

2011 GO-ESSP Workshop

Building a Scientific Workspace Environment for Collaborative Analysis of Climate Data

Luca Cinquini [1][2], Cecelia DeLuca [2], Sylvia Murphy [2]

[1] NASA Jet Propulsion Laboratory

[2] NOAA Earth System Research Laboratory

The Curator Commodity Governance (COG) project is based on a 3-year grant awarded by NSF to execute two lines of activities:

- Research, experiment and report on structured governance in a scientific project
- Development of a web-based scientific workspace environment

Historically COG is a follow up to the NSF Earth System Curator.

Project team is a diverse mixture of project managers, software engineers, professors and social scientists: Cecelia DeLuca [1][2] (PI), James Syvitsi [2] (PI), Paul Edwards [4] (PI), Balaji [3], Luca Cinquini [1][5], Christiane Jablonowski [4], Sylvia Murphy [1][2], Richard Rood [4], Irina Overeem [2], Don Middleton [6], Cristen Torrey [4]

[1] NOAA Earth System Research Laboratory

[2] University of Colorado

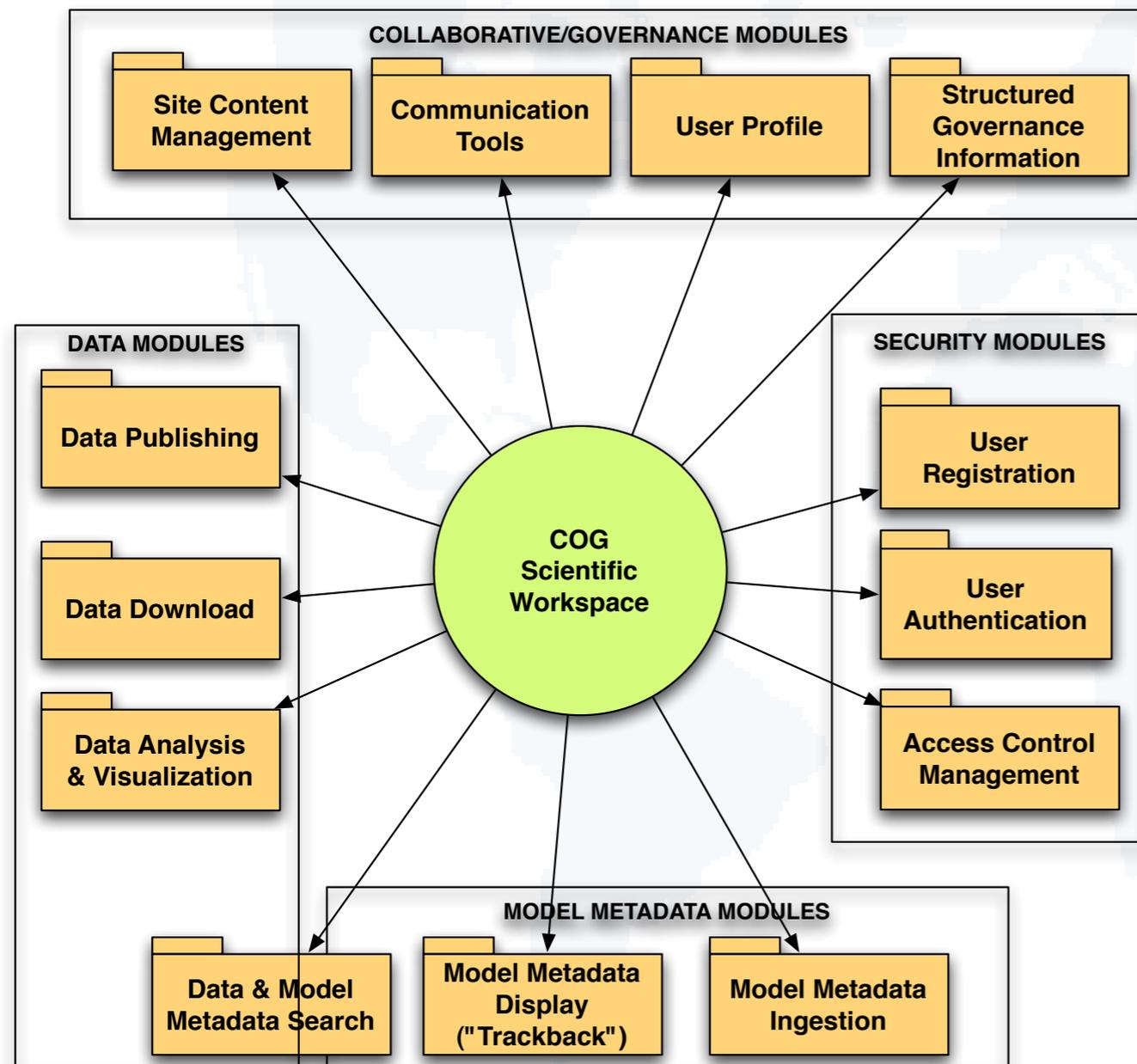
[3] NOAA Geophysical Fluid Dynamics Laboratory

[4] University of Michigan

[5] NASA Jet Propulsion Laboratory

[6] NSF National Center for Atmospheric Research

A web based project hosting environment that combines traditional data and metadata services, social and communication tools to enhance collaborative scientific research, and a structured model for capturing and exposing information for project governance



High Level Functionality

- A data workspace where users can collect references to datasets and associated metadata, use tools (e.g. TDS, LAS, others) to analyze or process these artifacts, and discuss the results with peers
- A web environment where information about a project can be easily represented, organized and shared (a "quick wiki")
- An indexing layer where project can discover information about other projects, and establish inter-project communication ("community of communities")

The COG workspace is intended to provide a flexible hosting environment for the following projects and activities:

- Graduate and post-doctoral workshops
 - ▶ Example: the ASP Colloquium held at NCAR in summer 2008 (and planned again for summer 2012) about comparison of atmospheric dynamical cores (i.e. the part of the model that solves the fluid equation)
- Generic Model Intercomparison Projects (not tied to class courses)
- Collaborative data analysis
- Hosting of specific applications that generate derived data products
 - ▶ Regional and local regridded and downscaled datasets
- Coordinated development of multi-component models
 - Enable communication among groups working at the separate pieces of a global Earth System model: atmosphere, sea-ice, biogeochemistry, ...
- Domain knowledge repository (organization and indexing of resources of different type about a given scientific topic)

Question: Why building another site hosting application ? Doesn't this functionality already exist ?

Answer: Because none of the existing applications combines data and metadata services with collaborative tools and project governance, or satisfy all of COG requirements

Software base requirements for COG

- Easily extensible to provide additional functionality (by coding to clear APIs in a secure and OO language: Python or Java)
- Light-weight installation, maintenance
- Open Source license
- Extensive community usage
- Extensive, high quality and readily available library of existing functionality

Evaluation of existing applications

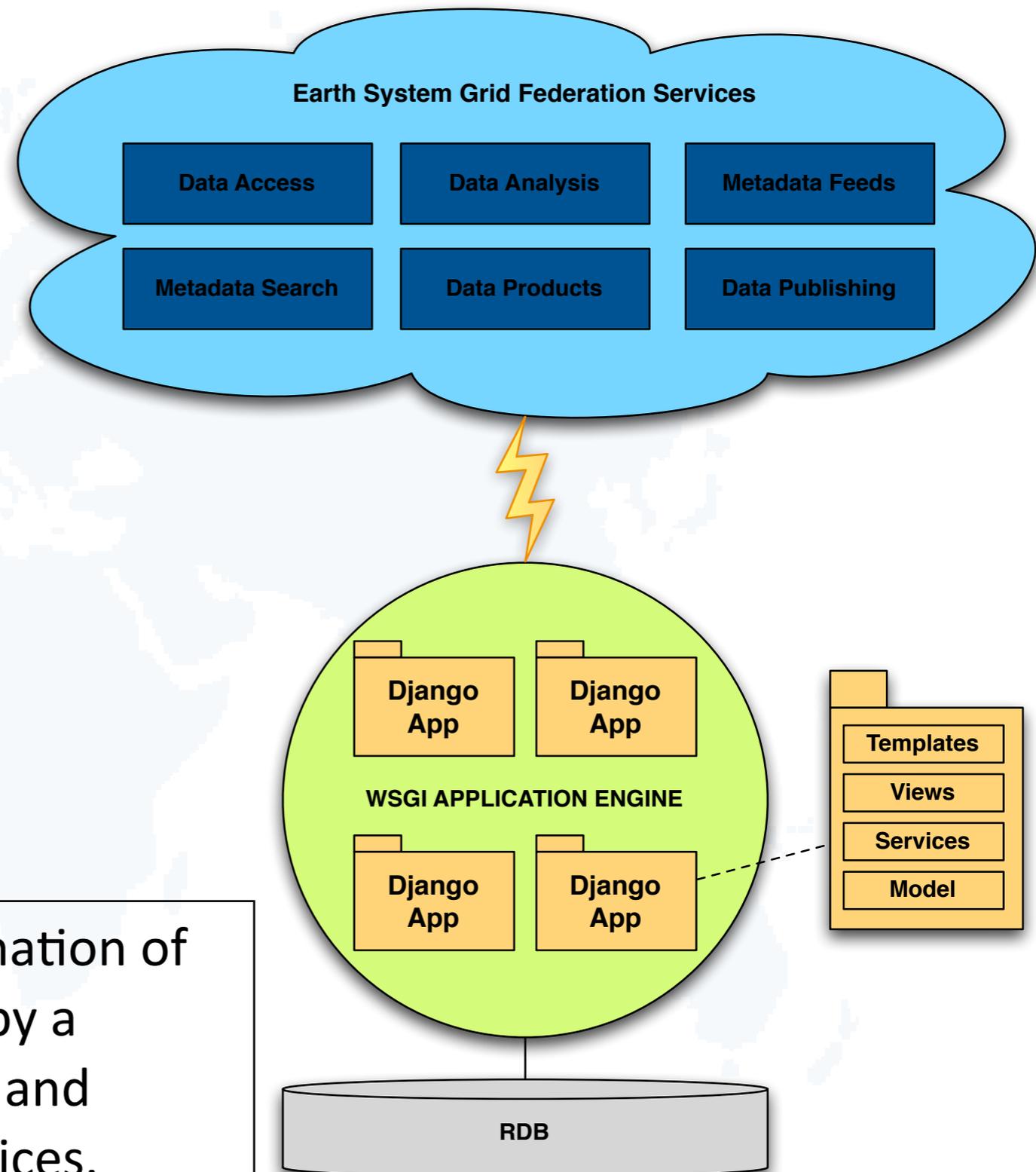
- Google Sites: friendly and powerful site building capabilities, no data/metadata
- Hub Zero: high level data applications but complex software stack, complex programming API, poor language (PHP)
- Drupal: great site building framework, large community, but complex installation, maintenance and difficult to extend

Conclusion: do not adopt an existing fully developed application, rather build own software stack using a web development framework that includes many community tools and applications

django: python based framework for rapid development of database driven web applications

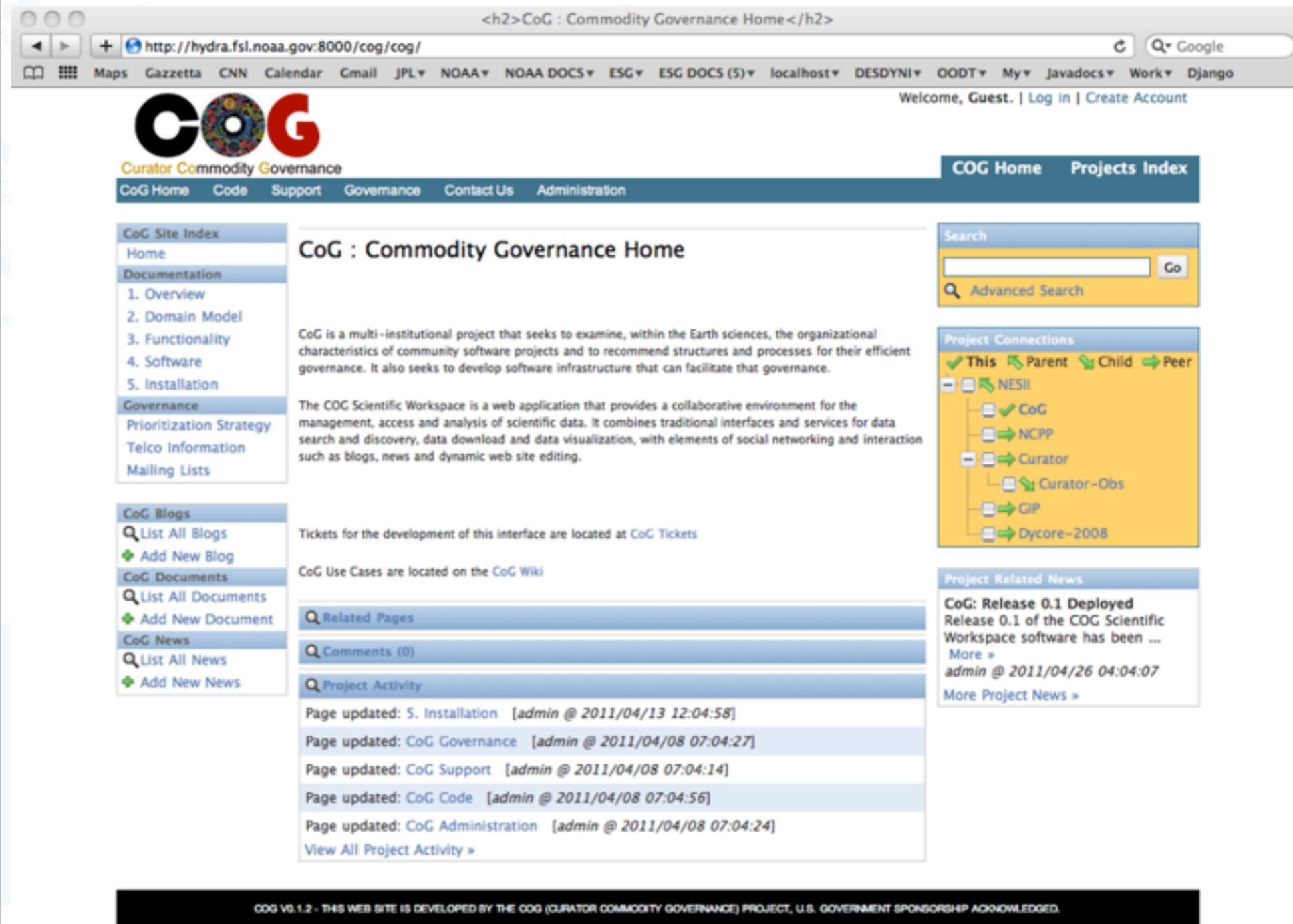
- Modular applications combined into larger projects
- Each application is divided into layers
- Includes ORM API for RDB interaction
- Extensive community and free apps
- WSGI compliant
- Strategically, may integrate with python toolkits (CDAT, CDX) and groups (BADC, PCMDI, JPL)

Software Stack: COG workspace is combination of several modular applications, backed up by a database, running within WSGI container and interacting with external servers and services.



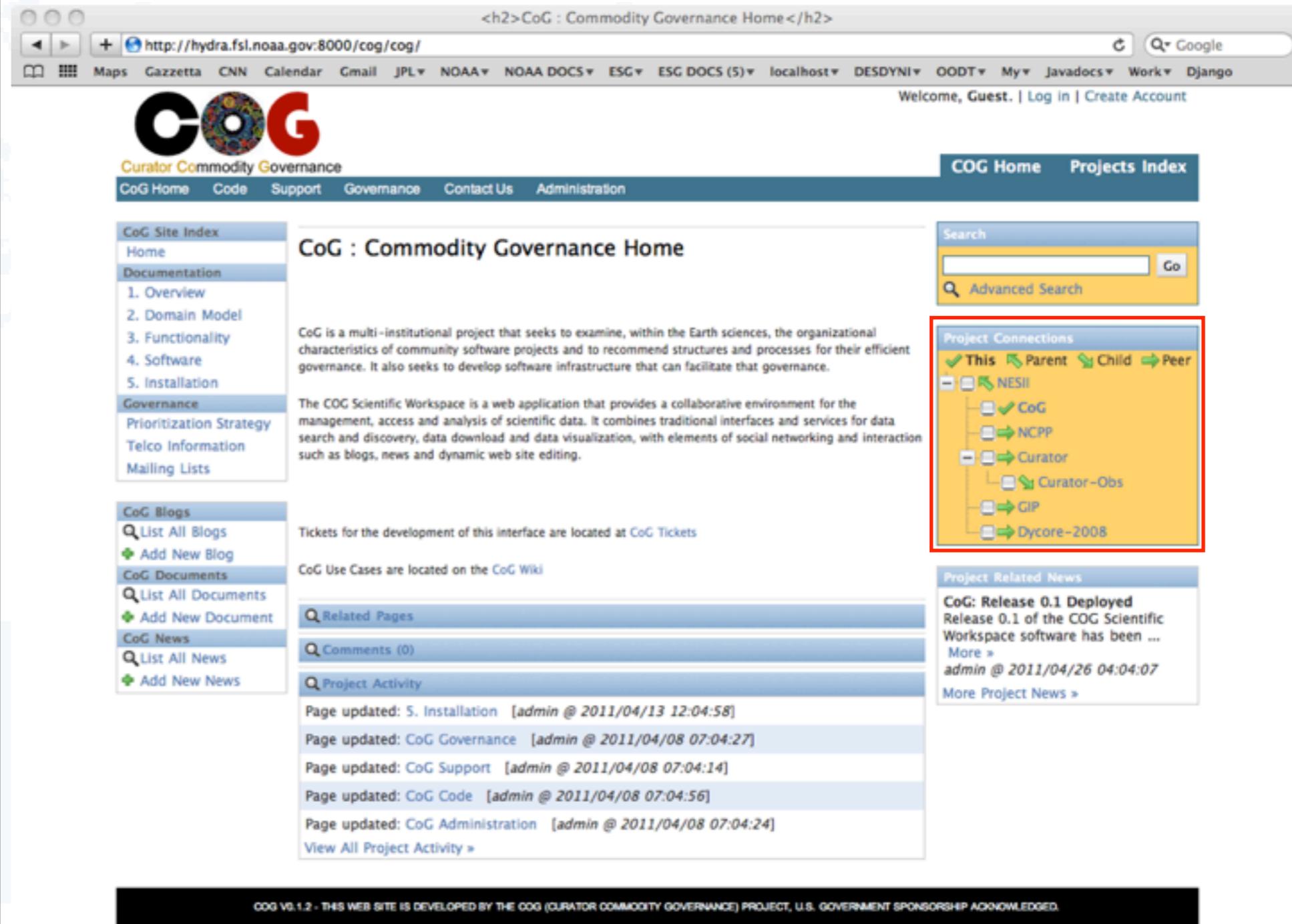
- Software development started 4-5 months ago
- First version 0.1 (alpha) deployed in March 2011 on public server
 - “preview” release, functionality largely incomplete
- Development focused thus far on collaboration tools
 - Because it represented the biggest unknown
 - Waiting for ESGF infrastructure to become available
- Next: tour of currently available functionality

- Project creation and description
- Formal relations among projects (parent-child and peer-to-peer)
- Project browsing widget
- Structured layout for project governance (automatic creation of home and other standard content pages)
- News cast to this project and related projects (selectable via widget)
- Project activity logs



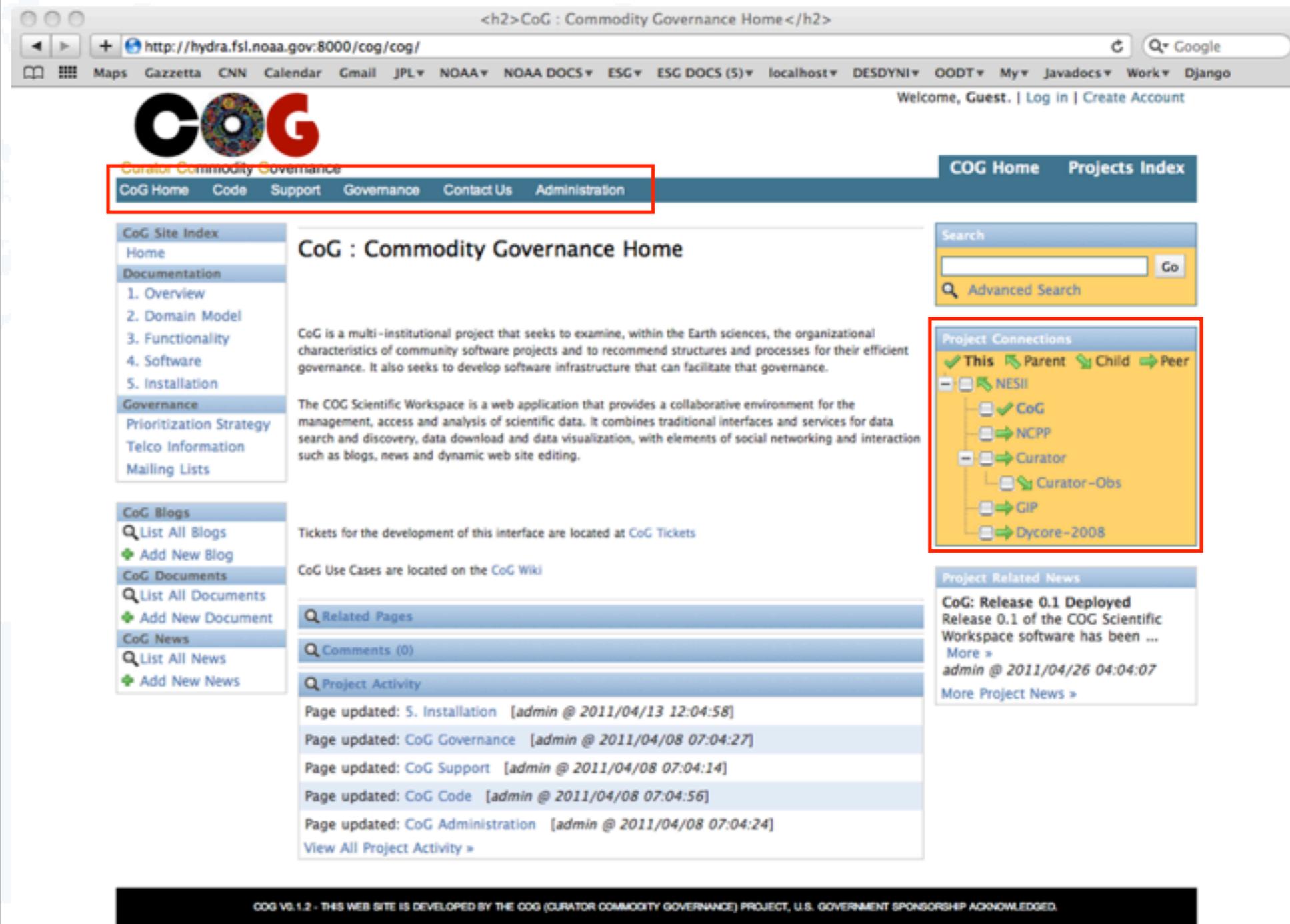
The screenshot shows the CoG : Commodity Governance Home website. The browser address bar displays `http://hydra.fsl.noaa.gov:8000/cog/cog/`. The page features a navigation menu with links for CoG Home, Code, Support, Governance, Contact Us, and Administration. A sidebar on the left contains sections for CoG Site Index, Documentation (Overview, Domain Model, Functionality, Software, Installation), Governance (Prioritization Strategy, Telco Information, Mailing Lists), CoG Blogs (List All Blogs, Add New Blog), CoG Documents (List All Documents, Add New Document), and CoG News (List All News, Add New News). The main content area is titled "CoG : Commodity Governance Home" and includes a search bar, a project connections diagram showing relationships between NESII, CoG, NCPP, Curator, Curator-Obs, GIP, and Dycore-2008, and a project-related news section. The news section highlights "CoG: Release 0.1 Deployed" with a "More" link and a timestamp of "admin @ 2011/04/26 04:04:07". At the bottom, a footer states: "COG V0.1.2 - THIS WEB SITE IS DEVELOPED BY THE COG (CURATOR COMMODITY GOVERNANCE) PROJECT, U.S. GOVERNMENT SPONSORSHIP ACKNOWLEDGED."

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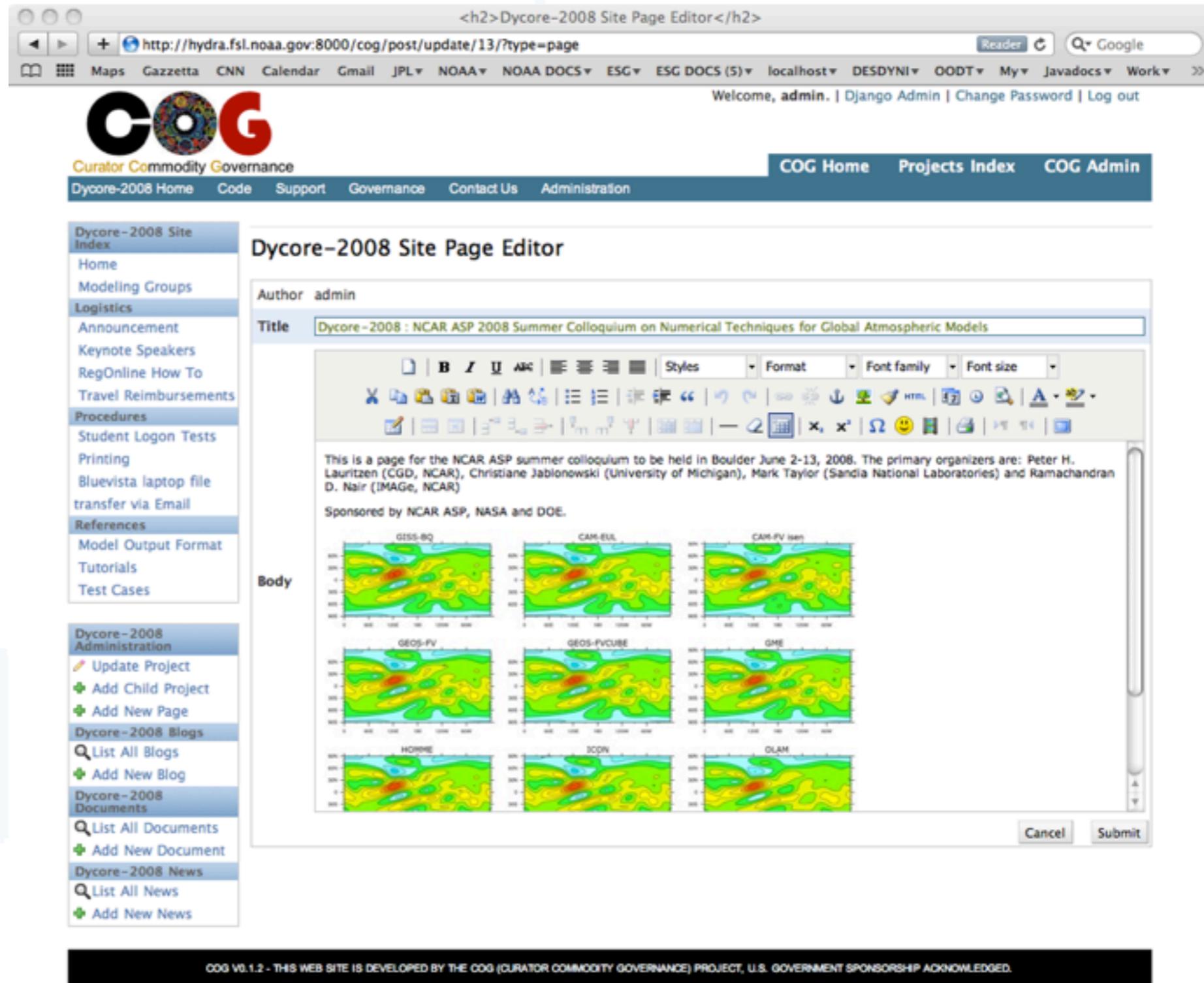
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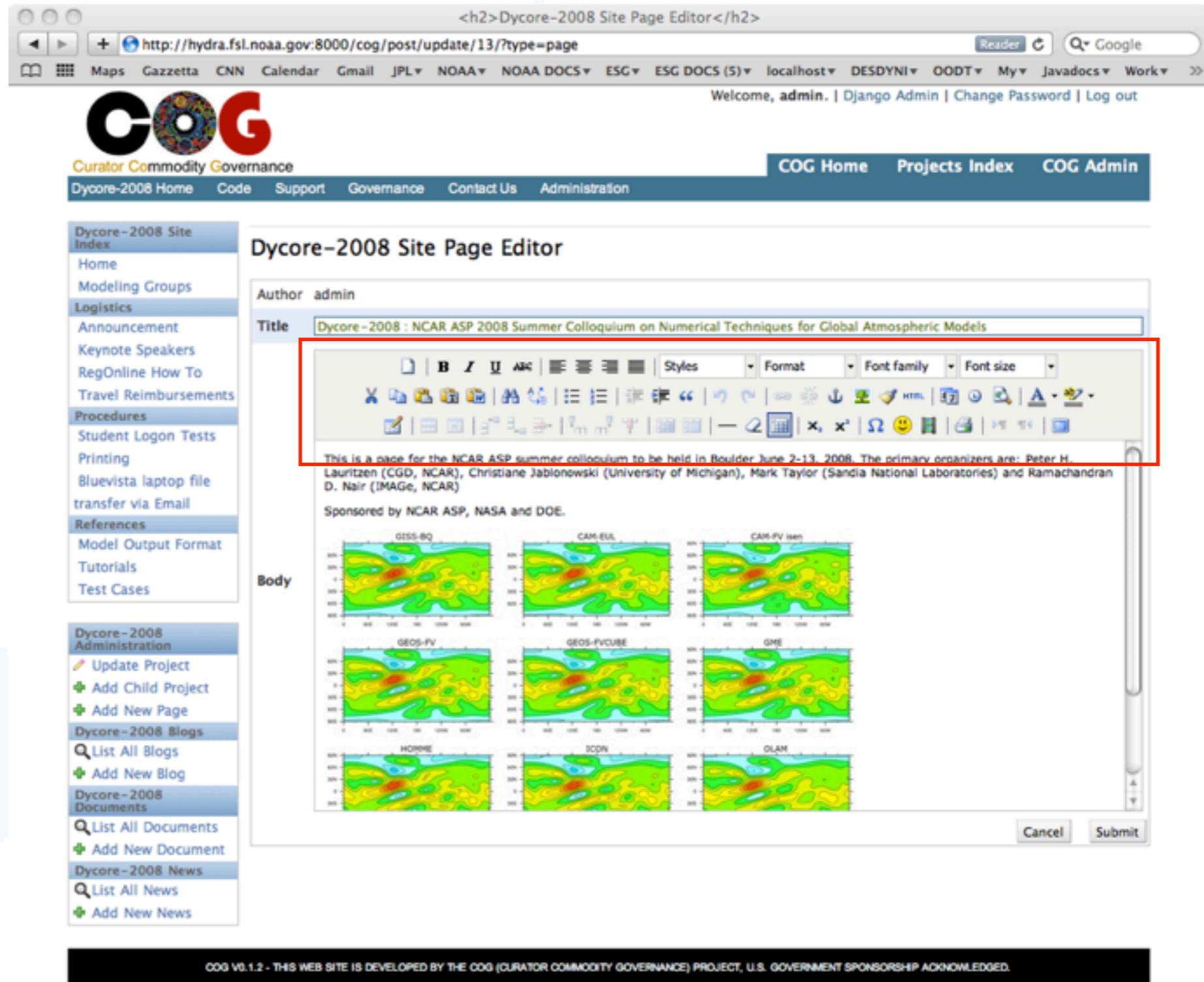
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- Creation of arbitrary web pages and blogs
- WYSIWYG style editing
- Web page can have arbitrary URL within project namespace
- Configurable template
- May be organized in a hierarchy and/or by topic
- Automatic creation of menus from topics
- Listable, searchable
- Upload attachments of any kind (pictures, documents, scripts...)
- Users can post comments after login



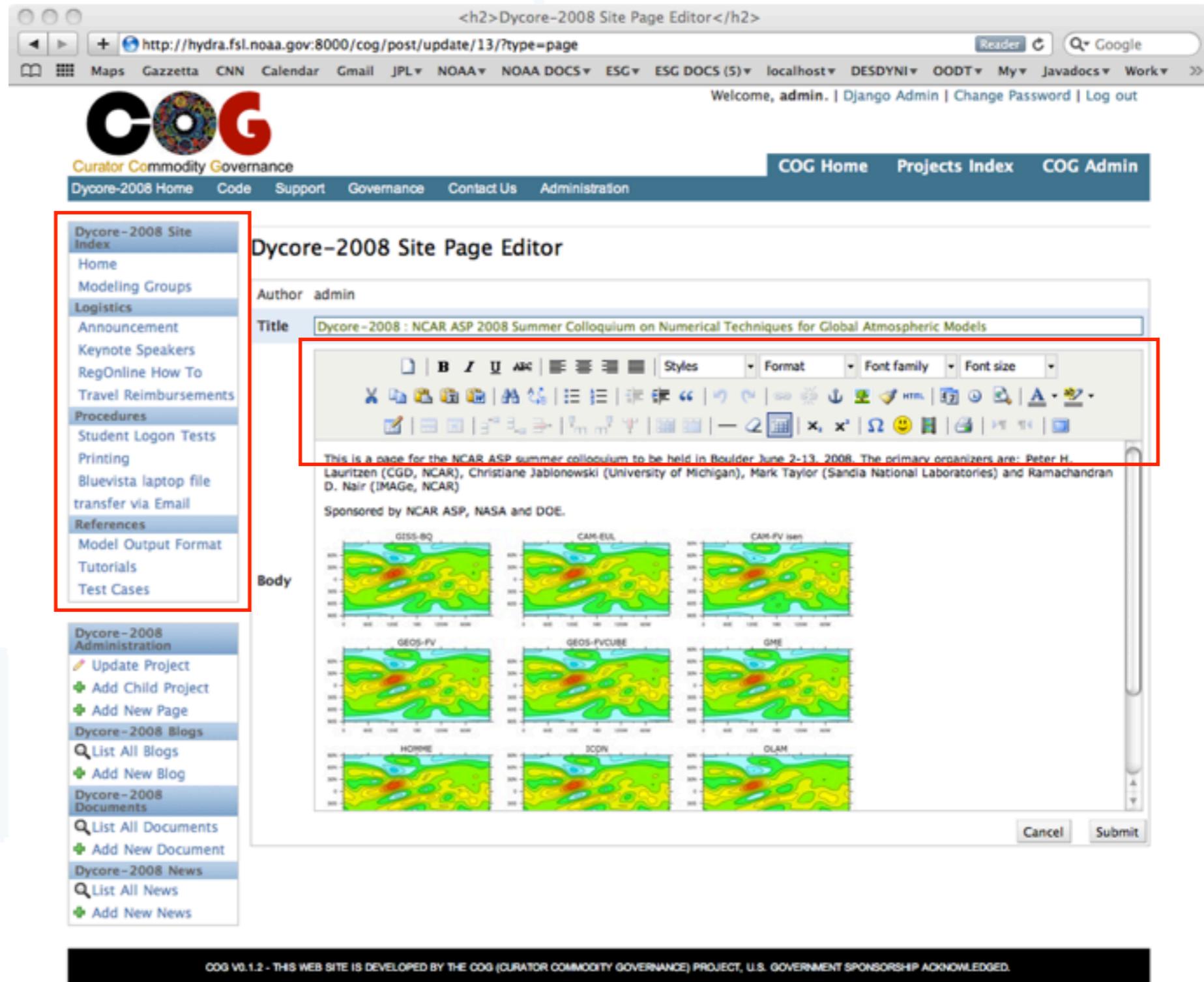
The screenshot displays the 'Dycore-2008 Site Page Editor' interface. At the top, the browser address bar shows the URL 'http://hydra.fsl.noaa.gov:8000/cog/post/update/13/?type=page'. The page header includes the COG logo and navigation links like 'COG Home', 'Projects Index', and 'COG Admin'. The main content area shows a form for editing a page. The 'Title' field is filled with 'Dycore-2008 : NCAR ASP 2008 Summer Colloquium on Numerical Techniques for Global Atmospheric Models'. Below the title is a rich text editor with a toolbar containing various formatting options. The body of the page contains text describing the colloquium and a grid of nine atmospheric model output plots. The footer of the page states 'COG V0.1.2 - THIS WEB SITE IS DEVELOPED BY THE COG (CURATOR COMMODITY GOVERNANCE) PROJECT, U.S. GOVERNMENT SPONSORSHIP ACKNOWLEDGED.'

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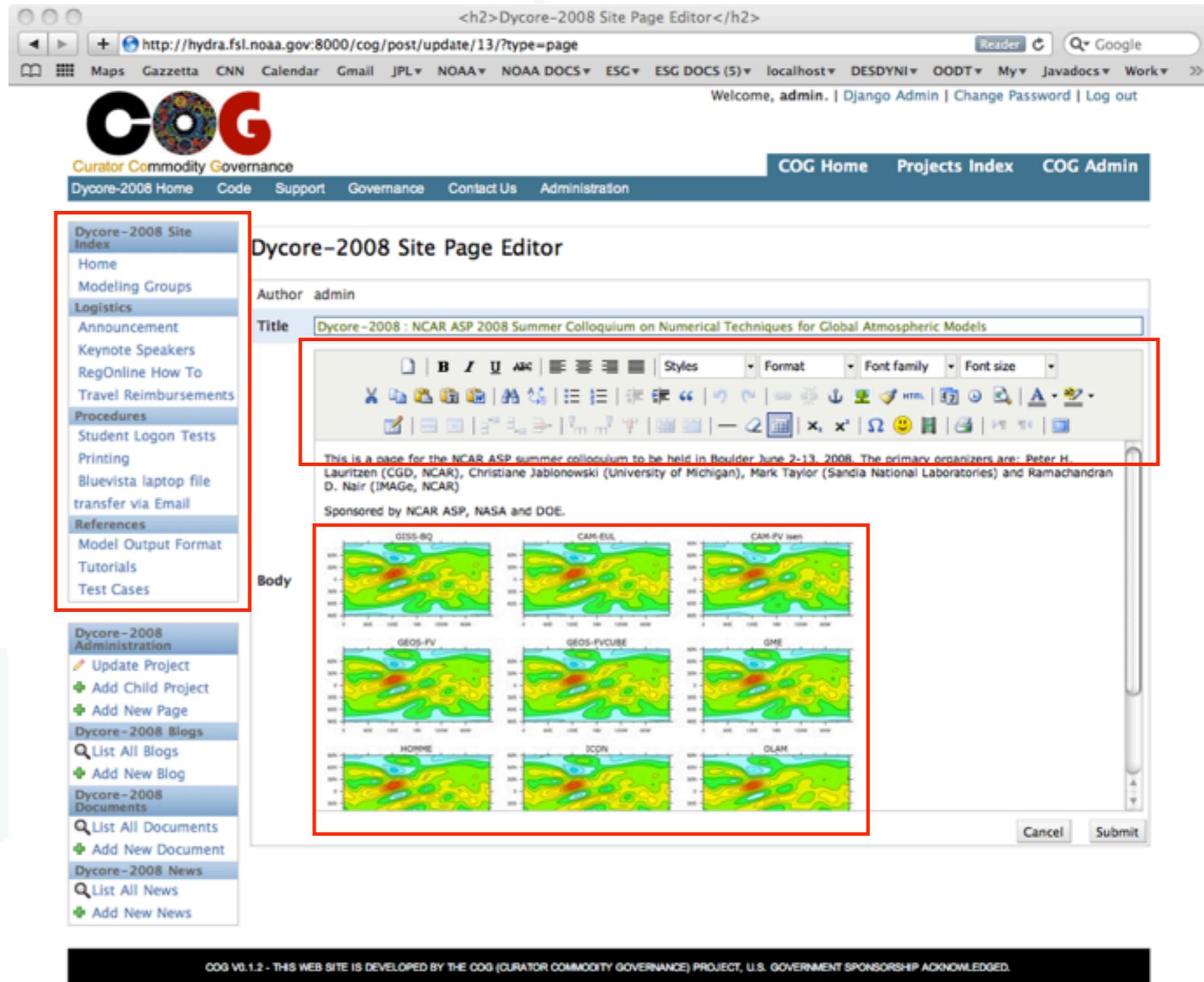
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The screenshot shows a web browser window titled "Dycore-2008 Site Page Editor". The address bar shows the URL: `http://hydra.fsl.noaa.gov:8000/cog/post/update/13/?type=page`. The page features the COG logo and navigation menus. A sidebar on the left contains a tree view of the site structure, with "Dycore-2008 Site Index" selected. The main editing area has a title field containing "Dycore-2008 : NCAR ASP 2008 Summer Colloquium on Numerical Techniques for Global Atmospheric Models" and a rich text editor with a toolbar. Below the editor, there is a text block about the NCAR ASP summer colloquium and a grid of nine atmospheric model output plots labeled with model names: GISS-BQ, CAM-EUL, CAM-FV isen, GEOS-FV, GEOS-FVCUBE, GME, HORRE, BCCN, and OLAM. The footer of the page reads: "COG V0.1.2 - THIS WEB SITE IS DEVELOPED BY THE COG (CURATOR COMMODITY GOVERNANCE) PROJECT, U.S. GOVERNMENT SPONSORSHIP ACKNOWLEDGED."

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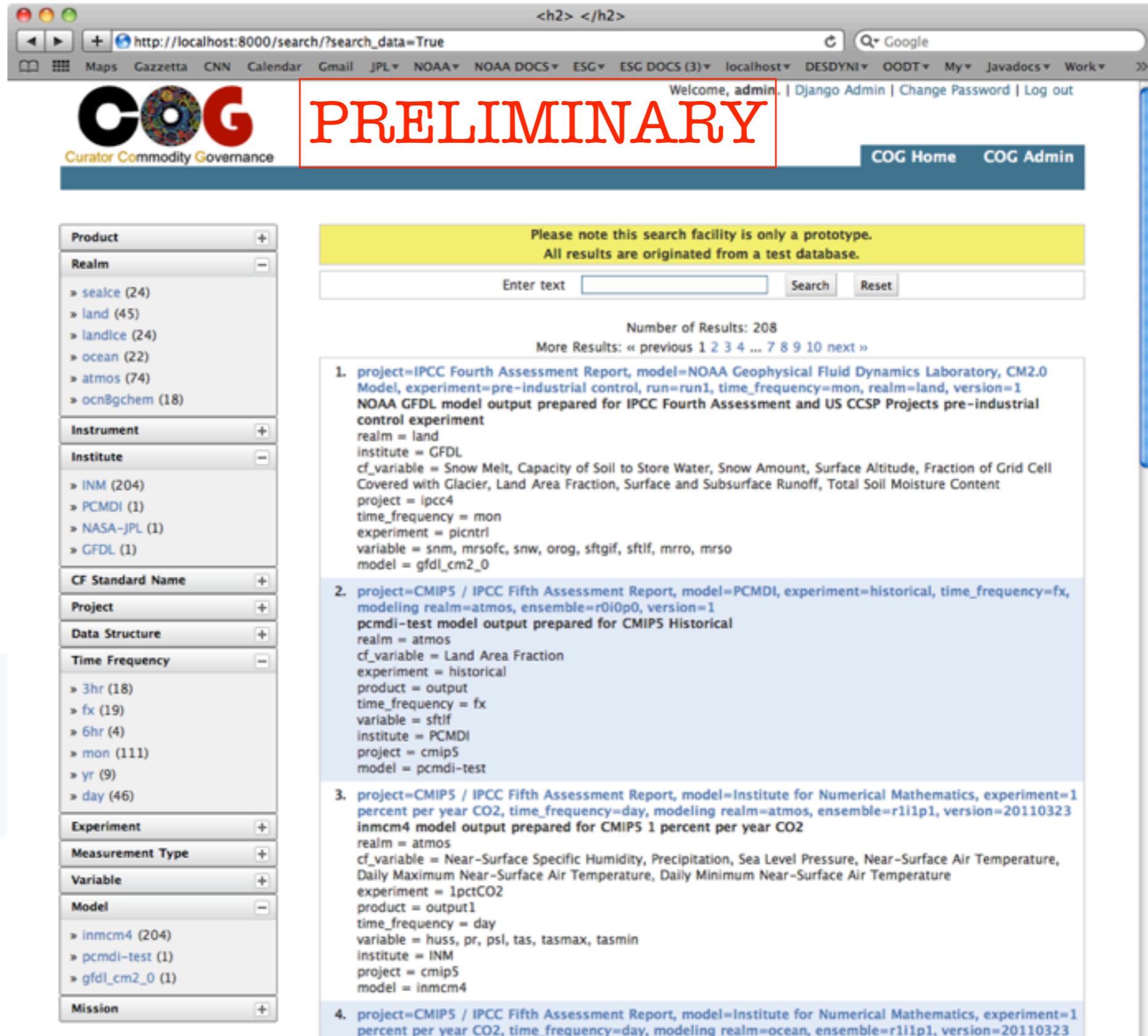


The screenshot shows a web browser window titled "Dycore-2008 Site Page Editor". The address bar shows the URL: `http://hydra.fsl.noaa.gov:8000/cog/post/update/13/?type=page`. The page features the Curator Commodity Governance logo and navigation menus. A sidebar on the left contains a tree view of the site structure, including sections like "Dycore-2008 Site Index", "Logistics", "Procedures", "References", "Administration", "Blogs", "Documents", and "News". The main editing area is titled "Dycore-2008 Site Page Editor" and shows a form for editing a page. The "Title" field contains: "Dycore-2008 : NCAR ASP 2008 Summer Colloquium on Numerical Techniques for Global Atmospheric Models". Below the title is a rich text editor toolbar with various icons for text formatting, alignment, and insertion. The main content area contains text about the NCAR ASP summer colloquium and a grid of nine atmospheric model output plots. The plots are arranged in a 3x3 grid and labeled as follows:

- Row 1: GISS-BQ, CAM-EUL, CAM-FV isen
- Row 2: GEOS-FV, GEOS-FVCUBE, GME
- Row 3: HORRE, BCCN, OLAN

 Each plot shows a map of the United States with color-coded atmospheric data. At the bottom of the page, a footer reads: "COG V0.1.2 - THIS WEB SITE IS DEVELOPED BY THE COG (CURATOR COMMODITY GOVERNANCE) PROJECT, U.S. GOVERNMENT SPONSORSHIP ACKNOWLEDGED."

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- UI is completely independent of metadata storage
- Can be used with RDF triple store, relational database, or Solr index
- Facets are customizable
- Future development: search on different target types , search within single project or all projects, ingest CIM metadata



The screenshot shows a web browser window displaying the COG search interface. The URL is `http://localhost:8000/search/?search_data=True`. The page features a navigation bar with the COG logo and a large red "PRELIMINARY" watermark. A yellow warning box states: "Please note this search facility is only a prototype. All results are originated from a test database." Below this is a search input field with "Enter text" and "Search" and "Reset" buttons. The results section shows "Number of Results: 208" and a list of search results. The left sidebar contains faceted search options for Product, Instrument, Insiteute, CF Standard Name, Project, Data Structure, Time Frequency, Experiment, Measurement Type, Variable, Model, and Mission.

Product (+)

- Realm (-)
- » sealce (24)
- » land (45)
- » landice (24)
- » ocean (22)
- » atmos (74)
- » ocnBgchem (18)

Instrument (+)

Insiteute (-)

- » INM (204)
- » PCMDI (1)
- » NASA-JPL (1)
- » GFDL (1)

CF Standard Name (+)

Project (+)

Data Structure (+)

Time Frequency (-)

- » 3hr (18)
- » fx (19)
- » 6hr (4)
- » mon (111)
- » yr (9)
- » day (46)

Experiment (+)

Measurement Type (+)

Variable (+)

Model (-)

- » inmcm4 (204)
- » pcmdi-test (1)
- » gfdl_cm2_0 (1)

Mission (+)

Please note this search facility is only a prototype.
All results are originated from a test database.

Enter text Search Reset

Number of Results: 208
More Results: « previous 1 2 3 4 ... 7 8 9 10 next »

1. project=IPCC Fourth Assessment Report, model=NOAA Geophysical Fluid Dynamics Laboratory, CM2.0 Model, experiment=pre-industrial control, run=run1, time_frequency=mon, realm=land, version=1
NOAA GFDL model output prepared for IPCC Fourth Assessment and US CCSP Projects pre-industrial control experiment
realm = land
institute = GFDL
cf_variable = Snow Melt, Capacity of Soil to Store Water, Snow Amount, Surface Altitude, Fraction of Grid Cell Covered with Glacier, Land Area Fraction, Surface and Subsurface Runoff, Total Soil Moisture Content
project = ipcc4
time_frequency = mon
experiment = picntrl
variable = snm, mrsofc, snw, orog, sftgif, sftif, mrro, mrso
model = gfdl_cm2_0
2. project=CMIP5 / IPCC Fifth Assessment Report, model=PCMDI, experiment=historical, time_frequency=fx, modeling realm=atmos, ensemble=r0i0p0, version=1
pcmdi-test model output prepared for CMIP5 Historical
realm = atmos
cf_variable = Land Area Fraction
experiment = historical
product = output
time_frequency = fx
variable = sftif
institute = PCMDI
project = cmip5
model = pcmdi-test
3. project=CMIP5 / IPCC Fifth Assessment Report, model=Institute for Numerical Mathematics, experiment=1 percent per year CO2, time_frequency=day, modeling realm=atmos, ensemble=r1i1p1, version=20110323
inmcm4 model output prepared for CMIP5 1 percent per year CO2
realm = atmos
cf_variable = Near-Surface Specific Humidity, Precipitation, Sea Level Pressure, Near-Surface Air Temperature, Daily Maximum Near-Surface Air Temperature, Daily Minimum Near-Surface Air Temperature
experiment = 1pctCO2
product = output1
time_frequency = day
variable = huss, pr, psi, tas, tasmax, tasmin
institute = INM
project = cmip5
model = inmcm4
4. project=CMIP5 / IPCC Fifth Assessment Report, model=Institute for Numerical Mathematics, experiment=1 percent per year CO2, time_frequency=day, modeling realm=ocean, ensemble=r1i1p1, version=20110323

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The left sidebar contains a faceted search menu with the following categories and counts:

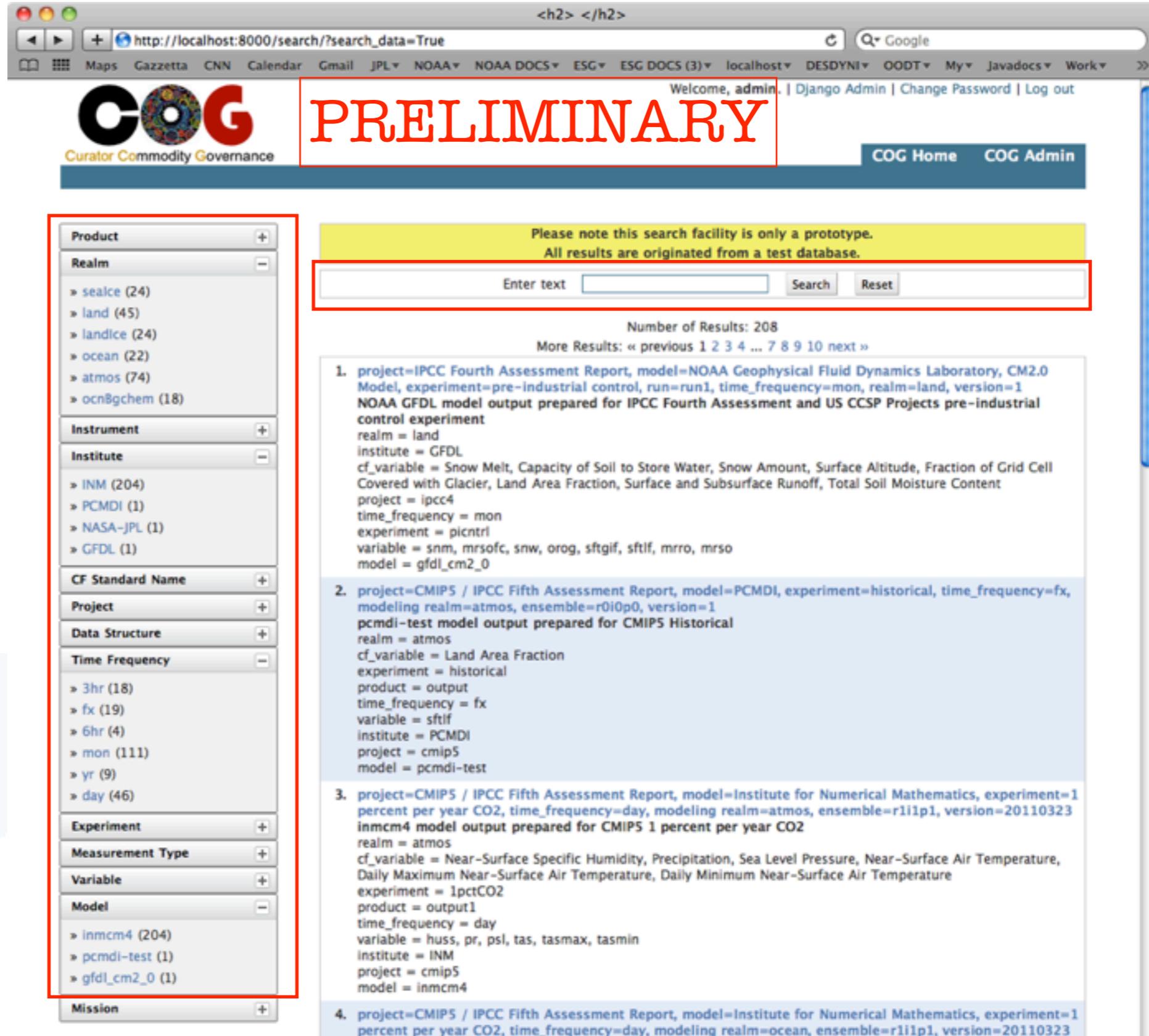
- Product** (+)
 - Realm (-)
 - sealce (24)
 - land (45)
 - landice (24)
 - ocean (22)
 - atmos (74)
 - ocnBgchem (18)
 - Instrument (+)
 - Institute (-)
 - INM (204)
 - PCMDI (1)
 - NASA-JPL (1)
 - GFDL (1)
 - CF Standard Name (+)
 - Project (+)
 - Data Structure (+)
 - Time Frequency (-)
 - 3hr (18)
 - fx (19)
 - 6hr (4)
 - mon (111)
 - yr (9)
 - day (46)
 - Experiment (+)
 - Measurement Type (+)
 - Variable (+)
 - Model (-)
 - inmcm4 (204)
 - pcmdi-test (1)
 - gfdl_cm2_0 (1)
 - Mission (+)

The main content area displays a list of search results, each with a detailed metadata string. The first result is:

1. `project=IPCC Fourth Assessment Report, model=NOAA Geophysical Fluid Dynamics Laboratory, CM2.0 Model, experiment=pre-industrial control, run=run1, time_frequency=mon, realm=land, version=1 NOAA GFDL model output prepared for IPCC Fourth Assessment and US CCSP Projects pre-industrial control experiment realm = land institute = GFDL cf_variable = Snow Melt, Capacity of Soil to Store Water, Snow Amount, Surface Altitude, Fraction of Grid Cell Covered with Glacier, Land Area Fraction, Surface and Subsurface Runoff, Total Soil Moisture Content project = ipcc4 time_frequency = mon experiment = picntrl variable = snm, mrsofc, snw, orog, sftgif, sftif, mrro, mrso model = gfdl_cm2_0`

Other results include CMIP5 historical and 1% CO2 scenarios from INM and GFDL models.

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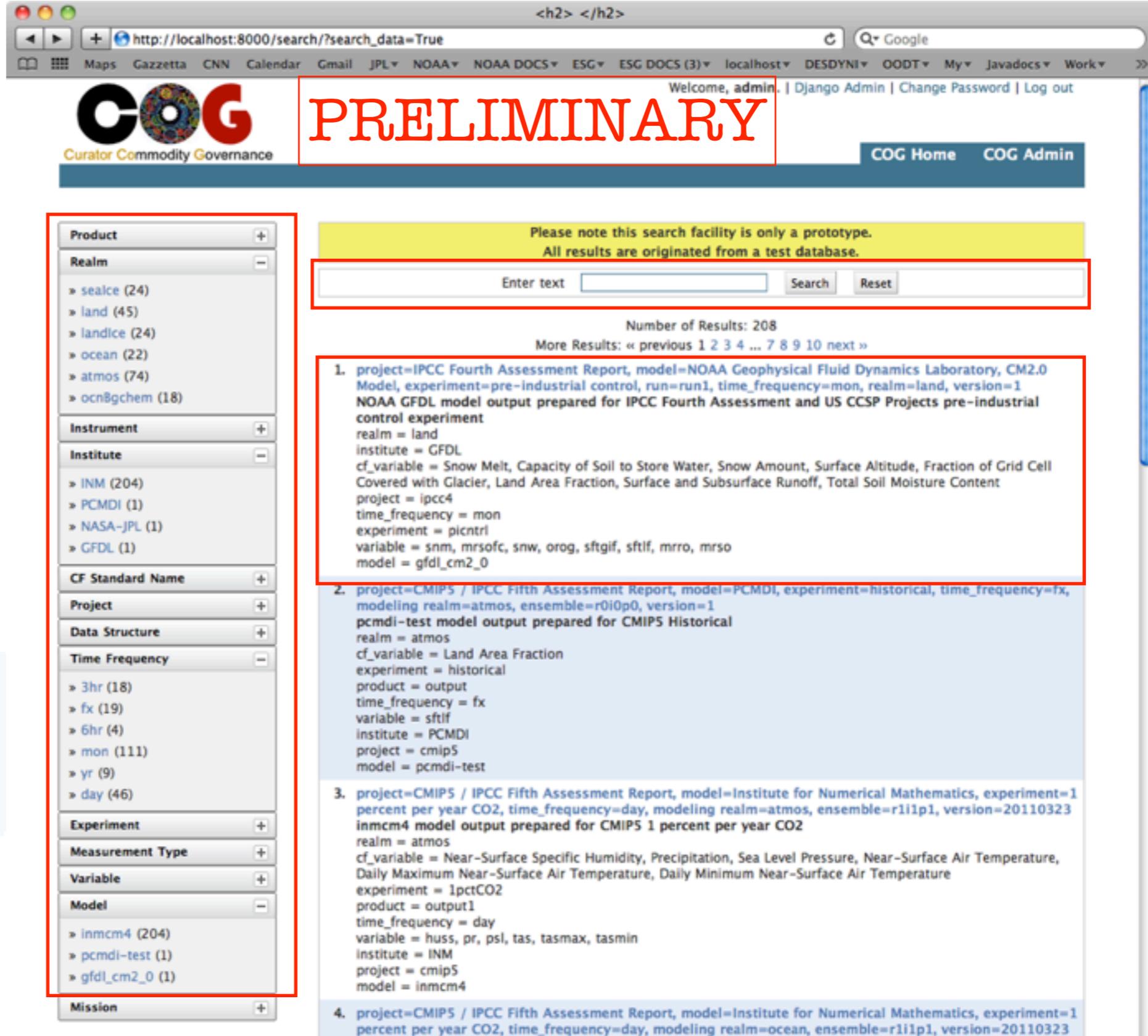
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On the left side of the interface, there is a faceted search menu with the following categories and counts:

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 - » NASA-JPL (1)
 - » GFDL (1)
- CF Standard Name** (+)
- Project** (+)
- Data Structure** (+)
- Time Frequency** (-)
 - » 3hr (18)
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- Future development: search on different target types, search within single project or all projects, ingest CIM metadata



The screenshot shows a web browser window displaying the COG search interface. The URL is `http://localhost:8000/search/?search_data=True`. The page features a search bar with a "Search" button and a "Reset" button. A large red box highlights the word "PRELIMINARY" in the top right corner. A yellow box contains a warning: "Please note this search facility is only a prototype. All results are originated from a test database." Below the search bar, the number of results is shown as "Number of Results: 208" with pagination links. The main content area displays a list of search results, each with detailed metadata. A red box highlights the first result, which is a NOAA GFDL model output prepared for IPCC Fourth Assessment and US CCSP Projects pre-industrial control experiment. The second result is a CMIP5 / IPCC Fifth Assessment Report, model=PCMDI, experiment=historical, time_frequency=fx, modeling realm=atmos, ensemble=r0i0p0, version=1 pcmdi-test model output prepared for CMIP5 Historical realm = atmos cf_variable = Land Area Fraction experiment = historical product = output time_frequency = fx variable = sftif institute = PCMDI project = cmip5 model = pcmdi-test. The third result is a CMIP5 / IPCC Fifth Assessment Report, model=Institute for Numerical Mathematics, experiment=1 percent per year CO2, time_frequency=day, modeling realm=atmos, ensemble=r1i1p1, version=20110323 inmcm4 model output prepared for CMIP5 1 percent per year CO2 realm = atmos cf_variable = Near-Surface Specific Humidity, Precipitation, Sea Level Pressure, Near-Surface Air Temperature, Daily Maximum Near-Surface Air Temperature, Daily Minimum Near-Surface Air Temperature experiment = 1pctCO2 product = output1 time_frequency = day variable = huss, pr, psl, tas, tasmax, tasmin institute = INM project = cmip5 model = inmcm4. The fourth result is a CMIP5 / IPCC Fifth Assessment Report, model=Institute for Numerical Mathematics, experiment=1 percent per year CO2, time_frequency=day, modeling realm=ocean, ensemble=r1i1p1, version=20110323.

Product

- Realm
 - » sealce (24)
 - » land (45)
 - » landice (24)
 - » ocean (22)
 - » atmos (74)
 - » ocnBgchem (18)
- Instrument
- Institute
 - » INM (204)
 - » PCMDI (1)
 - » NASA-JPL (1)
 - » GFDL (1)
- CF Standard Name
- Project
- Data Structure
- Time Frequency
 - » 3hr (18)
 - » fx (19)
 - » 6hr (4)
 - » mon (111)
 - » yr (9)
 - » day (46)
- Experiment
- Measurement Type
- Variable
- Model
 - » inmcm4 (204)
 - » pcmdi-test (1)
 - » gfdl_cm2_0 (1)
- Mission

Please note this search facility is only a prototype.
All results are originated from a test database.

Enter text Search Reset

Number of Results: 208
More Results: « previous 1 2 3 4 ... 7 8 9 10 next »

1. project=IPCC Fourth Assessment Report, model=NOAA Geophysical Fluid Dynamics Laboratory, CM2.0 Model, experiment=pre-industrial control, run=run1, time_frequency=mon, realm=land, version=1 NOAA GFDL model output prepared for IPCC Fourth Assessment and US CCSP Projects pre-industrial control experiment
realm = land
institute = GFDL
cf_variable = Snow Melt, Capacity of Soil to Store Water, Snow Amount, Surface Altitude, Fraction of Grid Cell Covered with Glacier, Land Area Fraction, Surface and Subsurface Runoff, Total Soil Moisture Content
project = ipcc4
time_frequency = mon
experiment = picntrl
variable = snm, mrsofc, snw, orog, sftgif, sftif, mrro, mrso
model = gfdl_cm2_0
2. project=CMIP5 / IPCC Fifth Assessment Report, model=PCMDI, experiment=historical, time_frequency=fx, modeling realm=atmos, ensemble=r0i0p0, version=1 pcmdi-test model output prepared for CMIP5 Historical
realm = atmos
cf_variable = Land Area Fraction
experiment = historical
product = output
time_frequency = fx
variable = sftif
institute = PCMDI
project = cmip5
model = pcmdi-test
3. project=CMIP5 / IPCC Fifth Assessment Report, model=Institute for Numerical Mathematics, experiment=1 percent per year CO2, time_frequency=day, modeling realm=atmos, ensemble=r1i1p1, version=20110323 inmcm4 model output prepared for CMIP5 1 percent per year CO2
realm = atmos
cf_variable = Near-Surface Specific Humidity, Precipitation, Sea Level Pressure, Near-Surface Air Temperature, Daily Maximum Near-Surface Air Temperature, Daily Minimum Near-Surface Air Temperature
experiment = 1pctCO2
product = output1
time_frequency = day
variable = huss, pr, psl, tas, tasmax, tasmin
institute = INM
project = cmip5
model = inmcm4
4. project=CMIP5 / IPCC Fifth Assessment Report, model=Institute for Numerical Mathematics, experiment=1 percent per year CO2, time_frequency=day, modeling realm=ocean, ensemble=r1i1p1, version=20110323

- Complete integration of data services for search, download, analysis and visualization (ESGF search, TDS, LAS)
- Explore synergy with NOAA NCPP (National Climate Projection Pilot)
 - ▶ Host project documentation
 - ▶ Explore integration of services developed by OpenClimateGIS initiative (based on geo-django)
- Develop metadata processing pipeline and tools: web-forms for entering metadata, indexing, displaying and comparing
- Support DyCore workshop in summer 2012

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We welcome collaboration with other ESGF partners for development of python-based infrastructure

Information about the COG project can be found in the COG workspace itself:

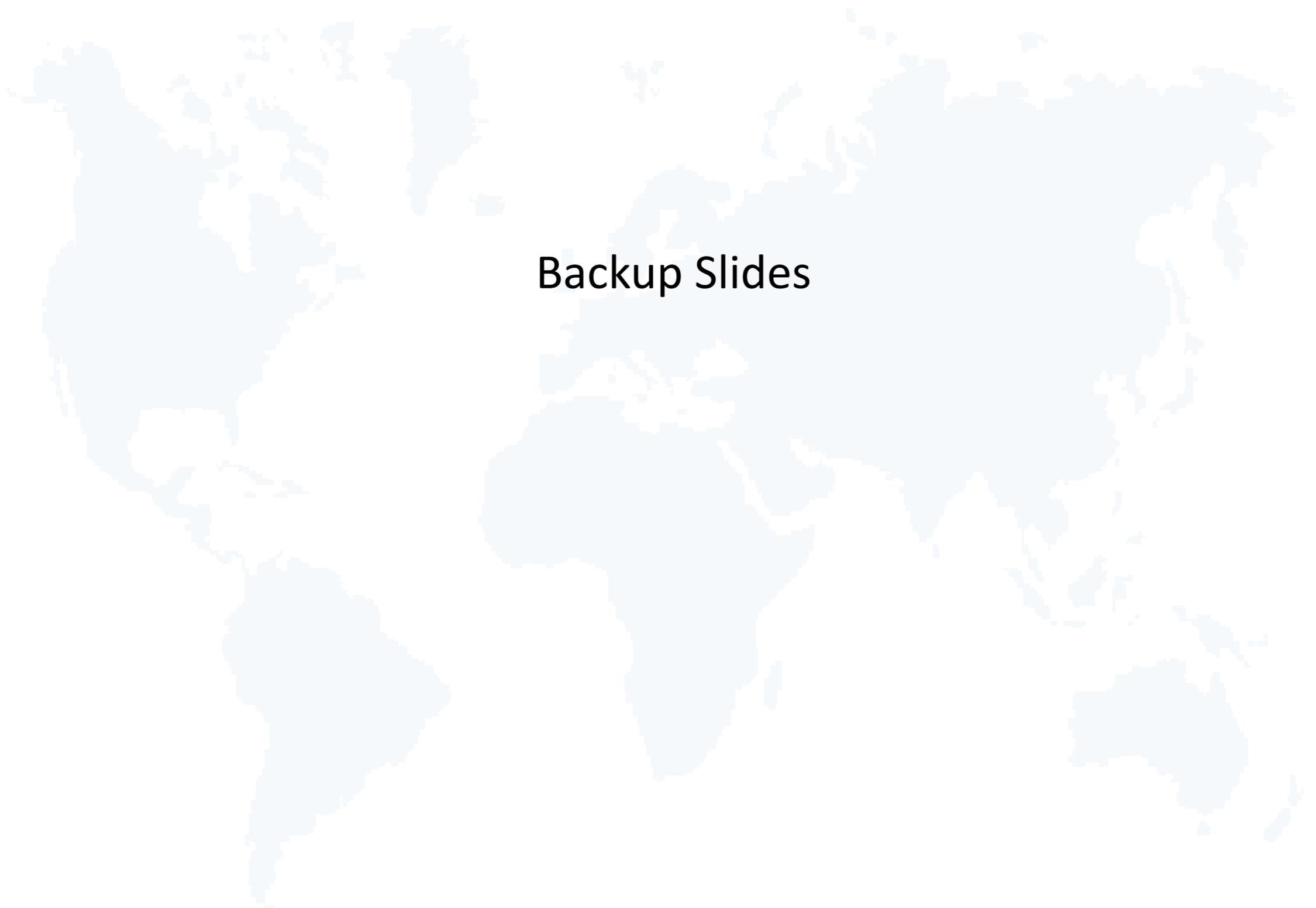
<http://hydra.fsl.noaa.gov:8000/cog/cog/>

For more information please contact:

Cecelia.DeLuca@noaa.gov

Sylvia.Murphy@noaa.gov

Luca.Cinquini@noaa.gov



Backup Slides

Now:

- django auth: user authentication and access control
- django comments: user provided comments on generic objects
- django filebrowser: documents and pictures upload
- django tinymce: WYSIWYG wiki editing capabilities
- django south: database schema migration
- django flatpages (inspiration only): web page and post creation
- blueprint (non-django): web page layout

Future:

- Openid authentication
- Metadata indexing (?)

