Real-Time Water Decision Support System

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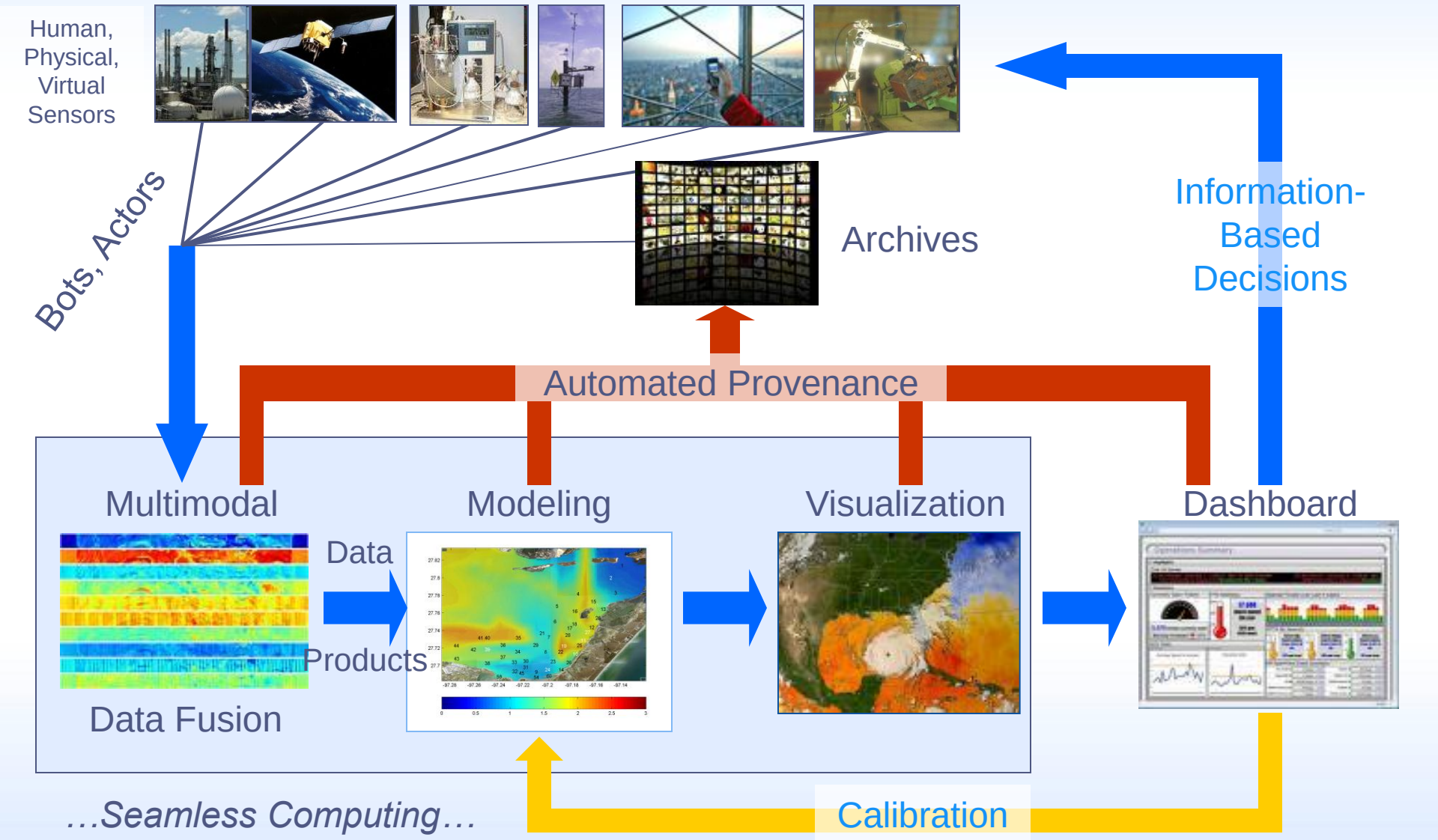
Integrated, Information-Based Decision Making



Sources include: Heidelberg Collaboratory, Minsker, GMES

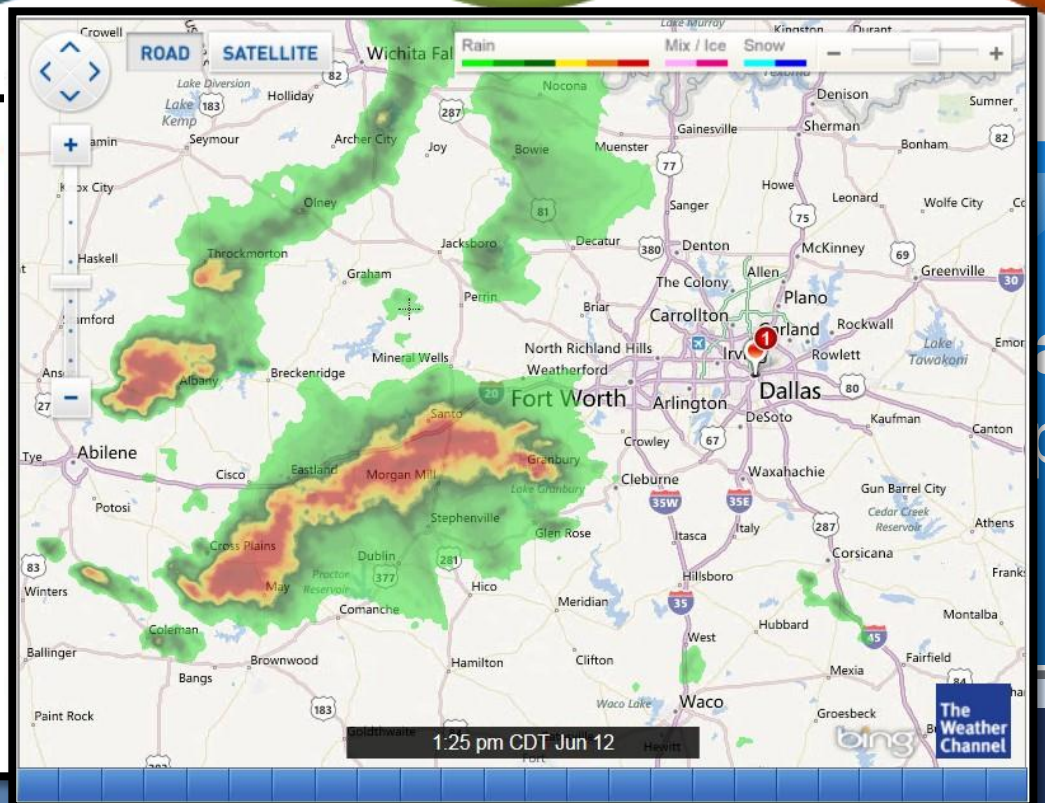
Real-Time Water Modeling System

Real-Time Water Decision Support System

Weather

Land Atmosphere

Rivers



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perations

Rivers

RAPID model

Error model

Water Operations

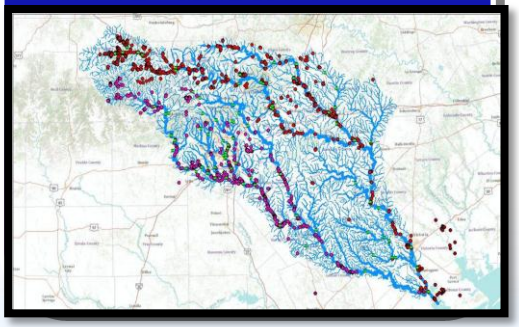
Permit holders

TCEQ

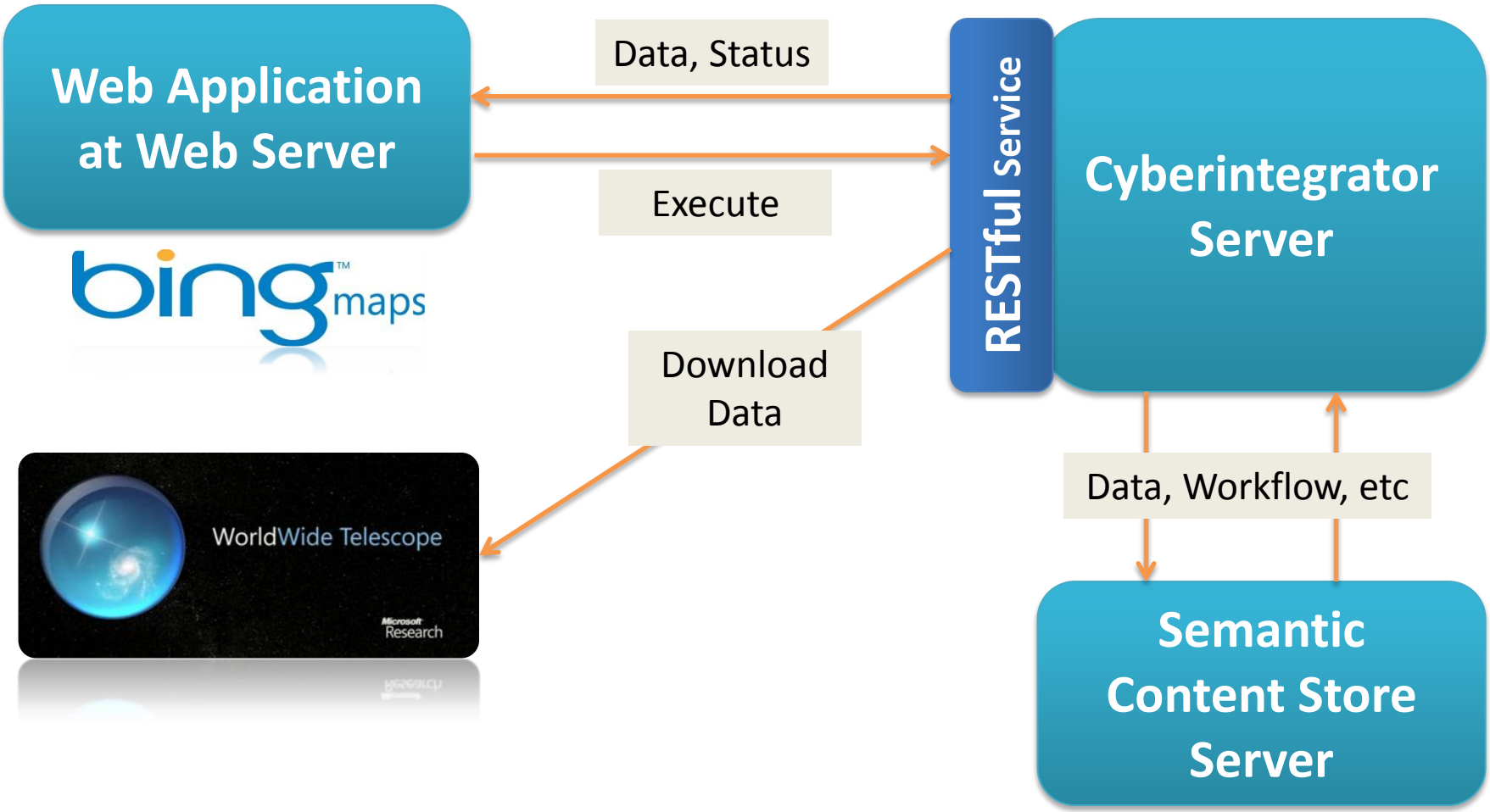
Reservoir Operations

Decision Support

- Web Visualization
- Scenario Builder
- Optimizer
- Water Market



Real-Time Modeling Service Architecture



Web Application: Set Parameters

REST Client | Real-Time Water Decision

rapid.ncsa.illinois.edu:8080/rapid/

RTWDSS v0.1 | About

Real-Time Water Decision Support System v0.1

This prototype real-time modeling system downloads Noah-MP Land Surface model data, which forecast runoff, soil moisture, evapotranspiration, and water table levels given land surface features. These results are then used by a river model called RAPID to forecast stream flows. Model forecasts are visualized as a Web application for students and decision makers to understand the impacts of drought and flood conditions on streamflows. Users can adjust model parameters to predict the impacts of alternative curtailment scenarios or weather forecasts.

Setting up Workflow

Input the following parameters to run the workflow

NLDAS start date	2012-10-05
NLDAS end date	2012-10-05
Viz start date	2012-10-05
Viz end date	2012-10-05

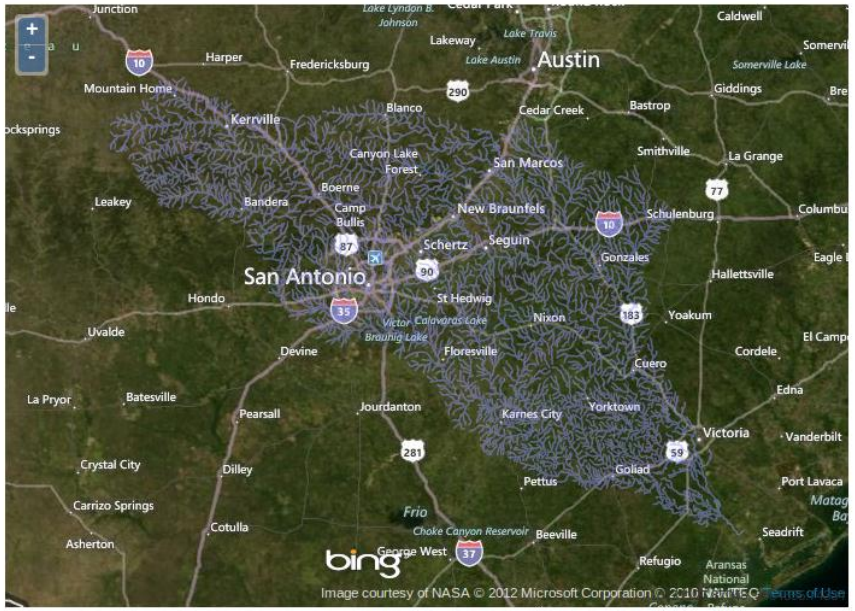
Run » Reset

Job Status

Job Id:
Download NLDAS data:
Execute RAPID:
Generate Viz:

Visualize the result »

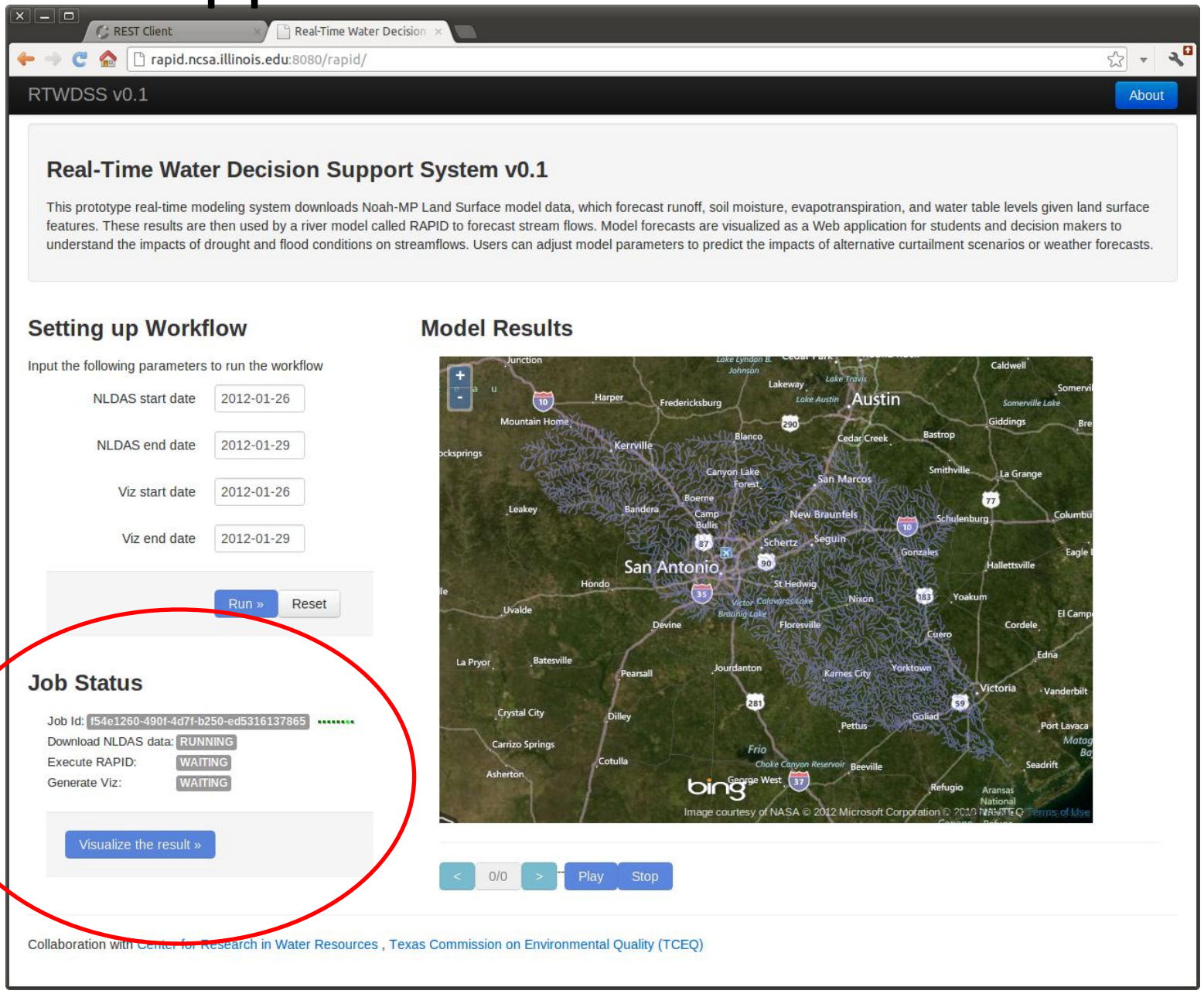
Model Results



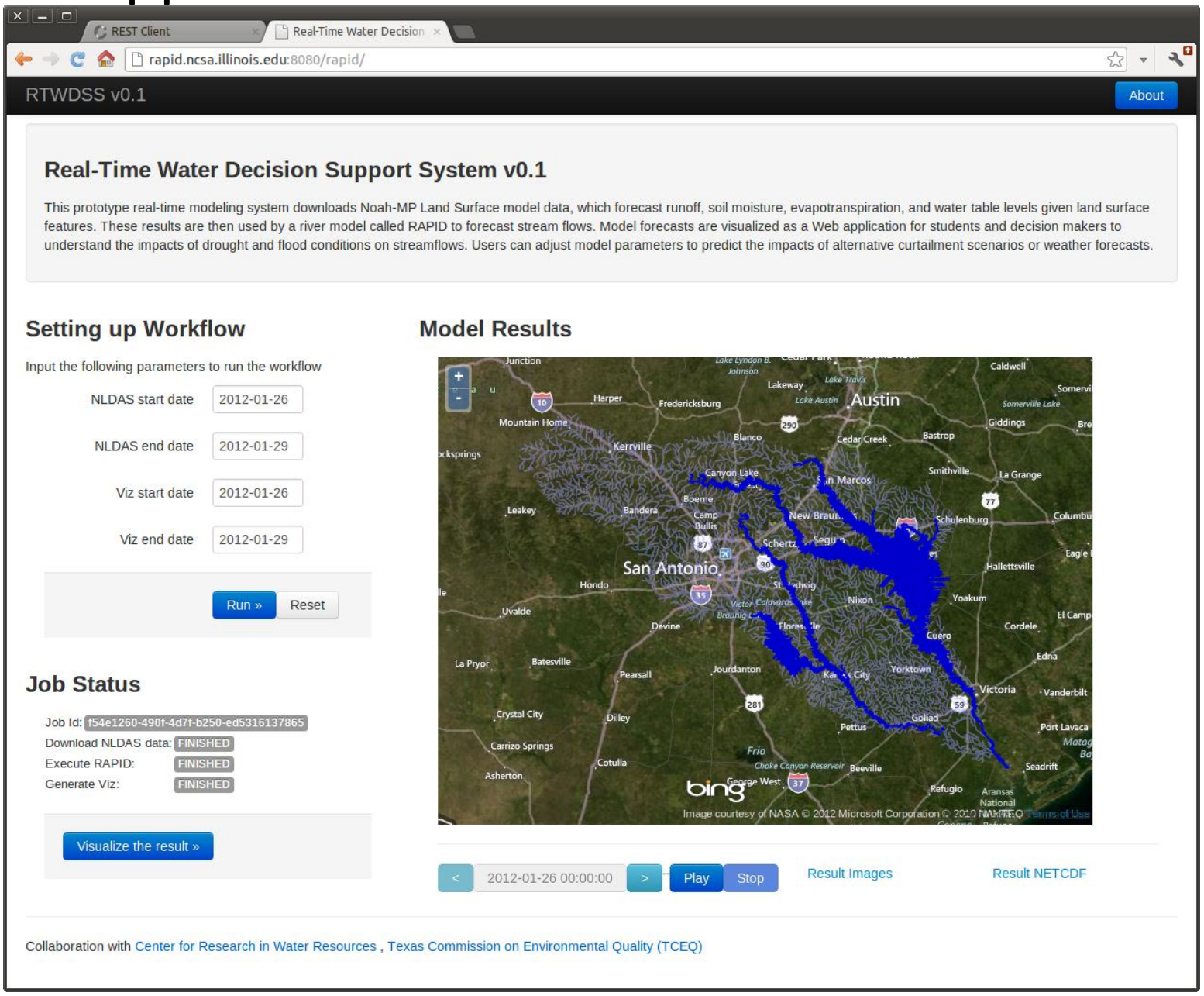
< 0/0 > Play Stop

Collaboration with Center for Research in Water Resources , Texas Commission on Environmental Quality (TCEQ)

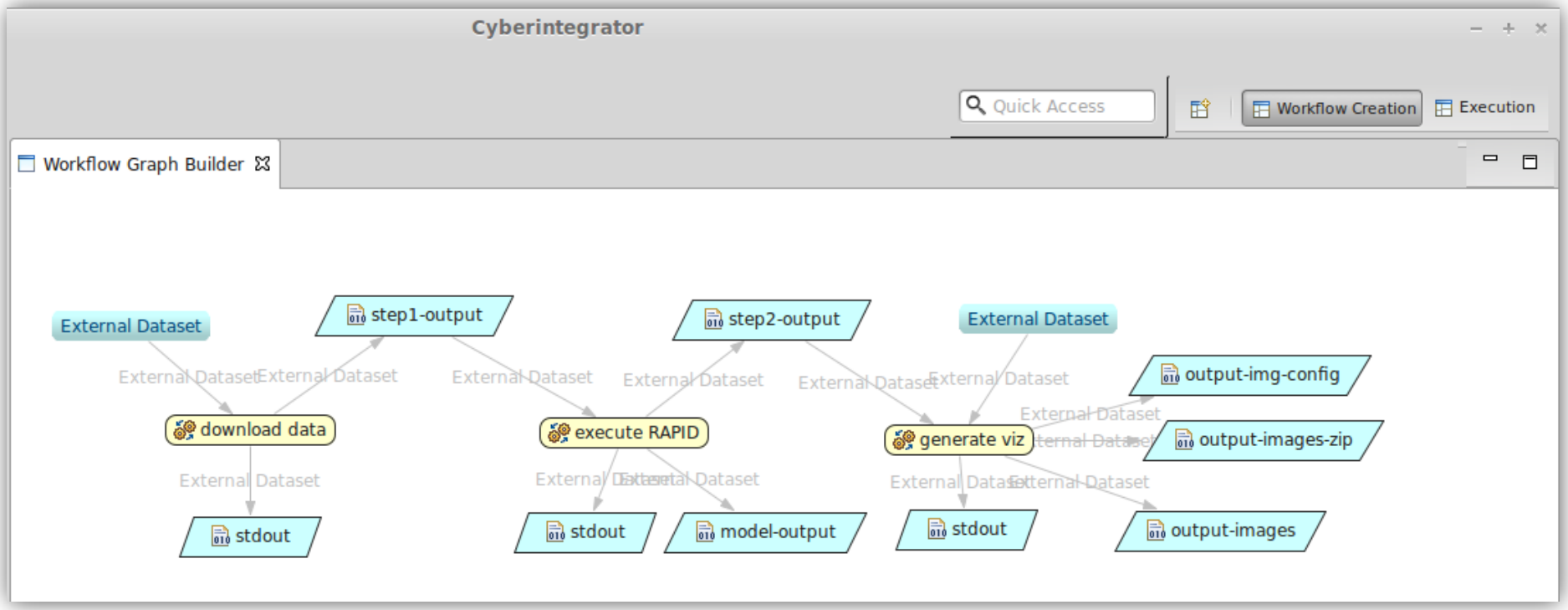
Web Application: Monitor Job Status



Web Application: Visualize & Download Results

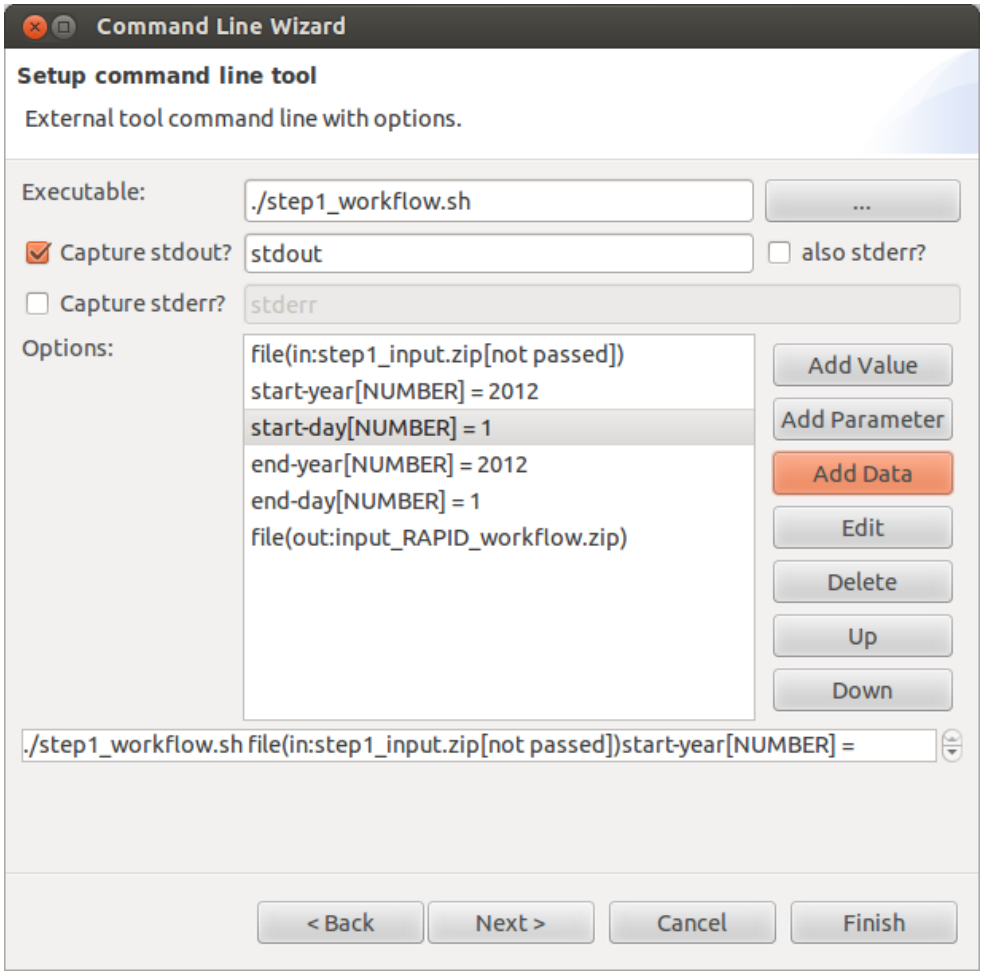


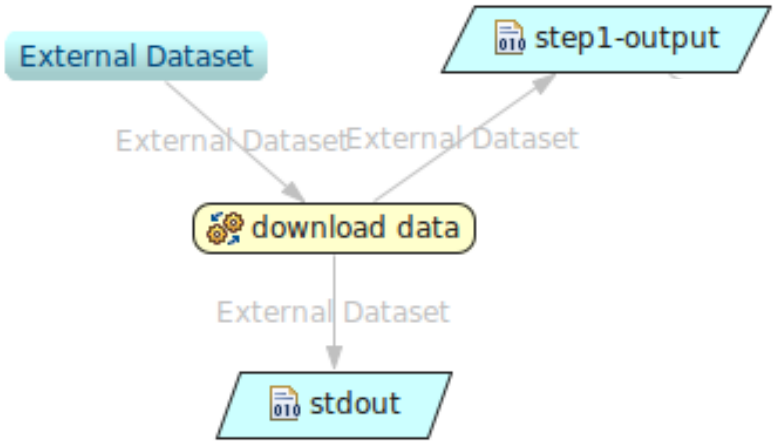
Cyberintegrator Workflow



- Download NLDAS data
- Execute RAPID model
- Generate visualization (images) of the model results

1. Define Workflow Steps

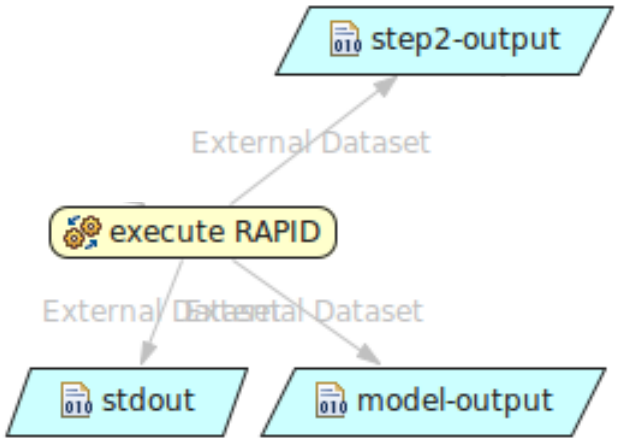




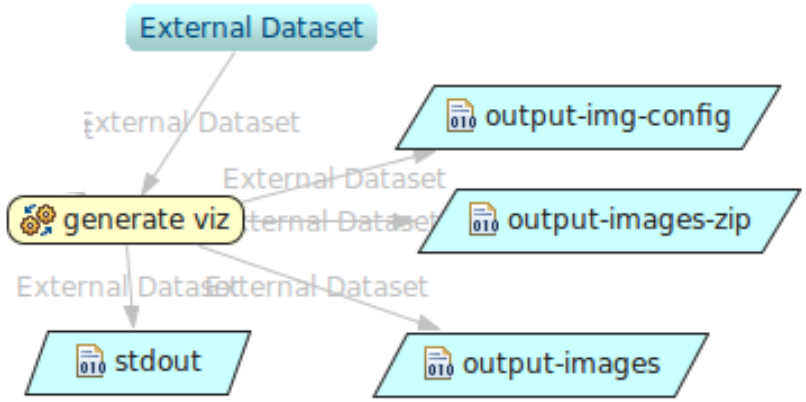
Download NLDAS data

1. Define Workflow Steps

- Define other steps the same way

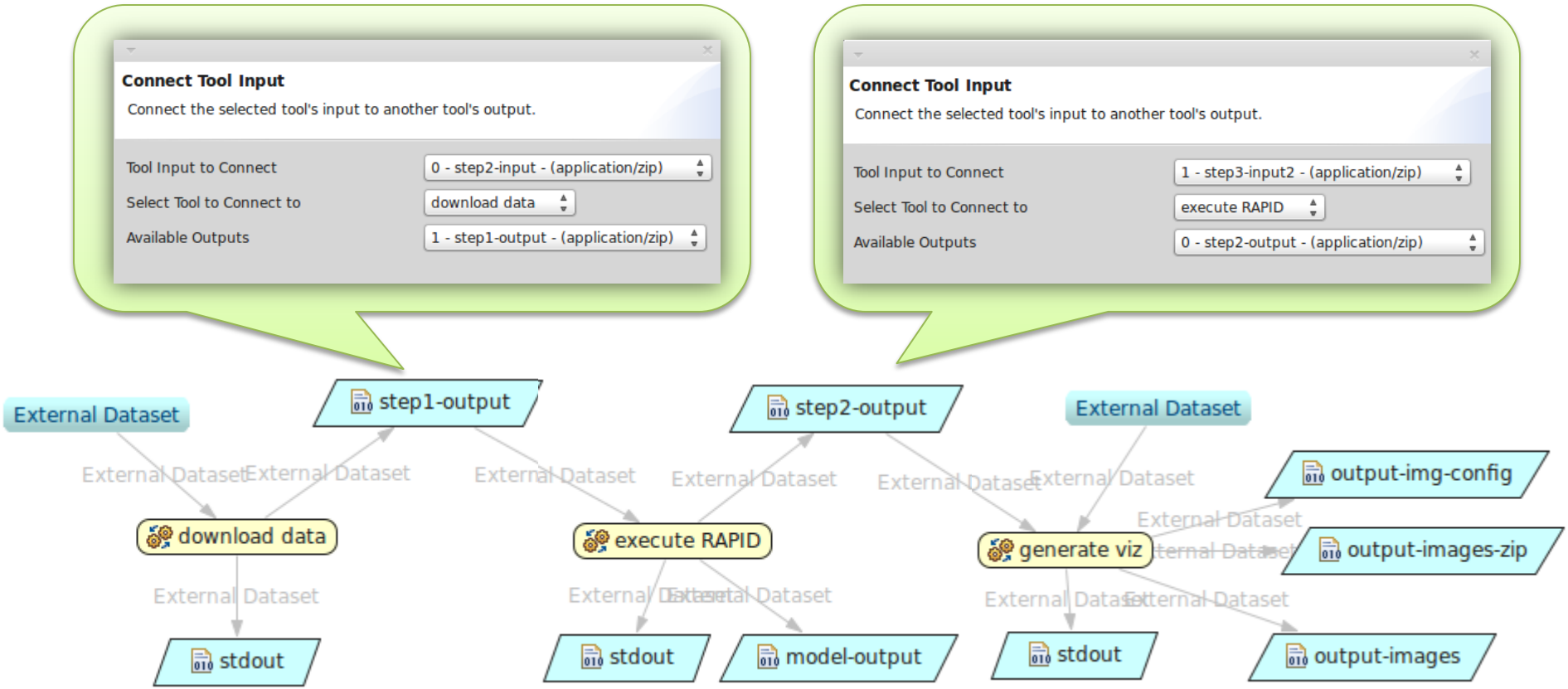


Execute RAPID model



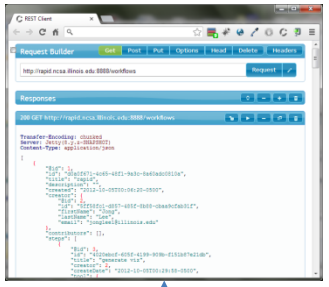
Generate visualization

2. Connect Steps

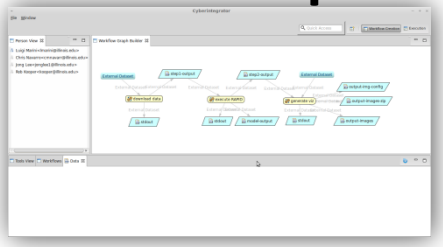


3. Sharing the Workflow as a Service

Clients
(i.e. Web browser)



Cyberintegrator Desktop



3. Access the shared workflow
GET http://<hostname>/workflows

1. Export Workflow

Workflow.zip

2. Upload the zip file
POST http://<hostname>/workflows

RESTful Service

Cyberintegrator Server

Behind the Web App: Cyberintegrator RESTful Service

- Browse detailed information about the workflow
  - http://<hostname>/workflows/{id}
  - JSON result:


```
{
   "@id":1,
   "id":"d0a0f671-4c65-48f1-9a3c-8a60adc0810a",
   "title":"rapid",
   "description":"",
   "created":"2012-10-05T00:06:20-0500",
   "creator":{ ...  },
   "contributors":[ ...  ],
   "steps":[
      {
         "@id":3,
         "id":"4020ebcf-605f-4199-909b-f151b87e21db",
         "title":"generate viz",
                        .
                        .
```

Behind the Web App: Cyberintegrator RESTful Service

- Check the status of the execution
  - http://<hostname>/executions/{id}
  - JSON result:

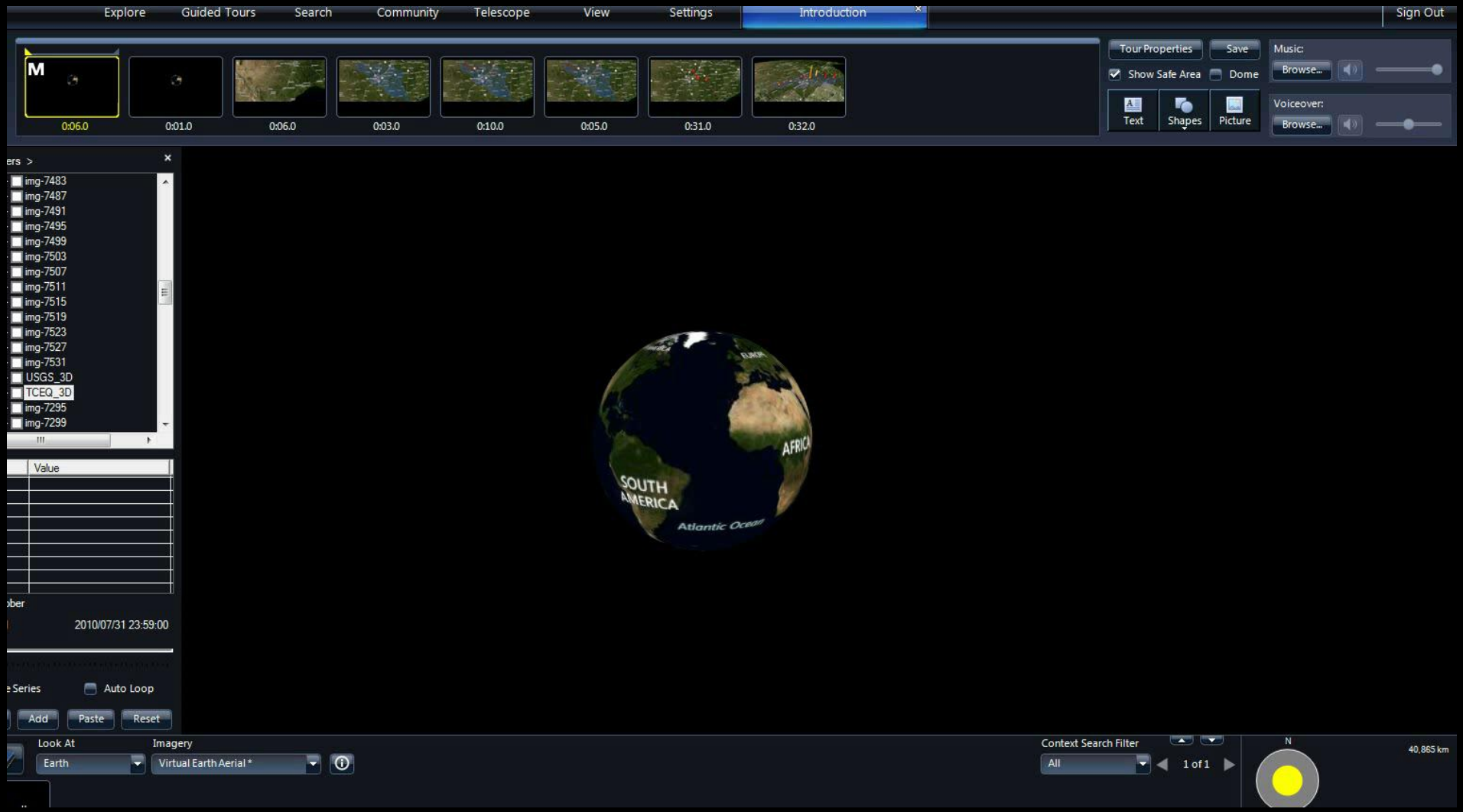

```
{
   "@id":1,
   "id":"221aa03b-58d3-4110-b609-696fec0b40e5",
   "workflowId":"d0a0f671-4c65-48f1-9a3c-8a60adc0810a",
   "date":"2012-10-07T02:13:58-0500",
   "creator":{ ... },
   "parameters":{... },
   "datasets":{... },
   "stepsQueued":{... },
   "stepsStart":{... },
   "stepsEnd":{... },
   "properties":{... },
   "stepStates":{
      "4c8879ff-d089-45a4-8c44-4bc5704cc732":"FINISHED",
      "4020ebcf-605f-4199-909b-f151b87e21db":"FINISHED",
      "83b6fcdd-48ef-444c-82ab-efe6b33a30be":"FINISHED"
   }
}
```

Behind the Web App: Cyberintegrator RESTful Service

- Browse the datasets
  - http://<hostname>/datasets/{id}
  - JSON result:


```
{
   "@id":47,
   "id":"232327f8-4ccf-44e0-bc28-898c7f3569ab",
   "title":"model-output",
   "description":"",
   "date":"2012-10-05T14:22:04-0500",
   "creator":2,
   "contributors":[],
   "fileDescriptors":[
      {
         "@id":48,
         "id":"33857c1b-01ea-4cf2-bb42-41488e4c0e1a",
         "filename":"result.nc",
         "size":4492040,
         "dataURL":".../result.nc",
         "md5sum":"49a514b73ddd8726c7e63100f7309cda",
         "mimeType":"application/octet-stream"
      }
   ]
}
```

World Wide Telescope Visualization



Next Steps & Future Work

- Improve modeling
  - Replace NLDAS data with real-time land-surface modeling service
  - Enable RAPID to:
    - Model water withdrawals
    - Assimilate real-time data
  - Visualize model errors
  - Implement real-time error model
  - Model social & economic dimensions
  - Adaptive meshing for large-scale implementation

Next Steps & Future Work

- Improve decision support & visualization
  - Create scenario builder interface for comparing multiple model scenarios
    - Allow real-time & long-term scenarios
  - Develop optimization model for real-time water withdrawal decision making during droughts
  - Explore impacts of alternative real-time water market scenarios
  - Better automate connection to World Wide Telescope

Acknowledgments

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