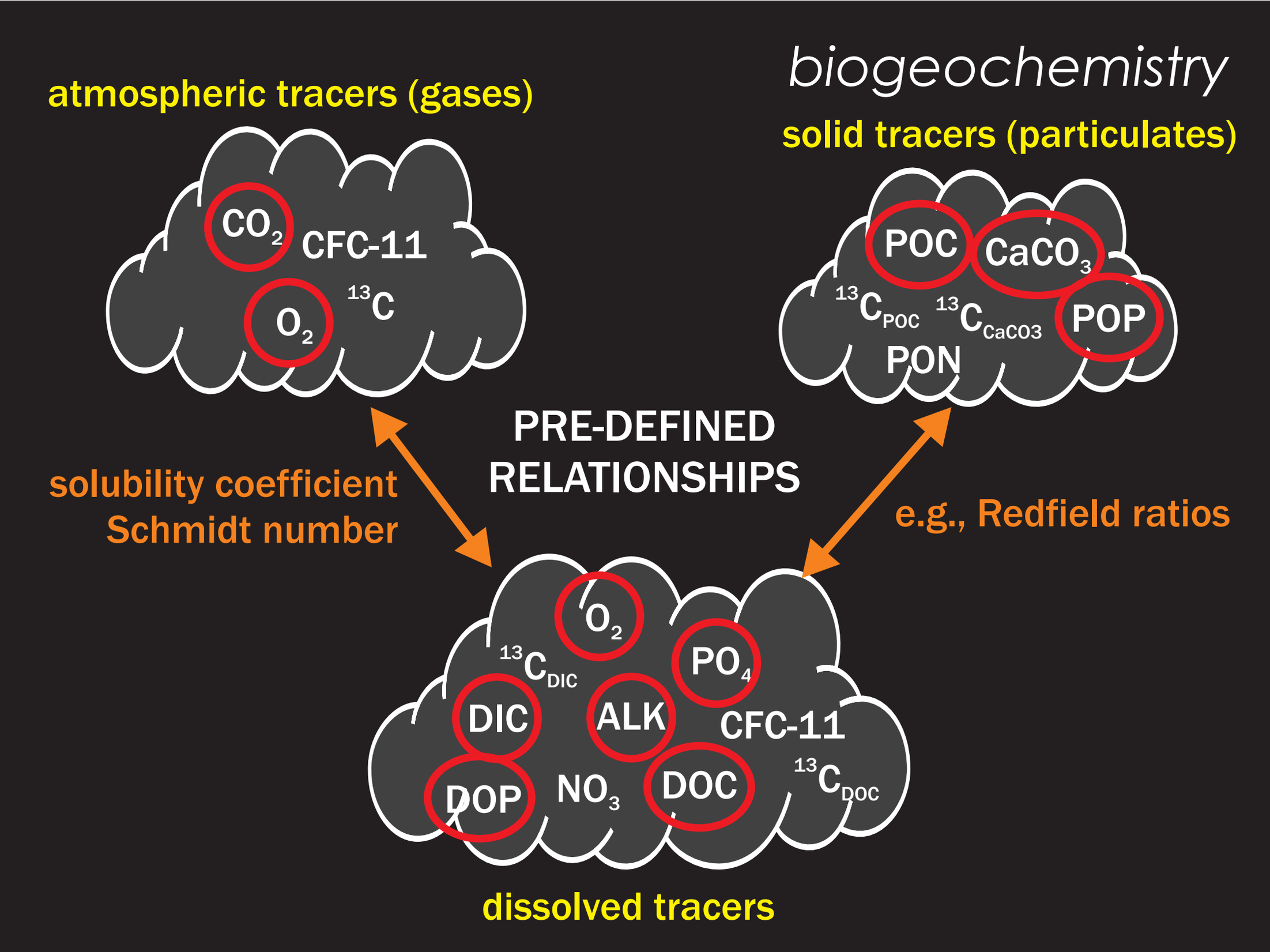
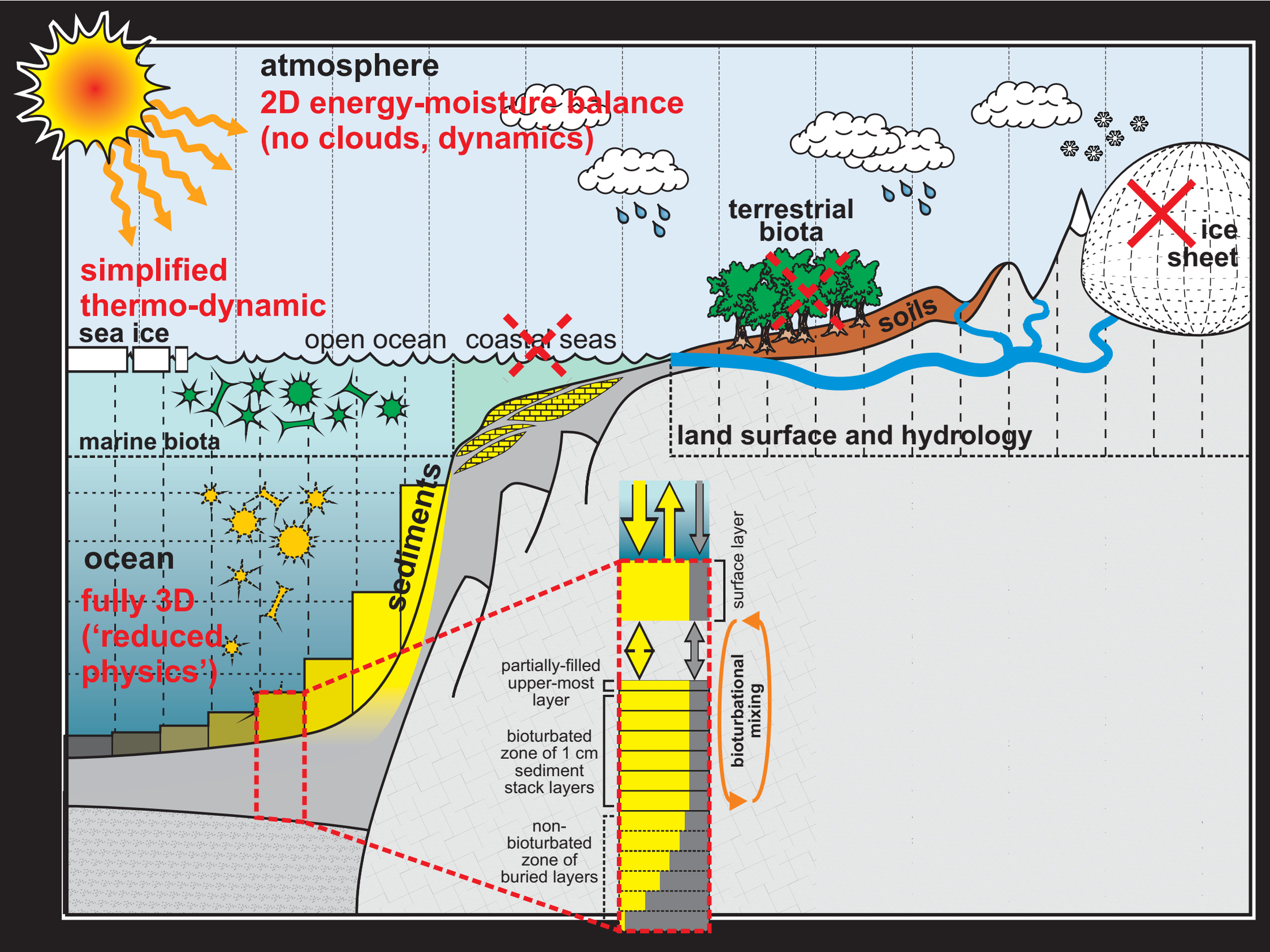
sediments
ocean
fully 3D
('reduced
36x36x8
64x32x8
90
60
30
0
-30
-60
-90
0 30 60 90 120 150 180 210 240 270 300 330 360
Depth (m)
175
411
729
1158
1738
2520
3576
5000


biogeochemistry
atmospheric tracers (gases)
CO_2
CFC-11
^{13}C
O_2
solid tracers (particulates)
POC
$CaCO_3$
$^{13}C_{POC}$
$^{13}C_{CaCO3}$
POP
PON
PRE-DEFINED
RELATIONSHIPS
solubility coefficient
Schmidt number
e.g., Redfield ratios
O_2
$^{13}C_{DIC}$
PO_4
DIC
ALK
CFC-11
DOP
NO_3
DOC
$^{13}C_{DOC}$
dissolved tracers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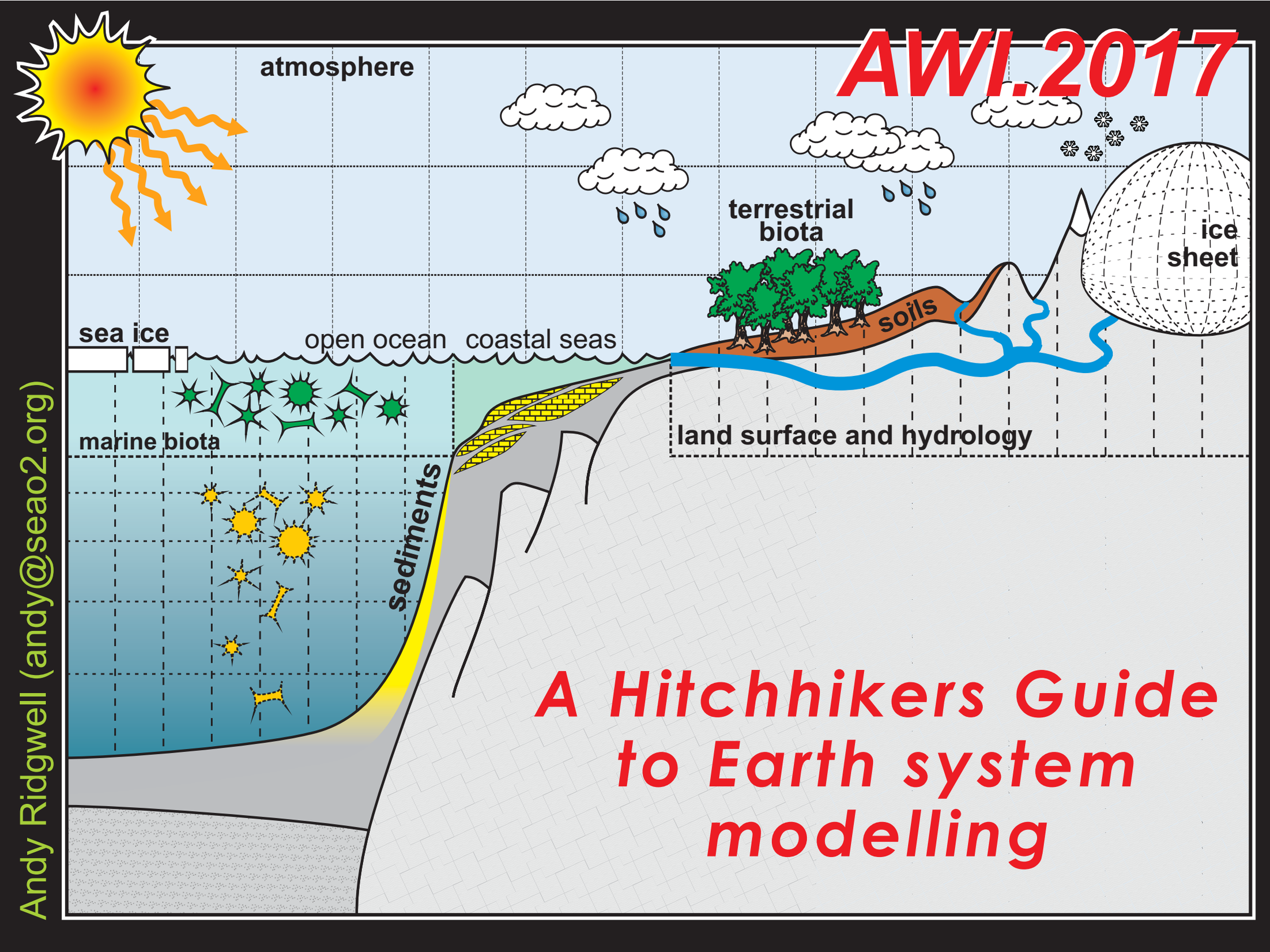
partially-filled
upper-most
layer
bioturbated
zone of 1 cm
sediment
stack layers
non-
bioturbated
zone of
buried layers
bioturbational
mixing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