

The Community Surface Dynamics Modeling System (CSDMS) Hydrology Focus Research Group

Jonathan L. Goodall

Chair, CSDMS Hydrology Research Focus Group

Associate Professor, University of Virginia



CSDMS

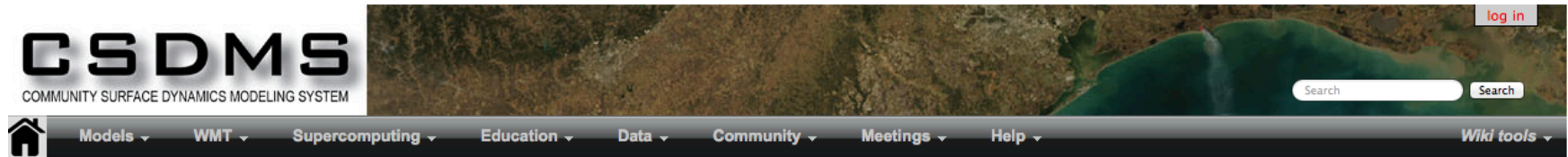
- CSDMS = The Community Surface Dynamics Modeling System
- Funded by the US National Science Foundation under awards (0621695 and 1226297)
- Includes software development and community-building goals centered on modeling the Earth's surface
- <http://csdms.colorado.edu>

CSDMS Community

Chair	Working Groups (WG) / Focus Research Groups (FRG)	Members
Greg Tucker	Terrestrial WG	547 Members
Brad Murray	Coastal WG	416 Members
Courtney Harris	Marine WG	279 Members
Sam Bentley	Education and Knowledge Transfer (EKT) WG	180 Members
Eckart Meiburg	Cyberinformatics and Numerics WG	172 Members
Jon Goodall	Hydrology FRG	406 Members
Peter Burgess	Carbonate FRG	73 Members
Carl Friedrichs	Chesapeake FRG	50 Members
Phaedra Upton and Mark Behn	Geodynamics FRG	50 Members
Chris Duffy	Critical Zone FRG	27 Members
Kathleen Galvin and Mike Ellis	Anthropocene FRG	23 Members
Brad Murray	Coastal Vulnerability Initiative	14 Members
Courtney Harris	Continental Margin Initiative	9 Members
		All members of CSDMS

Includes 2,246 members from 123 U.S. universities and 65 different countries

CSDMS Model Repository



SWAT

Metadata

Summary	Contact	Technical specs	In/Output	Process	Testing	Other	Component info
Also known as							
Model type	Modular						
Spatial dimensions	2D						
Spatial extent	Landscape-Scale, Watershed-Scale						
Model domain	,						
One-line model description	SWAT is a river basin scale model developed to quantify the impact of land management practices in large, complex watersheds.						
Extended model description	SWAT is the acronym for Soil and Water Assessment Tool, a river basin, or watershed, scale model developed by Dr. Jeff Arnold for the USDA Agricultural Research Service (ARS). SWAT was developed to predict the impact of land management practices on water, sediment and agricultural chemical yields in large complex watersheds with varying soils, land use and management conditions over long periods of time.						
Keywords:	biogeochemistry, water quality,						

Model info	
Authors	[show]
Source code	[show]
QR-code	[hide]
	
Link to this page	
Other models by this author	[show]

Includes 171 models and 56 tools with extensive metadata

Web Modeling Tool

The screenshot displays the CSDMS Web Modeling Tool interface in a web browser. The browser's address bar shows the URL <https://csdms.colorado.edu/wmt/WMT.html>. The page title is "The CSDMS Web Modeling Tool". In the top right corner, the user is logged in as "goodall@virginia.edu" with a "Sign Out" button.

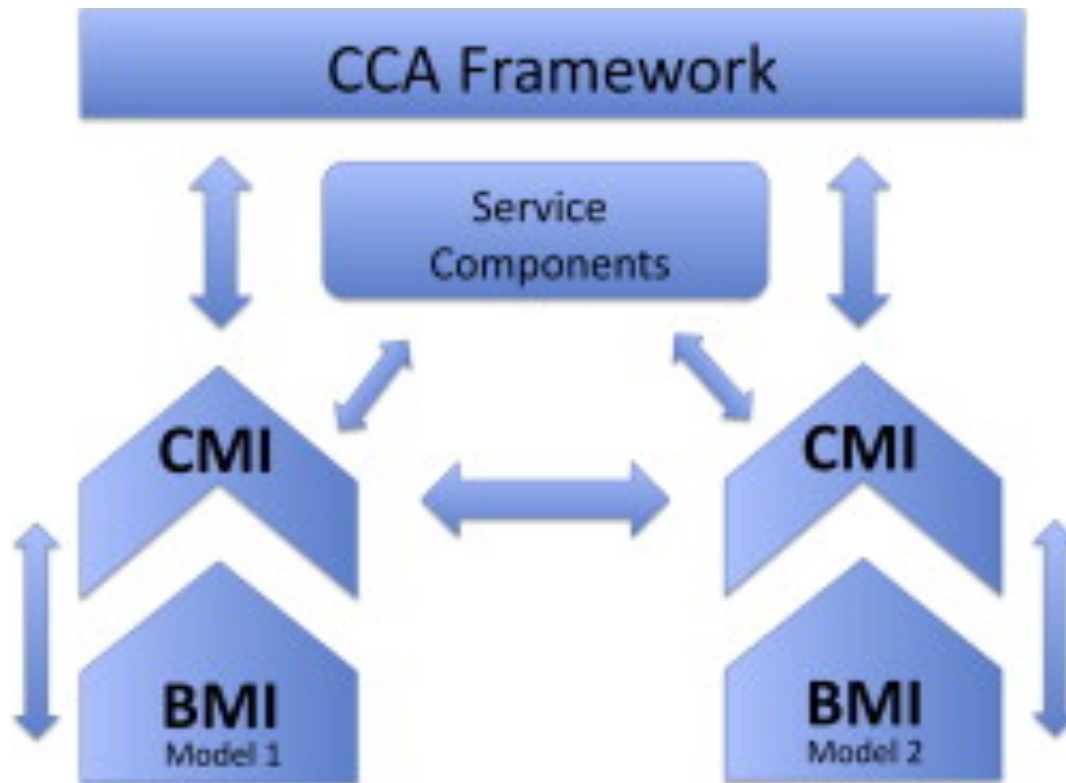
The interface is divided into two main panels. The left panel, titled "Model (*HydroTrend 5)", contains buttons for file operations (upload, save, play, and a "More" dropdown) and a "HydroTrend" dropdown menu. The right panel, titled "Parameters (HydroTrend)", contains a "Run Parameters" section with a "Simulation run time (d)" input field set to 100. Below this is an "Input Files" section with a "Basin hypsometry file" input field set to "waipaoa.hyps". The bottom section, titled "Temperature", contains a list of temperature parameters with input fields for each:

Parameter	Value
Simulation run time (d)	100
Basin hypsometry file	waipaoa.hyps
Mean annual temperature at the start of the simulation (deg C)	14.26
Rate of change of mean annual temperature (deg C / yr)	0.0
Standard deviation of mean annual temperature (deg C)	0.55
Mean temperature for January (deg C)	19.14
Mean temperature for February (deg C)	18.85
Mean temperature for March (deg C)	17.49
Mean temperature for April (deg C)	14.76
Mean temperature for May (deg C)	12.08

Web-based software tool for creating, editing, and executing linked model configurations.

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

Modeling Coupling Approach



BMI = Basic Modeling Interface

CMI = Component Model Interface

BMI

- A framework-agnostic, minimally invasive template for creating a model component
- Includes methods for
 - Model control
 - Getting model information
 - Getting variable information
 - Getting/setting variable values
 - Getting grid information

Source: http://csdms.colorado.edu/wiki/BMI_Description

Componentized Models

TopoFlow as an example of a hydrologic model that has been componentized

TopoFlow	Spatially-distributed, D8-based hydrologic model	Peckham, Scott		
TopoFlow-Channels-Diffusive Wave	Diffusive Wave process component for flow routing in a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Channels-Dynamic Wave	Dynamic Wave process component for flow routing in a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Channels-Kinematic Wave	Kinematic Wave process component for flow routing in a D8-based, spatial hydrologic model.	Peckham, Scott	▶	?
TopoFlow-Diversions	Diversions component for a D8-based, spatial hydrologic model.	Peckham, Scott	▶	?
TopoFlow-Evaporation-Energy Balance	Evaporation process component (Energy Balance method) for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Evaporation-Priestley Taylor	Evaporation process component (Priestley-Taylor method) for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Evaporation-Read File	Evaporation process component (read from file method) for a spatially-distributed hydrologic model.	Peckham, Scott	▶	?
TopoFlow-Infiltration-Green-Ampt	Infiltration process component (Green-Ampt method) for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Infiltration-Richards 1D	Infiltration process component (Richards 1D method) for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Infiltration-Smith-Parlange	Infiltration process component (Smith-Parlange method) for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Meteorology	Meteorology process component for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Saturated Zone-Darcy Layers	Saturated Zone process component (Darcy's law, multiple soil layers) for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Snowmelt-Degree-Day	Snowmelt process component (Degree-Day method) for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?
TopoFlow-Snowmelt-Energy Balance	Snowmelt process component (Energy Balance method) for a D8-based, spatial hydrologic model	Peckham, Scott	▶	?

Source: http://csdms.colorado.edu/wiki/CMT_run_models

55 models in total have been “componentized” using the BMI so that they can be used within CMT/WMT

The CSDMS Hydrology Focus Research Group (FRG)

- Co-sponsored with the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUASHI)
- 406 Hydrology FRG members as of June, 2014
- 53 hydrological models and 40 hydrological tools in CSDMS Model Repository

Goals of the Hydrology FRG

- Based on a discussion of community members at the 2012 CSDMS All Hands meeting we established a set of short, medium, and long-term goals
- These goals were documented in the CSDMS five year strategic plan
http://csdms.colorado.edu/w/images/CSDMS_Strategic_Plan-2013.pdf

Selected Goals

- **Short term:** Improve collaboration among related community modeling activities
- **Medium term:** Standardize model benchmarking and skill assessment tests
- **Long term:** Lower technical barriers for participating in community modeling

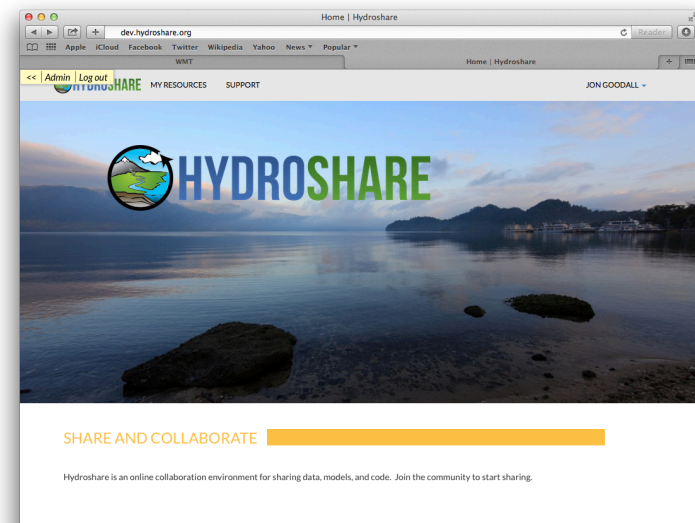
Example of the CSDMS Hydrology FRG goal: Improve collaboration among related community-based CI activities

CSDMS Web Modeling Tool

The screenshot shows the CSDMS Web Modeling Tool interface. The browser address bar displays <https://csdms.colorado.edu/wmt/WMT.html>. The page title is "The CSDMS Web Modeling Tool". A user is logged in as "goodall@virginia.edu" with a "Sign Out" button. The interface is divided into two main sections: "Model (*HydroTrend 5)" on the left and "Parameters (HydroTrend)" on the right. The left section has a "HydroTrend" dropdown menu. The right section contains several input fields for simulation parameters:

Parameter	Value
Simulation run time (d)	100
Basin hypsometry file	waipaoa.hyps
Mean annual temperature at the start of the simulation (deg C)	14.26
Rate of change of mean annual temperature (deg C / yr)	0.0
Standard deviation of mean annual temperature (deg C)	0.55
Mean temperature for January (deg C)	19.14
Mean temperature for February (deg C)	18.85
Mean temperature for March (deg C)	17.49
Mean temperature for April (deg C)	14.76
Mean temperature for May (deg C)	12.08

CUAHSI HydroShare



Both NSF funded efforts with overlap in the hydrology community and a shared interest in fostering community building in model and data sharing

CSDMS Web Modeling Tool

https

csdms.colorado.edu/wmt/WMT.html

Reader

Apple

iCloud

Facebook

Twitter

Wikipedia

Yahoo

News

Popular

The CSDMS Web Modeling Tool

goodall@virginia.edu

Sign Out

Model (*Model 0)

More

driver

+

Parameters

CSDMS Web Modeling Tool

https

csdms.colorado.edu/wmt/WMT.html

Reader

Apple

iCloud

Facebook

Twitter

Wikipedia

Yahoo

News

Popular

The CSDMS Web Modeling Tool

goodall@virginia.edu

Sign Out

Model (*Model 0)

More

driver

+

Avulsion

base_level

CEM

CHILD

coastal_environment

HydroTrend

Plume

River

Sedflux2D

Sedflux3D

Waves

Parameters

CSDMS Web Modeling Tool

https://csdms.colorado.edu/wmt/WMT.html

Reader

Apple iCloud Facebook Twitter Wikipedia Yahoo News Popular

The CSDMS Web Modeling Tool

goodall@virginia.edu Sign Out

⚙️ Model (*Model 0)

📁

💾

▶️

More ▾

driver +

⚙️ Avulsion

⚙️ base_level

⚙️ CEM

⚙️ CHILD

⚙️ coastal_environment

⚙️ HydroTrend

⚙️ Plume

⚙️ River

⚙️ Sedflux2D

⚙️ Sedflux3D

⚙️ Waves

🔑 Parameters

CSDMS Web Modeling Tool

https

csdms.colorado.edu/wmt/WMT.html

Reader

Apple

iCloud

Facebook

Twitter

Wikipedia

Yahoo

News

Popular

The CSDMS Web Modeling Tool

goodall@virginia.edu

Sign Out

Model (*HydroTrend 5)

More

HydroTrend

Parameters (HydroTrend)

Run Parameters

Simulation run time (d)

100

Input Files

Basin hypsometry file

waipaoa.hyps

Temperature

Mean annual temperature at the start of the simulation (deg C)

14.26

Rate of change of mean annual temperature (deg C / yr)

0.0

Standard deviation of mean annual temperature (deg C)

0.55

Mean temperature for January (deg C)

19.14

Mean temperature for February (deg C)

18.85

Mean temperature for March (deg C)

17.49

Mean temperature for April (deg C)

14.76


Mean temperature for May (deg C)

12.08

Model (*HydroTrend 5)



More ▼

HydroTrend 

Parameters (HydroTrend)



Run Parameters

Simulation run time (d)	100
-------------------------	-----

100

Input Files

Basin_hypsometry file waipaoa.hyps 

Name:

 Labels

 Save  Cancel

Name: HydroTrend - Run 1



Labels



Save



⊘ Cancel

Temperature (deg C) 14.26

14.26

0.0

Standard deviation of mean annual temperature (deg C)	0.55
---	------

0.55

Mean temperature for January (deg C)	19.14
--------------------------------------	-------

19.14

Mean temperature for February (deg C)	18.85
---------------------------------------	-------

18.85

Mean temperature for March (deg C)	17.49
------------------------------------	-------

17.49

Mean temperature for April (deg C)	14.76
------------------------------------	-------

14.76

Mean temperature for May (deg C)	12.08
----------------------------------	-------

12.08

Model (HydroTrend – Run 1)

More ▾

HydroTrend ▾

Parameters (HydroTrend)

Run Parameters

Simulation run time (d)	100
Input file	waipaoa.hyps
Temperature (deg C)	14.26
Change (deg C / yr)	0.0
Wind speed (deg C)	0.55
Mean temperature for January (deg C)	19.14
Mean temperature for February (deg C)	18.85
Mean temperature for March (deg C)	17.49
Mean temperature for April (deg C)	14.76
Mean temperature for May (deg C)	12.08

Run Model...

Host: beach.colorado.edu

Username: jogo5261

Password:

Run

Cancel

CSDMS Web Modeling Tool

goodall@virginia.edu Sign Out

https csdms.colorado.edu/wmt/WMT.html

Reader

Apple iCloud Facebook Twitter Wikipedia Yahoo News Popular

CSDMS Web Modeling Tool

https

csdms.colorado.edu/wmt/WMT.html

Reader

Apple iCloud Facebook Twitter Wikipedia Yahoo News Popular

The CSDMS Web Modeling Tool

goodall@virginia.eduSign Out

Model (HydroTrend – Run 1)

More

HydroTrend

Parameters (HydroTrend)

Run Parameters

Simulation run time (d)

100

Input Files

Model Run Information

Success!

You have submitted your model run.

View run status...

Close

waipaoa.hyps

deg C)

14.26

0.0

Standard deviation of mean annual temperature (deg C)

0.55

Mean temperature for January (deg C)

19.14

Mean temperature for February (deg C)

18.85

Mean temperature for March (deg C)

17.49

Mean temperature for April (deg C)

14.76

Mean temperature for May (deg C)

12.08

WMT

https

csdms.colorado.edu/wmt/api-dev/run/show

Reader

Apple

iCloud

Facebook

Twitter

Wikipedia

Yahoo






News

Popular


The CSDMS Modeling Tool

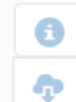
goodall@virginia.eduSign out

Simulation Status

Model	Owner	Date	Message	
 HydroTrend - Run 1	gooda...	2014-06-13 13:02	simulation is complete and available for pickup	<div><div>i</div><div>cloud</div><div>trash</div></div>
 River 3	gooda...	2014-06-13 12:44	simulation is complete and available for pickup	<div><div>i</div><div>cloud</div><div>trash</div></div>
 HydroTrend 0	gooda...	2014-06-13 12:29	simulation is complete and available for pickup	<div><div>i</div><div>cloud</div><div>trash</div></div>
 HydroTrend 0	gooda...	2014-06-13 12:27	authentication error of beach.colorado.edu	<div><div>i</div><div>cloud</div><div>trash</div></div>
 HydroTrendtestforbf	irina...	2014-06-10	simulation is complete and available for pickup	<div><div>i</div></div>

Simulation Status

Model	Owner	Date	Message
 HydroTrend - Run 1	gooda...	2014-06-13 13:02	simulation is complete and available for pickup



Model



Owner

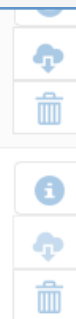
Date

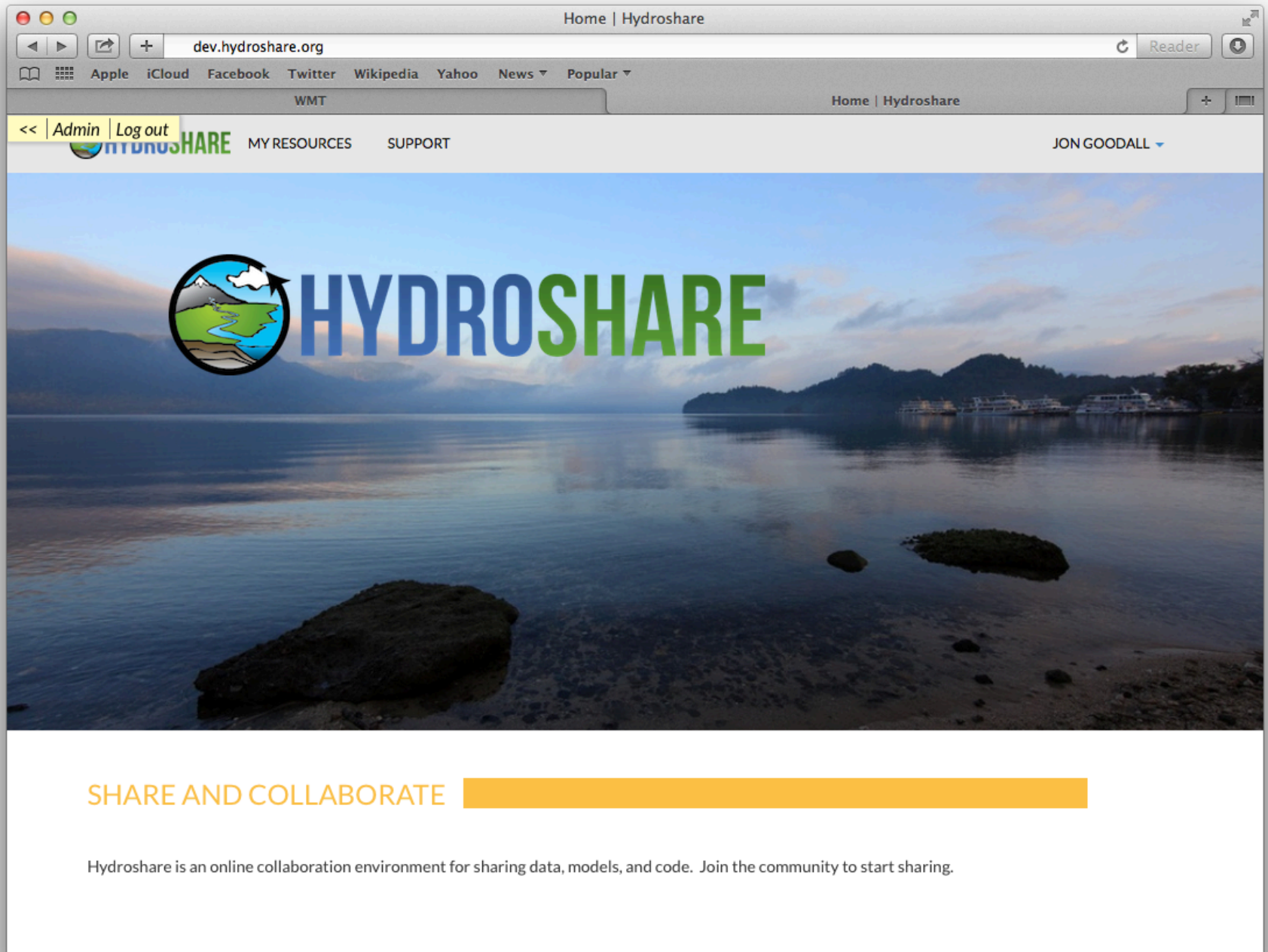
Message

 HydroTrend - Run 1	gooda...	2014-06-13 13:02	simulation is complete and available for pickup
--	----------	------------------	---



		06-13 12:29	
 HydroTrend 0	gooda...	2014-06-13 12:27	authentication error of beach.colorado.edu
 HydroTrendtestforbf	irina...	2014-06-10	simulation is complete and available for pickup





My Resources | Hydroshare

dev.hydroshare.org/my-resources/

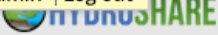
Reader

Apple iCloud Facebook Twitter Wikipedia Yahoo News Popular

WMT

My Resources | Hydroshare

<< Admin Log out

 MY RESOURCES SUPPORT

JON GOODALL

JON GOODALL'S RESOURCES

Filtering

Keywords

General keywords associated with the resource

Dublin core

Abstract

Keywords that should appear in the term content

Add row

Update results

Created by me

Editable by me

Viewable by me

Published

+ Create new

<input type="checkbox"/> Title ^	Type	Creator	Last modified
<input type="checkbox"/> EPA-SWMM model	Generic Hydroshare Resource	Mohamed Morsy	June 12, 2014, 1:20 p.m.

Create Resource | Hydroshare

dev.hydroshare.org/create-resource/

WMT

Create Resource | Hydroshare

Admin | Log out

MY RESOURCES SUPPORT JON GOODALL

CREATE RESOURCE

Upload files to create a new Resource:

- All of the files you upload here will be grouped together into a "Resource"
- File size is limited to 4 GB per file
- Once you've added all of your files, you can describe your Resource using the form below
- Files are private, until you choose to share them

Add your files here:

Choose File 40e61b50-80a7-4dee-82bc-e18b8aec0e75.tar Delete

Add a Row

Describe your Resource with metadata:

Use this form to create metadata for your Resource. Be as descriptive as you can since all of this information will show up when your Resource is displayed. You can edit this information later.

Add your metadata here:

Resource Type Generic Resource

Title HydroTrend - Run 1

Creators Jon Goodall

Contributors Jon Goodall

Abstract A CSDMS Web Modeling Tool model run of the HydroTrend component with default model parameters.

Subject Keywords CSDMS, WMT, HydroTrend

Create Resource

CSDMS Model
Run Output

Could have new
resource type:
CSDMS Model
Package
Resource

Need to have
consistent
metadata
across systems

HydroTrend - Run 1 | Hydroshare

dev.hydroshare.org/hydotrend-run-1/

WMT HydroTrend - Run 1 | Hydroshare

<< Admin Log out HYDROSHARE MY RESOURCES SUPPORT JON GOODALL

EDIT HYDOTREND - RUN 1

Resource Details

Share Edit Delete

Resource Type	Generic Hydroshare Resource
Created by	Jon Goodall
Created on	June 13, 2014
Last updated by	Jon Goodall
Updated on	June 13, 2014
Keywords	CSDMS, WMT, HydroTrend
Size	47.1 KB
Permalink	126c860945a94585bf3c6d6f8aacb26d
DOI	Submit for publication

Resource Description

Edit Abstract

A CSDMS Web Modeling Tool model run of the HydroTrend component with default model parameters.

References

No citations listed

Add reference

Other Metadata

Contributor	Jon Goodall
Creator	Jon Goodall
Date Submitted	2014-06-13T19:08:43.910451+00:00
Title	HydroTrend - Run 1

Add metadata term

Content

40e61b50-80a7-4dee-82bc-e18b8aec0e75.tar	Download (150.0 KB)	Delete
--	---------------------	--------

Export all Add file

Mechanism to publish resource and assign DOI

Track both creators and contributors

HydroTrend - Run 1 | Hydroshare

dev.hydroshare.org/hydotrend-run-1/

WMT HydroTrend - Run 1 | Hydroshare

<< Admin Log out MY RESOURCES SUPPORT JON GOODALL

Sharing

Edit This resource can be viewed and downloaded by anyone.

You are the owner of this resource.

Users with full read/write permissions on this resource

Hold down "Control", or "Command" on a Mac, to select more than one.

- Lisa Stillwell
- David Tarboton
- carol song
- david valentine
- Jeffery Horsburgh
- Tian Gan
- Mohamed Morsy
- Ash Semien
- Dan Ames
- Ray Idaszak
- Jon Goodall**
- Tony Castronova
- Wilfred Alvarez
- Shaun Livingston
- shaun livingston
- Jefferson Heard
- Jefferson Heard
- Stephen Jackson
- Jefferson Heard
- Jeff Heard

Update access list

Users who can edit the content of this resource

Research groups that can edit the content of this resource

Comments

There are currently no comments

New Comment

Name

Jon Goodall

required

Email

goodall@virginia.edu

required (not published)

Website

optional

Comment

^

Control permissions for resource

Comment on resources

My Resources | Hydroshare

dev.hydroshare.org/my-resources/

WMT My Resources | Hydroshare

<< Admin Log out MY RESOURCES SUPPORT JON GOODALL

JON GOODALL'S RESOURCES

Filtering

Keywords

General keywords associated with the resource

Dublin core

Abstract Keywords that should appear in the term content

Add row Update results

Created by me

Editable by me

Viewable by me

Published

+ Create new

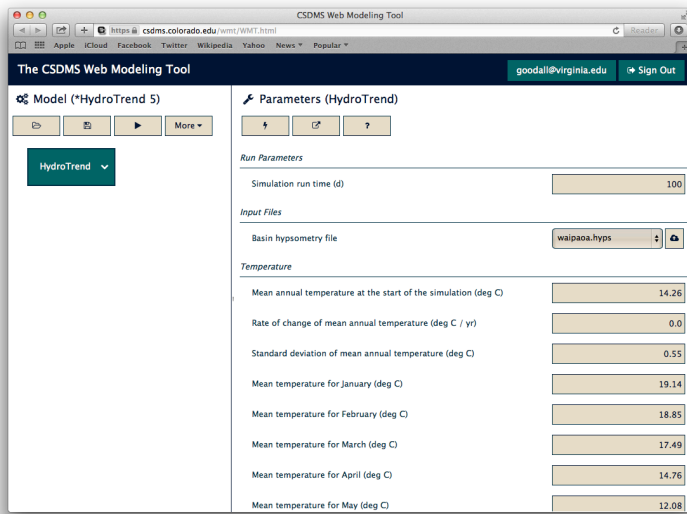
<input type="checkbox"/> Title ^	Type	Creator	Last modified
<input type="checkbox"/> EPA-SWMM model	Generic Hydroshare Resource	Mohamed Morsy	June 12, 2014, 1:20 p.m.
<input type="checkbox"/> Generic Resource Test	Generic Hydroshare Resource	Jefferson Heard	June 11, 2014, 5:35 p.m.
<input type="checkbox"/> HydroTrend - Run 1	Generic Hydroshare Resource	Jon Goodall	June 13, 2014, 7:08 p.m.
<input type="checkbox"/> Provo River Water Flow 2009-12-12 to 2010-12-15	Generic Hydroshare Resource	shaun livingston	June 11, 2014, 5:31 p.m.
<input type="checkbox"/> Provo River Water Flow 2009-12-12 to 2010-12-15	Generic Hydroshare Resource	shaun livingston	June 11, 2014, 6:58 p.m.
<input type="checkbox"/> Text and figures for our iEMSs paper titled 'Metadata for Describing Water Models'	Generic Hydroshare Resource	Jon Goodall	June 11, 2014, 5:30 p.m.

Results 0-6 of 6

Filter resources based on metadata

See your resources and those shared with you

CSDMS Web Modeling Tool

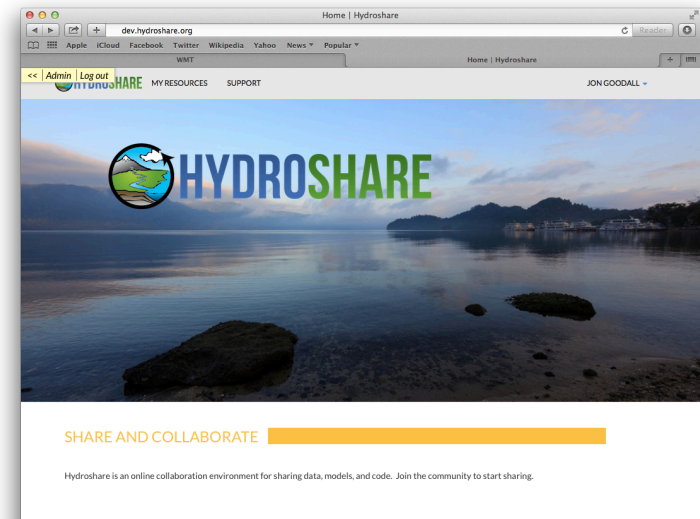


Load, Edit, and Execute
Model Packages within
CSDMS WMT

Example of Improve
collaboration among related
community modeling
activities

Backup, document, and
share model runs as
HydroShare Model Resources

HydroShare



*This can be done manually now but
could be automated.*

How can you help?

- Become a member of CSDMS and the Hydrology Focus Research Group
- Contribute your model to the CSDMS model repository
- Vote on candidate models to be added to WMT
- Refactor your model (or someone else's model) so that it follows the BMI convention
- Create mappings between your variables and variables within the list of CSDMS Standard Names
- Request that your model be added to the WMT:
http://csdms.colorado.edu/wiki/WMT_add_model

Thank you!

- Contact information:

Jon Goodall

University of Virginia

goodall@virginia.edu

