

CSDMS Modeling Tool Introduction

Run & Couple Surface Dynamics Models



Outline

OBJECTIVE

- Learn the vision and basic concepts of the CMT
- Vision of CMT
- Use of CSDMS HPCC (Beach)
- Select Projects
- Workspace
- Set Up Simulations
- Visualization with VisIt

DEMO

- Visualize Infiltration on an inclined plane with TOPOFLOW

Vision behind CMT

Develop a modeling framework of inter-connectable process modules able to predict the transport and deposition of water, sediment and nutrients over the Earth's surfaces, and how surfaces evolve over a broad range of time and space scales.

- **Empowering users to model science questions...**
- **Streamlining process of idea generation to actual simulation....**
- **Be inclusive, modular, and user-friendly.....**

(CSDMS Science Plan, Implementation Plan)

Evolution of a CSDMS Model

TeleMAC
Cyclopath



WRF
PARFLOW



ROMS
1D –Parker Routines



SedFlux
CHILD



None?

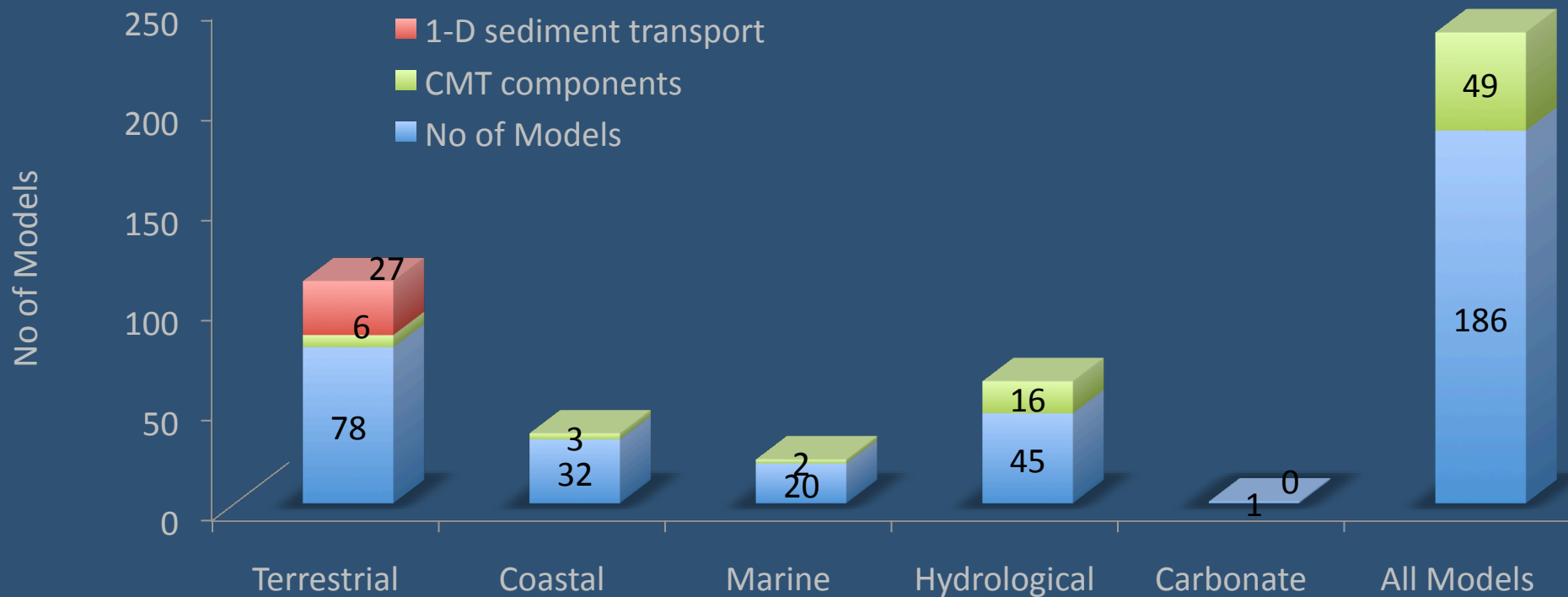


Submitted - IRF interface – Componentized - Coupled in CMT – Fully Vetted

186 Models

49 Components

Number of Components



Download CMT

Get Help!
information
on the CMT

The screenshot shows the CSDMS website with a navigation bar at the top containing links for Models, CMT, HPCC, Education, Data, CSDMS Community, Meetings, Help, and Wiki tools. The main content area is divided into four sections: Upcoming Meetings, Models, About, and Group area. The Upcoming Meetings section lists two events: 'Modeling for Environmental Change' in October and 'Chapman Conference' in January. The Models section provides links to get access, run models, and download source code for over 125 models, categorized by Terrestrial, Coastal, Marine, Hydrology, and Carbonate. The About section describes CSDMS as a growing community with 456 members. The Group area encourages feedback and participation in discussions.

CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

Models CMT HPCC Education Data CSDMS Community Meetings Help Wiki tools

Upcoming Meetings

Modeling for Environmental Change
October 14-17, San Antonio, TX
[Participant Information \(updates\)](#)

OCT 14 **Modeling for Environmental Change:** San Antonio, TX. The first CSDMS all-hands meeting.

JAN 24 **Chapman Conference** on source-to-sink studies from around the world, Oxnard, CA
[More...](#)

Models

- [Get Access and Run](#) your model for free on the CSDMS HPCC.
- [CSDMS Handbook](#) on modeling tools.
- [Submit](#) your model to CSDMS.
- Learn more about [IRF interfaces](#): the first step to get your model ready to couple with other models
- Find proper [input data](#) for your model.

Direct links to download source code to over 125 models.

- Terrestrial
- Coastal
- Marine
- Hydrology
- Carbonate

CSDMS Modeling Tool
v. 1.4 - 6/14/2010
[Launch](#) | [Download](#)
[Learn more about CMT...](#)

About

- CSDMS is the Community Surface Dynamics Modeling System.
- CSDMS is a growing community, with already **456** members. Become part of it by [signing up](#) today!
- Read the [latest update](#) from the director.

Group area

We are interested in your feedback! Please fill out the [Modeling course survey](#) to improve our products for the college classroom in the future.

Join in the discussions of the various groups:

- [Marine WG: Oil spill in the Gulf of Mexico](#)
- [Carbonate FRG](#)
- [Coastal WG](#)

General:

- Learn more about the various [CSDMS groups](#)
- Join one or more groups, [sign up](#) today!
- See all the members, or give your feed back to one of the CSDMS groups in the [Group area](#)

Download it!

Download from CSDMS wiki: <http://csdms.colorado.edu>

CMT runs on Beach



Download the CMT
to your computer



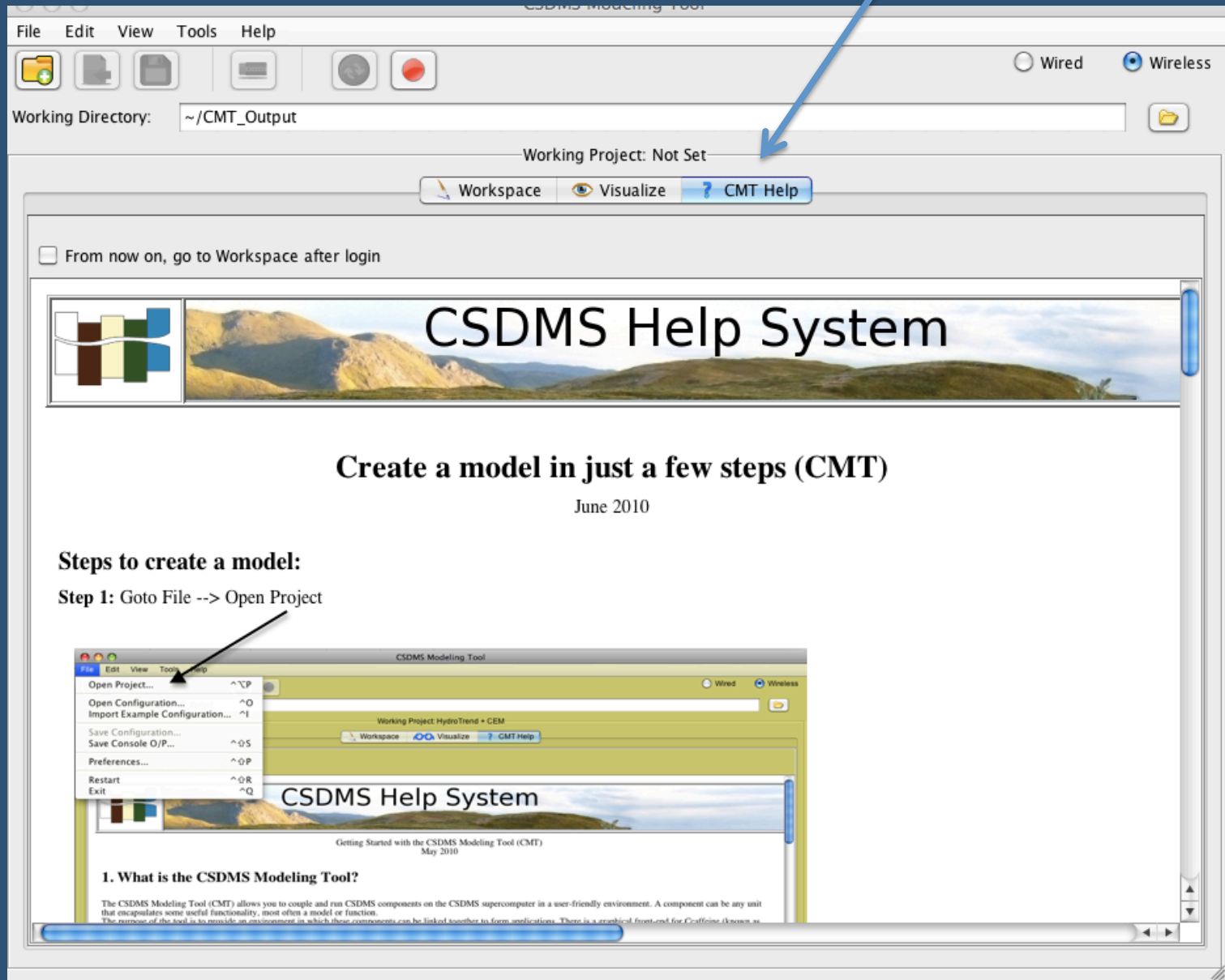
PRE-REQUISITES

- Need to be a member
- Need an account to use HPCC
- Need a secure connection (with VPN)
- Realize you are one of many users
- Realize that 2-way traffic is ongoing



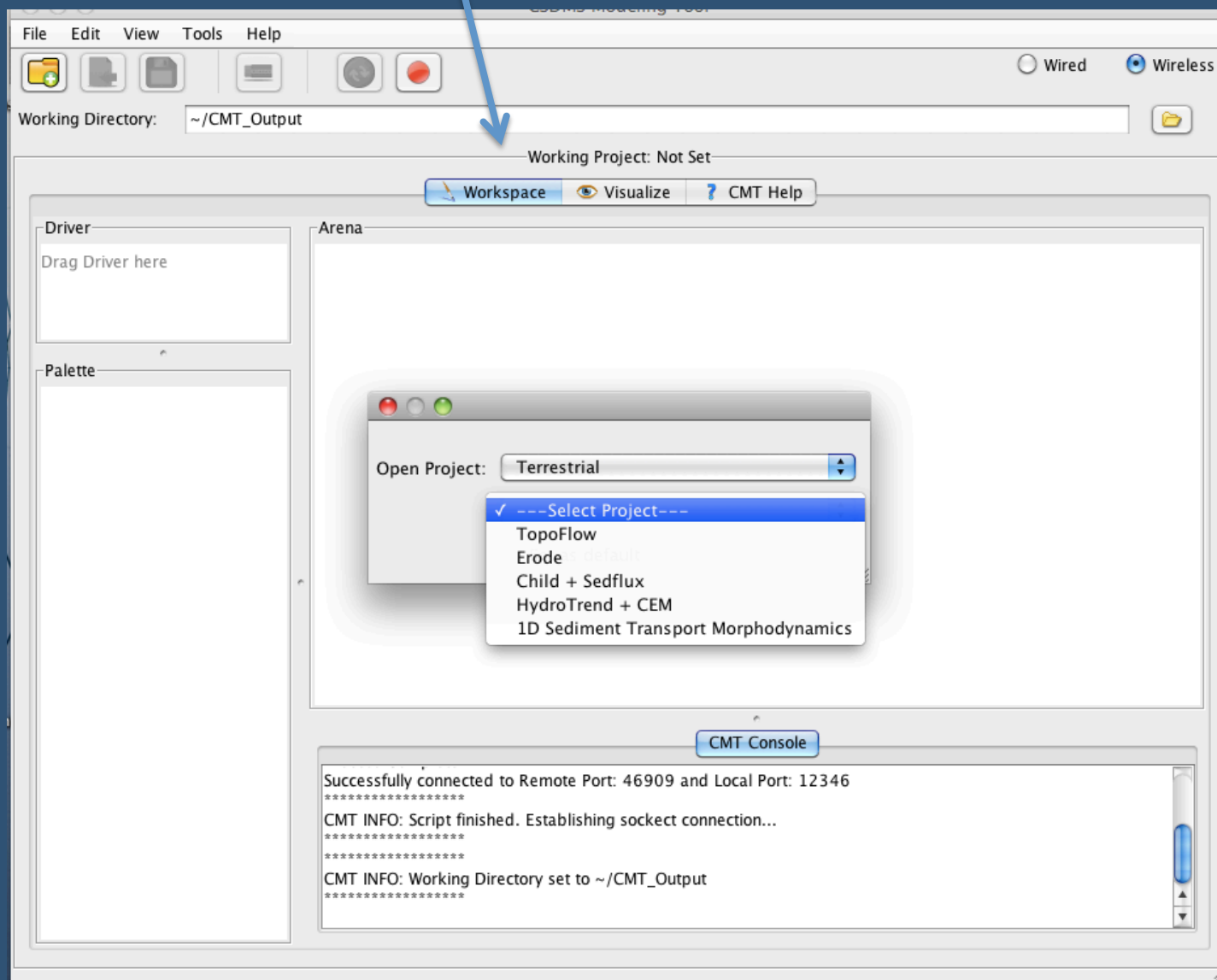
Beach in Colorado
512 nodes 4U

Workspace Visualize Help



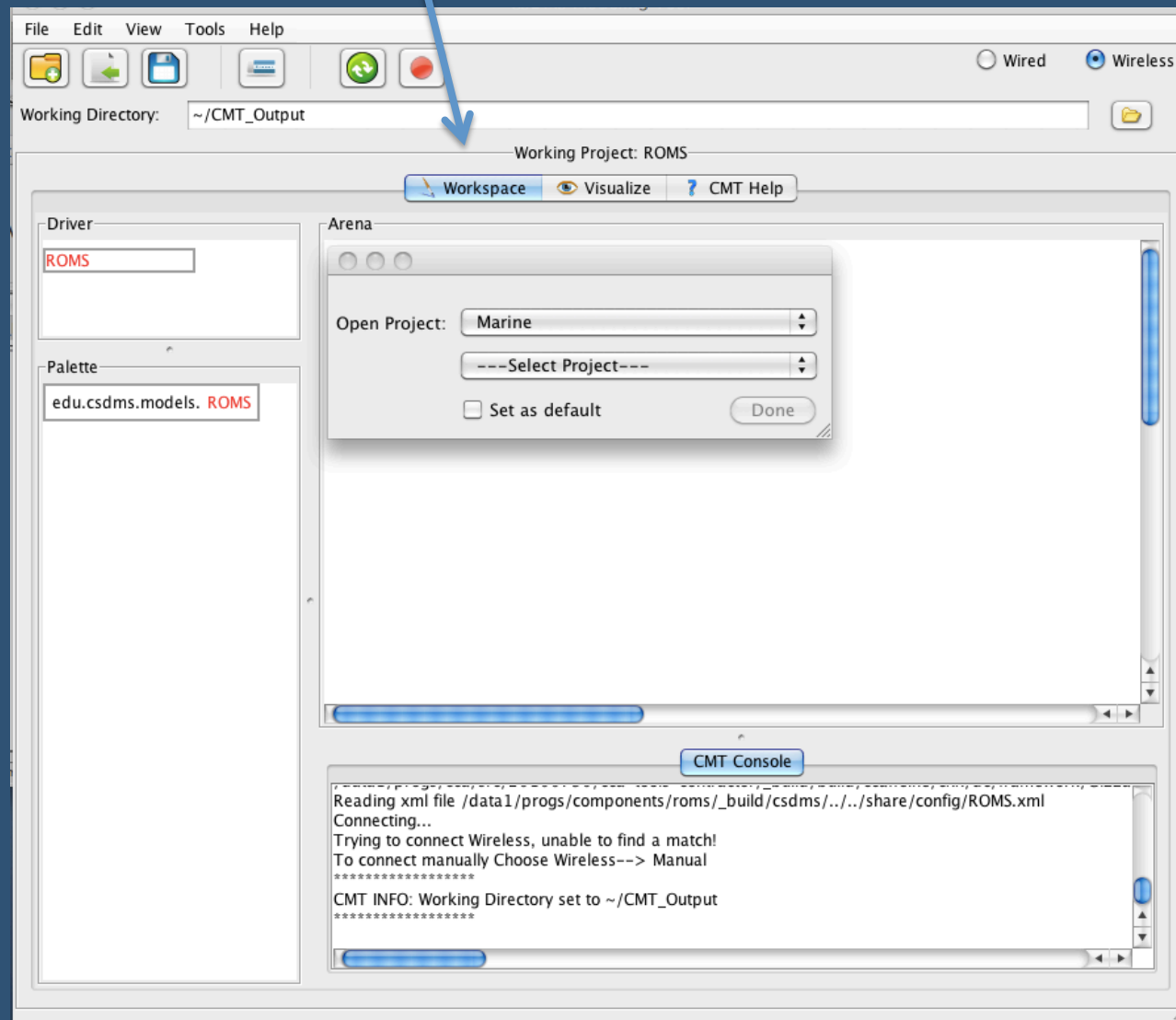
Open Projects

Workspace

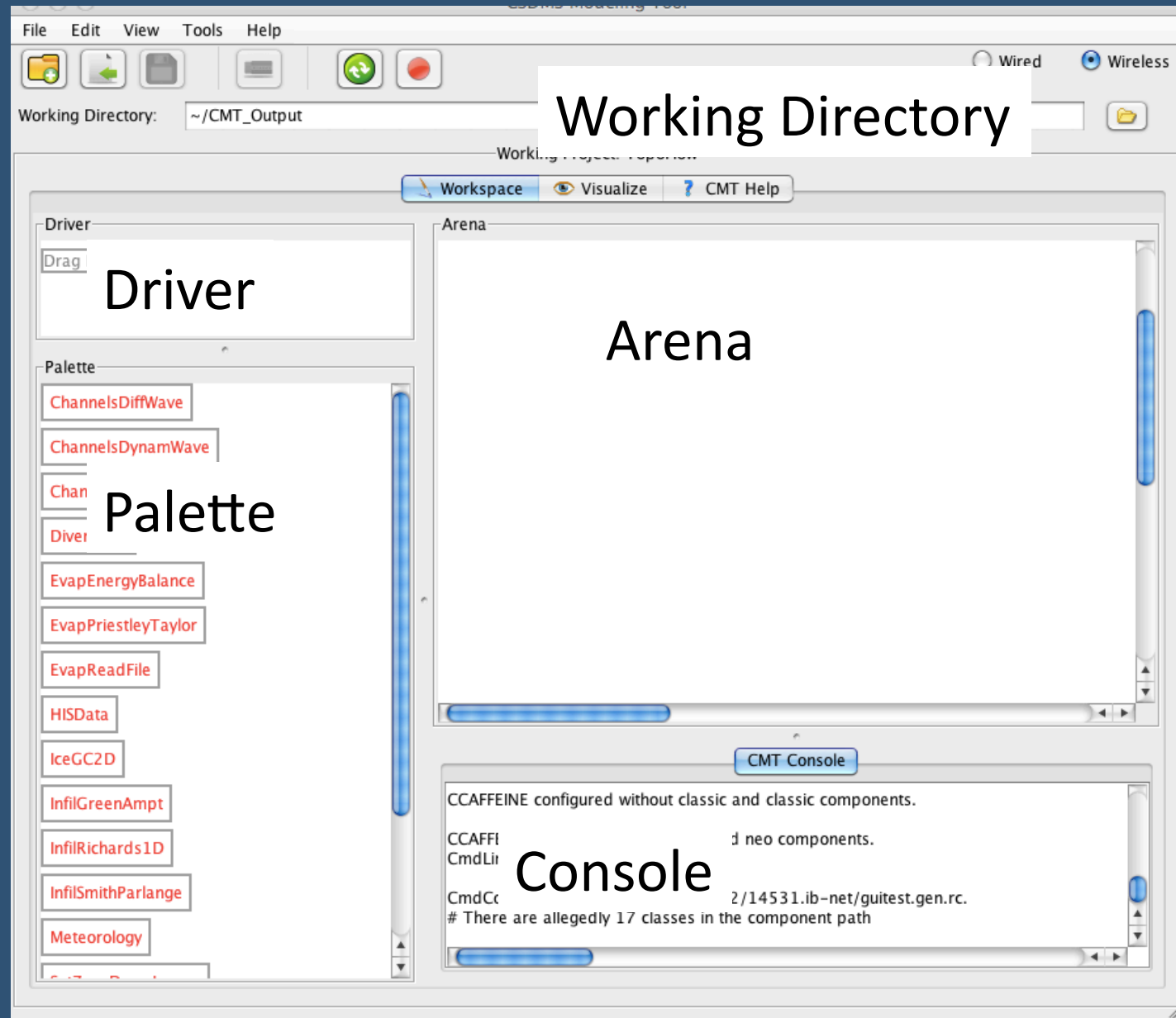


Open Projects

Workspace



Workspace Features



Setting up a Simulation

Now hit RUN

The screenshot shows the CMT (Contractor Modeling Tool) interface. The top menu bar includes File, Edit, View, Tools, and Help. Below the menu is a toolbar with icons for file operations and simulation control. The 'Working Directory' is set to ~/CMT_Output. The 'Working Project' is 'HydroTrend + CEM'. The interface is divided into several sections:

- Driver:** A list on the left showing 'CEM'.
- Palette:** A list on the left showing 'CEM', 'HydroTrend', and 'Waves'.
- Arena:** The main workspace containing three components:
 - Driver: CEM:** A component with buttons for 'Run', 'River', 'Elevation', 'Waves', and 'Configure'. A green arrow points to the 'Run' button.
 - Component: HydroTrend:** A component with buttons for 'River' and 'Configure'.
 - Component: Waves:** A component with buttons for 'Waves' and 'Configure'.
- CMT Console:** A text area at the bottom showing the following output:

```
/data1/progs/cca/src/20100730/cca-tools-contractor/_build/build/ccaffeine/cxx/dc/framework/Gizzard.cxx:855: !U
Reading xml file /data1/progs/components/hydrotrend_cem/ht_cem/_build/hydrotrend_cem/../../share/config/Hydro
Connecting...
userPI = name = River, tm.portname= Waves, type = edu.csdms.ports.IRFPort, active=false, selfConnected=false, con
provPI = name = River, tm.portname= ppf, type = edu.csdms.ports.IRFPort
```


Setting up a Simulation

The screenshot displays the CMT (Contractor Modeling Tool) interface, which is used for setting up and running simulations. The main window is titled "Working Project: HydroTrend + CEM".

Top Bar: Includes a menu bar (File, Edit, View, Tools, Help) and a toolbar with icons for file operations and simulation control. The "Working Directory" is set to "~/CMT_Output".

Workspace: The central area for building the simulation model. It contains three main components:

- Driver: CEM:** A component with buttons for "Run", "Elevation", "Configure", "River", and "Waves".
- Component: HydroTrend:** A component with buttons for "River" and "Configure".
- Component: Waves:** A component with buttons for "Waves" and "Configure".

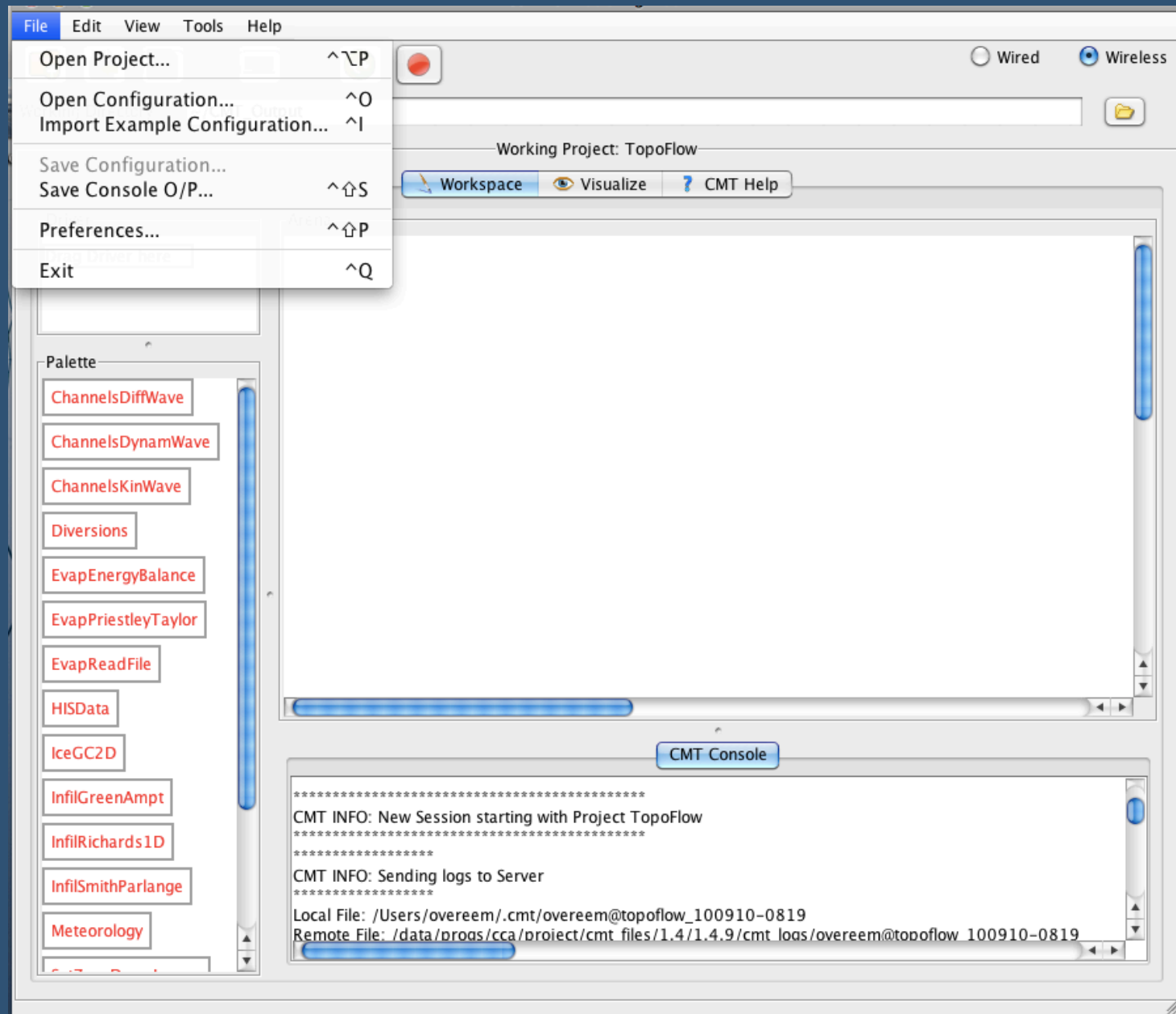
Red lines indicate connections between the "River" button of the "Driver: CEM" component and the "River" button of the "Component: HydroTrend" component. Another red line connects the "Waves" button of the "Driver: CEM" component to the "Waves" button of the "Component: Waves" component.

Left Panel: Contains a "Driver" list with "CEM" selected and a "Palette" with "CEM", "HydroTrend", and "Waves" components.

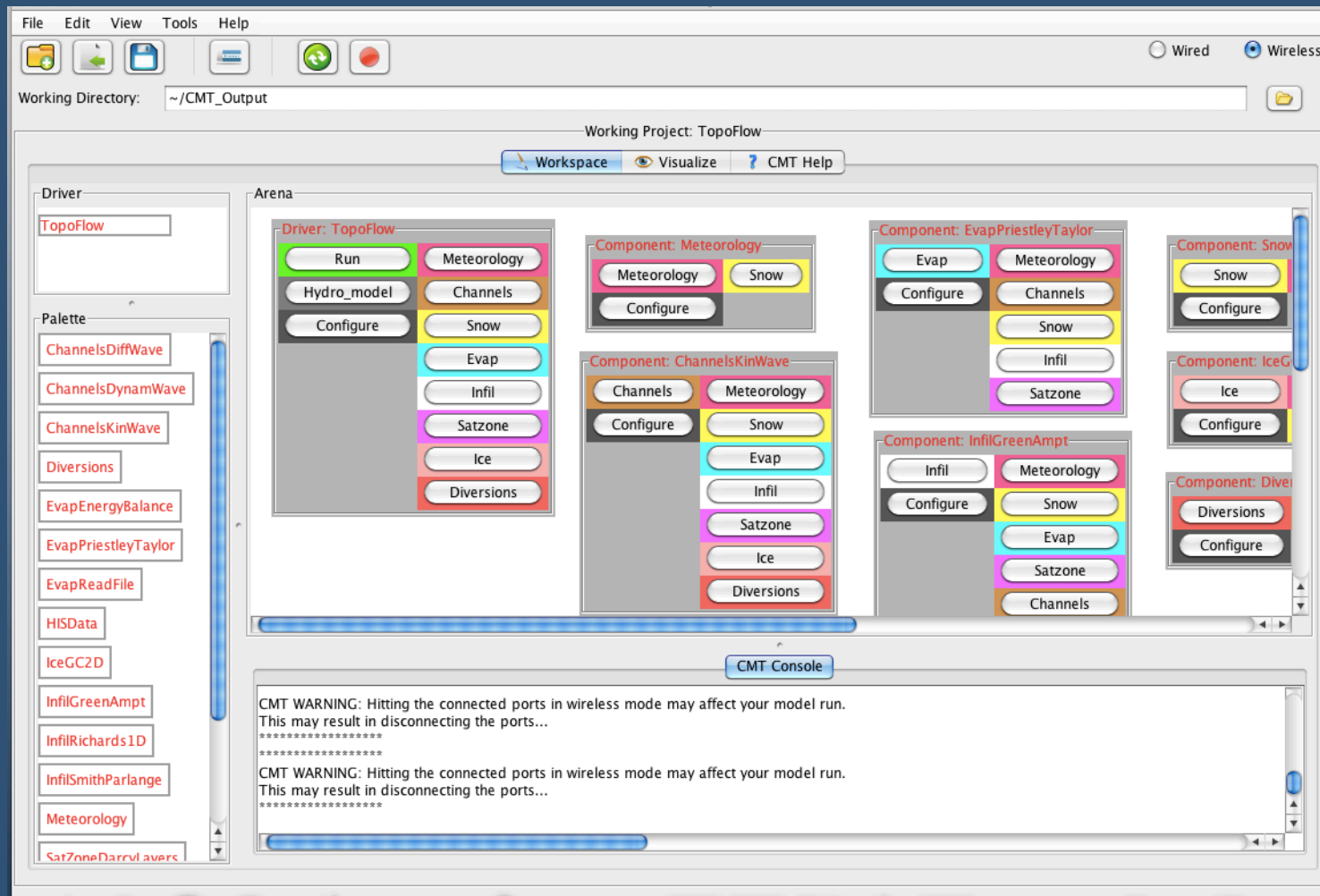
Bottom Panel: Labeled "CMT Console", it displays the following log output:

```
/data1/progs/cca/src/20100730/cca-tools-contractor/_build/build/ccaffeine/cxx/dc/framework/Gizzard.cxx:855: !U
Reading xml file /data1/progs/components/hydrotrend_cem/ht_cem/_build/hydrotrend_cem/../../share/config/Hydro
Connecting...
userPI = name = River, tm.portname= Waves, type = edu.csdms.ports.IRFPort, active=false, selfConnected=false, con
provPI = name = River, tm.portname= ppf, type = edu.csdms.ports.IRFPort
```

Example Configurations: 'BLD-Files'



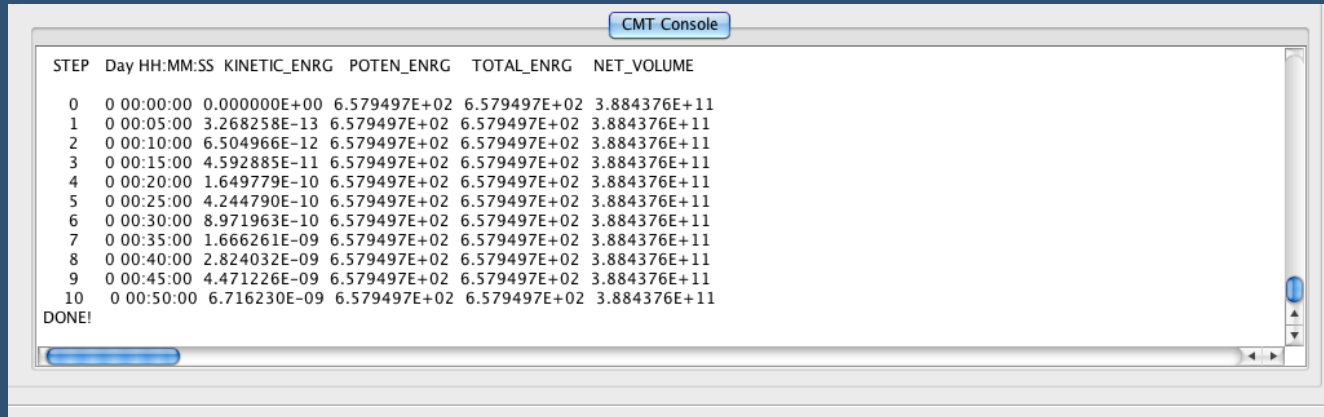
Example Configurations: 'BLD-Files'



TopoFlow; infiltration modules. This is an example where you can first run more simple algorithms, Green-Ampt Infiltration, and then swap in more complex methods, f.e. Richards Infiltration.

Getting Simulation Results

1. Console prints basic model results & statements on simulation

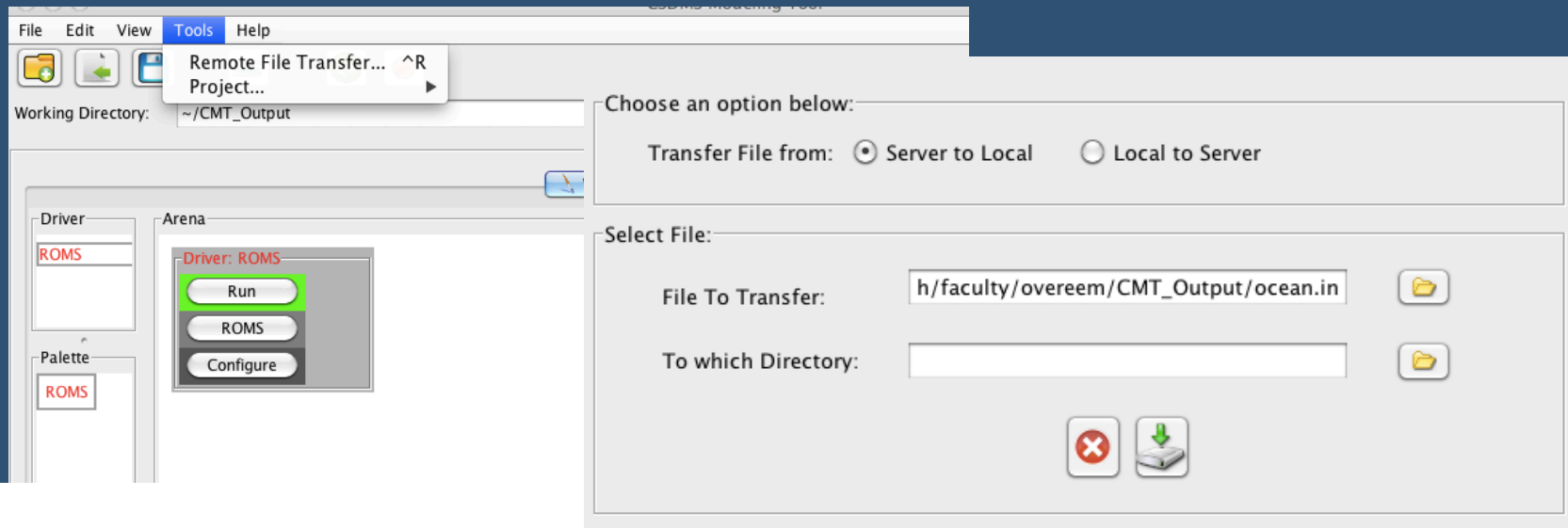


The screenshot shows a window titled "CMT Console" with a table of simulation results. The table has five columns: STEP, Day HH:MM:SS, KINETIC_ENRG, POTEN_ENRG, TOTAL_ENRG, and NET_VOLUME. The data spans from STEP 0 to STEP 10, with the final row indicating "DONE!".

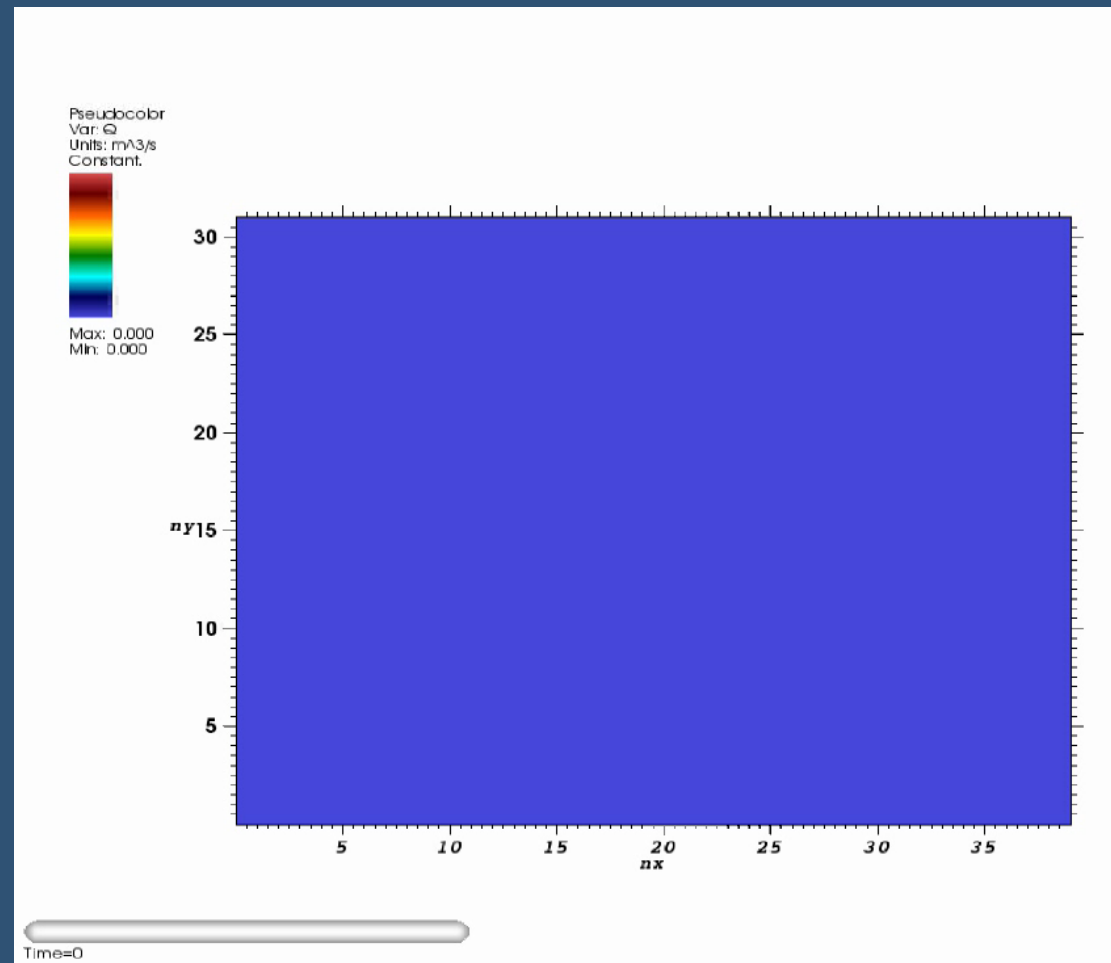
STEP	Day HH:MM:SS	KINETIC_ENRG	POTEN_ENRG	TOTAL_ENRG	NET_VOLUME
0	0 00:00:00	0.000000E+00	6.579497E+02	6.579497E+02	3.884376E+11
1	0 00:05:00	3.268258E-13	6.579497E+02	6.579497E+02	3.884376E+11
2	0 00:10:00	6.504966E-12	6.579497E+02	6.579497E+02	3.884376E+11
3	0 00:15:00	4.592885E-11	6.579497E+02	6.579497E+02	3.884376E+11
4	0 00:20:00	1.649779E-10	6.579497E+02	6.579497E+02	3.884376E+11
5	0 00:25:00	4.244790E-10	6.579497E+02	6.579497E+02	3.884376E+11
6	0 00:30:00	8.971963E-10	6.579497E+02	6.579497E+02	3.884376E+11
7	0 00:35:00	1.666261E-09	6.579497E+02	6.579497E+02	3.884376E+11
8	0 00:40:00	2.824032E-09	6.579497E+02	6.579497E+02	3.884376E+11
9	0 00:45:00	4.471226E-09	6.579497E+02	6.579497E+02	3.884376E+11
10	0 00:50:00	6.716230E-09	6.579497E+02	6.579497E+02	3.884376E+11

DONE!

2. Output files have been written onto your Working directory on Beach. Go grab them! Transfer the remote file to your local machine.



VisIt: Visualizing Grids



Richard's Infiltration, during 200 min rainstorm.
Runoff over an inclined plane over 300 min.

CMT Contributors & Team

- CMT Model Contributors: Hernan Arango & Aaron Beaver, Andrew Ashton & Brad Murray, Eric Hutton, Albert Kettner, Mark Kessler & Bob Anderson, Gary Parker & Enrica Viparelli, Scott Peckham, Greg Tucker.
- CMT Tool development: Jisamma Kallumadikal.
- Development of Components: Scott Peckham, Eric Hutton, Beichuan Yan.
- Help & Educational Material: Irina Overeem, Maureen Berlin, Jisamma Kallumadikal.
- Testing: many of the above + 8 CU Department of Geology Graduate Students 2010 + visiting students and postdocs.
- CCA team provided Ccaffeine GUI.

Find Help on CSDMS wiki

1) Register for HPCC account and use Beach

http://csdms.colorado.edu/wiki/HPCC_Access

2) CSDMS Modeling Tool installation and use

http://csdms.colorado.edu/wiki/CMT_download

3) Visit for parallel scientific visualization

http://csdms.colorado.edu/wiki/CMT_visualization

<https://wci.llnl.gov/codes/visit/>

4) NetCDF output files now standard within CSDMS framework

<http://www.unidata.ucar.edu/software/netcdf/>