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Summary Report on Information Technology Integration Activities

For project to Enhance NASA Tools for Coastal Managers in the Gulf
of Mexico and Support Technology Transfer to Mexico

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Pacific Northwest
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Summary Report on Information Technology Integration Activities

**For project to Enhance NASA Tools for Coastal Managers in the Gulf
of Mexico and Support Technology Transfer to Mexico**

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April 10, 2009

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Introduction

This report summarizes accomplishments made by Pacific Northwest National Laboratory (PNNL) and its subcontractors (University of Alabama in Huntsville (UAH) and Oregon State University (OSU)) on Task 1.0: Integrate COAST-GoMRC systems to enhance value to end users, for the project “Enhance NASA Tools for Coastal Managers in the Gulf of Mexico and Build Capacity in Mexico.” This report covers the entire period of performance for the contract. The Work Breakdown Structure and timeline for Task 1.0 is shown in Table 1. Most of the original dates shifted forward, as agreed with NASA, based on their dependency on input from the conceptual modeling work and the final end user workshop held with scientists from Mexico. The outputs of each task are described below along with any significant adjustments from the original plan which became necessary based on user needs, data availability or software interoperability.

Tasks	Tasks and Milestones	Task Lead	Contributor	Start Date	End Date
1.0	Integrate COAST-GoMRC systems to enhance value to end users				
1.1	Refine GoMRC search tool to enable COAST to use search results	Ramachandran (UAH)	Brown (SSC), Gulbransen (Battelle), Guzy (OSU)	10/27/2008	3/13/2009
1.2	Integrate search seeds for COAST geospatial image/vector data formats into GoMRC search and analysis tools	Ramachandran (UAH)	Brown (SSC), Gulbransen (Battelle)	10/27/2008	3/13/2009
1.3	Adapt GoMRC tools to support regional trend analysis in COAST	Ramachandran (UAH)	Brown (SSC), Gulbransen (Battelle), Guzy (OSU)	10/27/2008	3/13/2009
1.4	Make GoMRC model outputs viewable in COAST	Ramachandran (UAH)	Brown (SSC), Gulbransen (Battelle), Guzy (OSU)	10/27/2008	3/13/2009
1.5	Enhance COAST by making research related to COAST imagery available to users	Gulbransen (Battelle)	Brown (SSC), Gulbransen (Battelle), Guzy (OSU)	10/27/2008	3/13/2009
<i>Deliverable</i>	<i>Status report on integration efforts</i>	<i>Gulbransen (Battelle)</i>	<i>Ramachandran (UAH), Guzy (OSU), Brown (SSC), Brown (SSC)</i>		<i>12/1/2008</i>
<i>Deliverable</i>	<i>Summary report on COAST and GoMRC tool enhancements complete</i>	<i>Gulbransen (Battelle)</i>	<i>Ramachandran (UAH), Guzy (OSU), Brown (SSC), Brown (SSC)</i>		<i>4/10/2009</i>
<i>Deliverable</i>	<i>All tools available through GoMRC website</i>	<i>Gulbransen (Battelle)</i>	<i>Ramachandran (UAH), Guzy (OSU), Brown (SSC), Brown (SSC)</i>		<i>4/15/2009</i>

Integration of COAST and GoMRC improved connectivity and was accomplished via a service oriented architecture which enables applications exchange to exchange data and instructions. Figure 1 depicts the basic relationships between COAST and GoMRC components.

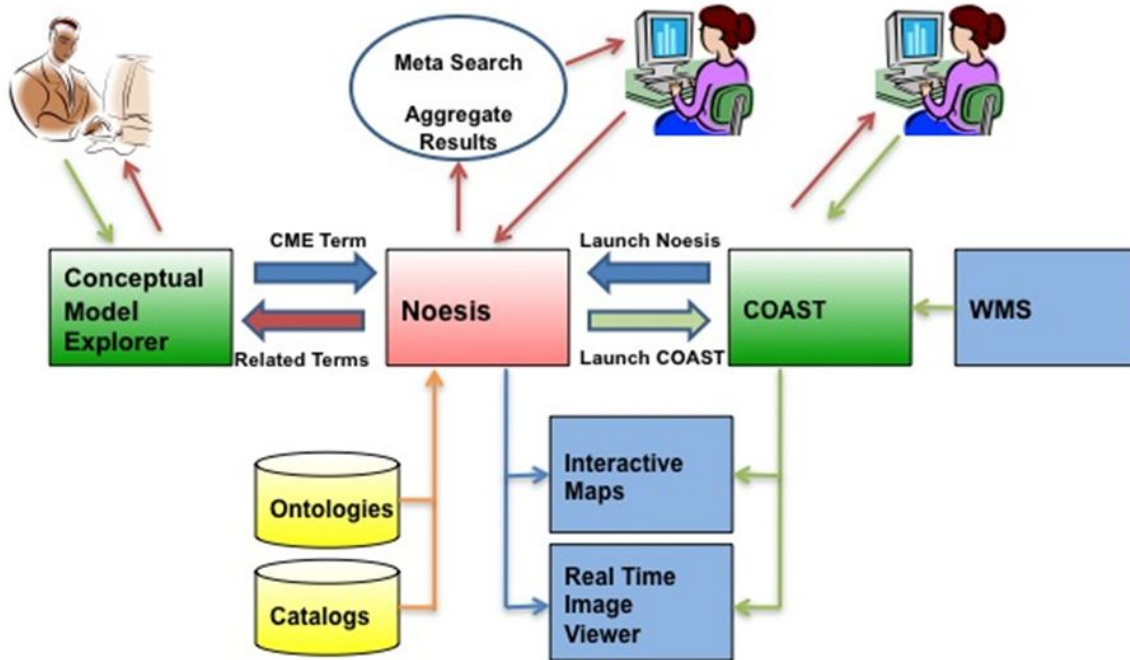


Figure 1. Basic architecture depicting integration of COAST and GoMRC.

Task 1.1. Refine GoMRC search tool to enable COAST to use search results

The goal of this task was to refine the GoMRC search tool, Noesis, so that its findings could be made available for use with the portfolio of geospatial products offered by the Coastal Online Assessment and Synthesis Tool (COAST). This was to be accomplished by recognizing the format of search results and offer users an icon to announce that results could be used in COAST. Noesis search destinations were also to be extended to include repositories which offered products suitable for use in COAST beyond those already incorporated into GoMRC from the SAV experiments. The University of Alabama Huntsville (UAH) led this task and was supported primarily by COAST developers from NASA Stennis Space Center.

Catalog of Web Mapping Service Sites: UAH assembled a catalog of Web Map Service (WMS) sites with data types relevant to coastal issues. Datafed.net is an online registry of WMS available. An entire new component was added to search this resource. Noesis was primarily designed to be a Federated search tool that can search multiple resources as long as the resources provide either a search interface or a web service end point. Datafed.net site did not provide any such capability. Therefore, in order to search this site, a new component was designed and implemented. This component consisted on a web crawler and an indexing module. The web crawler crawls all the

pages on this site and uses the indexing module to create a database of terms. This database resides on the server. A new search servlet was designed and implemented that searches this database based on user's search keywords.

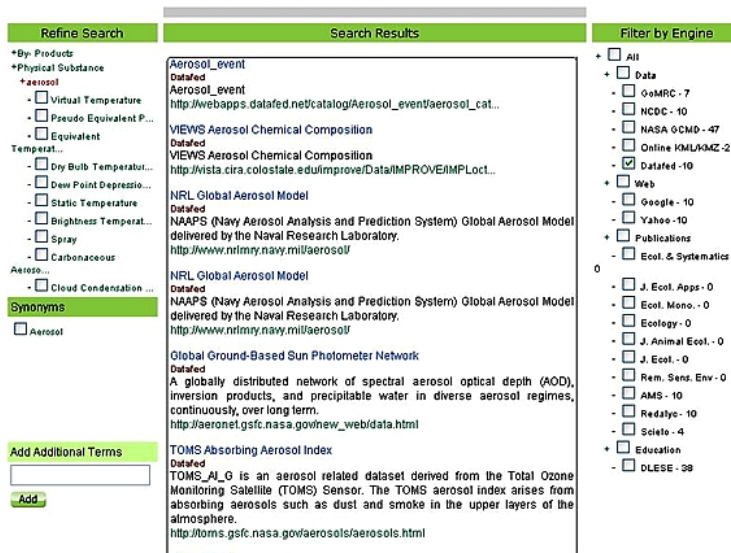


Figure 2. Screen snapshots showing results from DataFed.net resource.

KML/KMZ files integrated in search and display: Noesis was also upgraded with a new search servlet designed and implemented to search a specified list of online KML/KMZ resources based on user's search keywords (Figure 3). The servlet searches the KML/KMZ metadata and description for search keyword matches. The list of online KML/KMZ resource is easily configurable and maintained in an external XML file. The search servlet spawn searches to the different KML/KMZ online resources listed in this XML file. The results displayed from the search include URLs to the KML/KMZ files that can then be visualized using COAST.

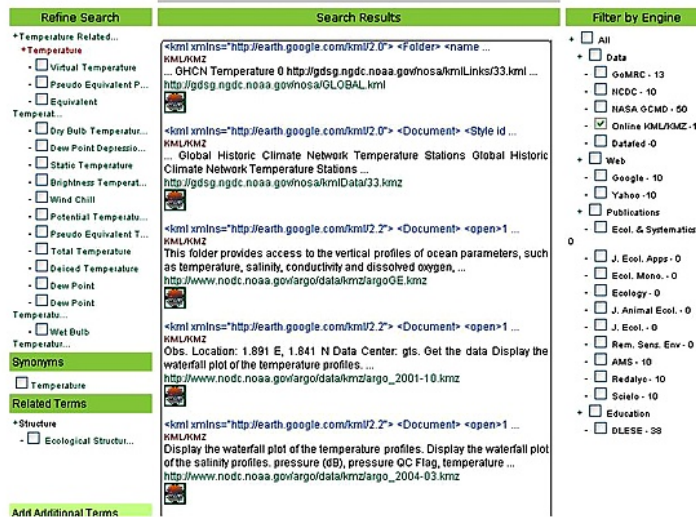


Figure 3. Screen snapshots showing results from KML/KMZ resources.

Limited bilingual search: Noesis search methods were enhanced to accommodate limited bilingual functionality. At the request of our Mexican colleagues, two additional search servlets were designed and implemented. These two servlets searched two publications resources of interest to them, namely redalyc.uaemex.mx and scielo.org.mx. Addition of these two resources allows Noesis users to seamlessly search for new publications in addition of the existing publication resources.

Ontology translation: UAH also expanded the ontology to include Spanish translation for priority keywords in the ontology. Spanish language translations for keywords will be associated with conceptual model boxes. These aliases will be employed when the Mexican catalogs are specified in the Noesis search.

Expanded keyword definitions capability: Because of the expanding breadth of the GoMRC ontology, which now includes SAV, atmospheric science, mangroves and initial coral reef terms, UAH expanded GoMRC's capability to find and post definitions of keywords supplied. The previous version of Noesis searched both the GoMRC database and the American Meteorological Society glossary for the definition for the search term entered by the user. This feature has been further extended. Now, Noesis also searches Wikipedia for relevant definition and term descriptions (Figure 4). To accomplish this, a new servlet was implemented that queried the Wikipedia API based on user's search term.



Figure 4. Example of the term description returned by Wikipedia.

Error checking: In response to user testing and feedback during the workshop UAH was able to insert additional checking to ensure smooth operation of NOESIS. Modifications were made to Noesis so that it checks to see if cookies and Java script on user's browsers are correctly set. If Noesis detects that either the cookies or the Java script has not been correctly set, it provides users instructions on how to enable them (Figure 5).



Figure 5. Screen capture of error checking in Noesis.

Task 1.2. Integrate search seeds for COAST geospatial image/vector data formats into GoMRC search and analysis tools

This task had three distinct goals. The first goal was to embed mangrove logic and terms in the GoMRC ontology so results could be identified and offered for use in COAST. The second goal was to determine how Noesis searches can best harvest assets for use by COAST. The third goal was to accommodate the formats that COAST is capable of ingesting.

Ontology expanded to include mangrove and coral reef terms: The first two goals were fulfilled together by expanding the ontology to include mangrove and coral reef terms. The logic of mangroves was loaded into the Noesis ontology based on the conceptual models developed by the Mexican colleagues and PNNL scientists. While beyond the original scope of work agreed upon with the Mexican scientists, a coral reef conceptual model was also developed in the Conceptual Model Explorer during the final month of the project. UAH is working to integrate this logic into the Noesis ontology in the final weeks of the project as well. These ontology additions were accomplished by integrating mangrove and coral reef logic into the main ontology. A portion of the ontology logic is shown in Figure 6 below. Expanding this ontology increased the effectiveness of NOESIS search to find assets that might be relevant for display in COAST. The final step was to accommodate the broader range of formats amenable to COAST ingestion.

The formats and search targets relevant to COAST were handled by direct compilation of WMS sources and open discovery of KML/KMZ offerings. NOESIS now produces icons which direct the user to invoke a COAST session if they would like to display the new search results.

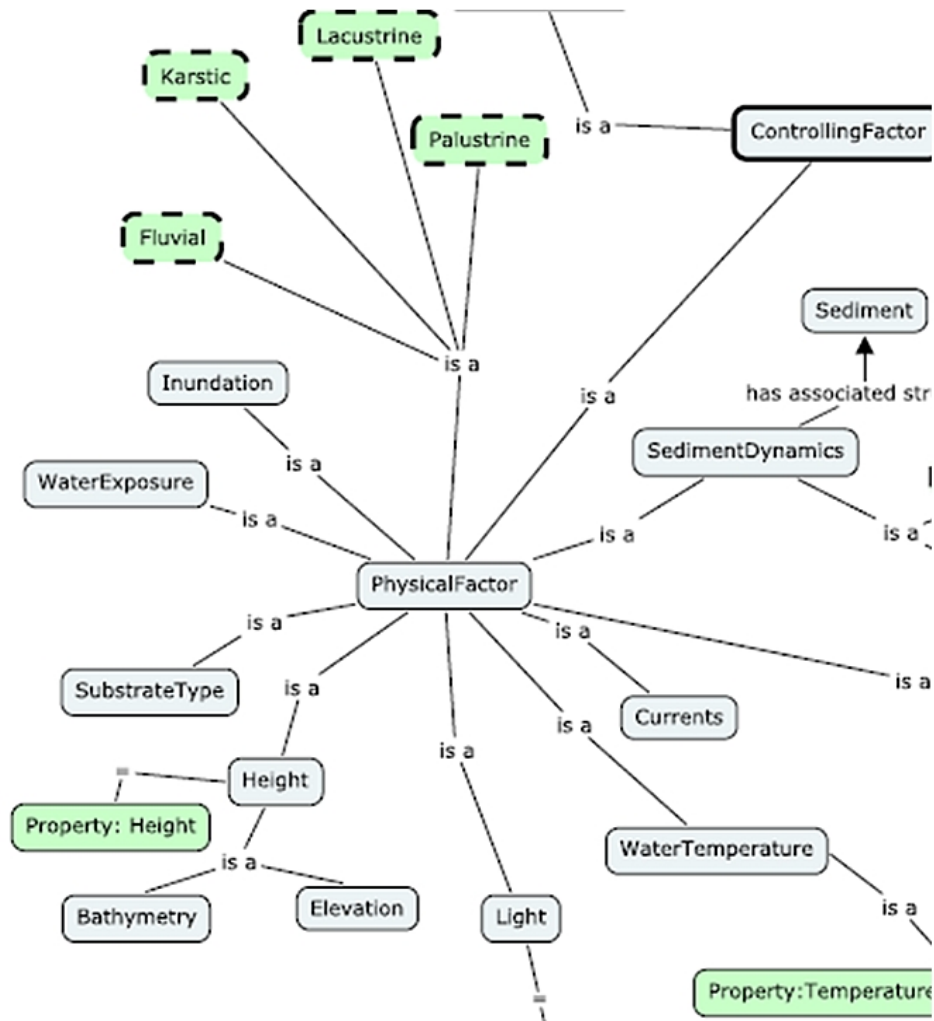


Figure 6. Portion of Mangrove Ontology for Controlling Factors.

Task 1.3. Adapt GoMRC tools to support regional trend analysis in COAST

Enabled integration of mangrove system into CME: Oregon State University (OSU) made the Conceptual Model Explorer (CME) and Work Flow Explorer (WFE) available for model refinement of the mangrove ecosystem characteristics and tools to identify trends or changes in habitat. The workshop participants in Xalapa, Mexico successfully developed the mangrove model through an iterative process. Semantic search terms corresponding to the mangrove system and new to the underlying CME database were integrated into CME. Reconciliation with the Noesis vocabulary proceeded using the methods of the previous GOMRC project (Figure 7). The full model can be viewed at: <http://persephone.bioe.orst.edu/cme/>.

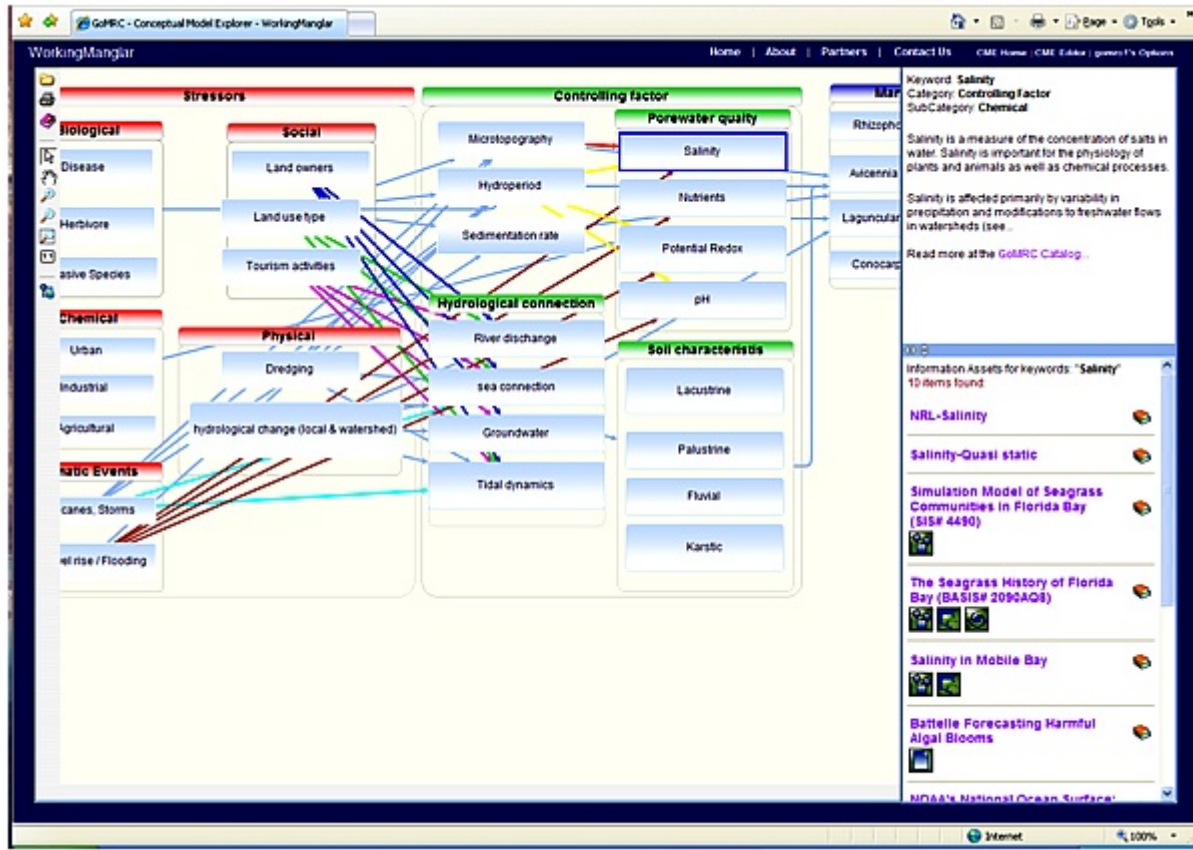


Figure 7. CME/WFE with Links to Noesis and COAST Connectivity.

Browser compatibility updates: Significant effort was dedicated to updating CME and WFE to ensure operations in the most recent versions of Internet Explorer and FireFox. The latest version of mxGraph (<http://www.mxgraph.com>) replaced the existing version to ensure compatibility. Code was updated to remove deprecated and unavailable references to the mxGraph API.

Supporting multiple users in CME: A number of issues apparent with large group of simultaneous users were corrected. The most important of these issues involved granting read and write privileges and concurrency.

WFE upgrade work with ArcGIS 9.3: The WFE tool was upgraded to work with the most recent version of ArcGIS Server, 9.3, to achieve performance boosts. A new WFE geoprocessing model, 'zonal change' was added to the library. Online documentation is embedded in its web page (Figure 8).

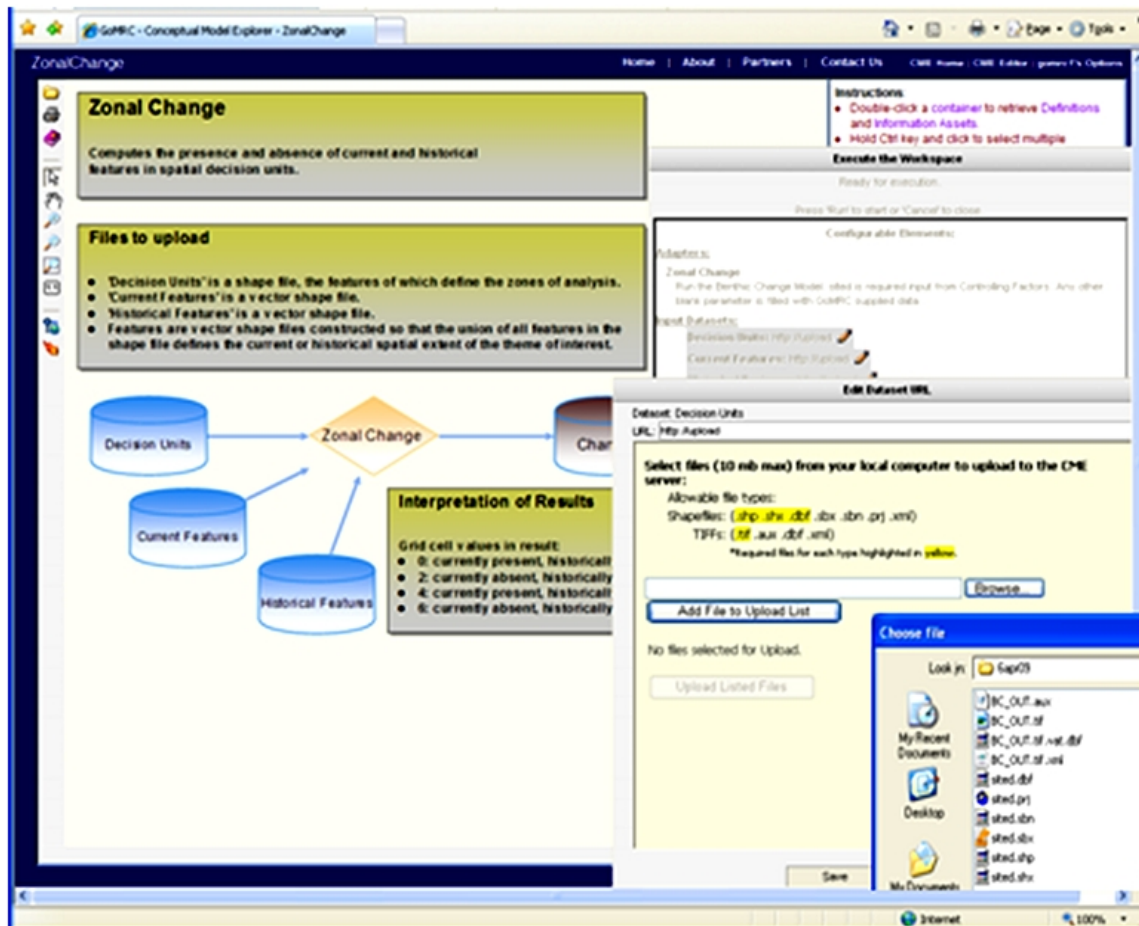


Figure 8. WFE Upgrade to Incorporate Zonal Change Tool

Other enhancements: The annotations attached to graphical representation of conceptual models were enhanced. New descriptors for relationships, represented graphically as edges between nodes, were added, including, flux and correlation. The numeric edge-weight feature was made operational.

An online issue-tracker was established and contains records of updates. Access to the tracker has been offered to project participants as a way to coordinate responses during implementation of the other tasks.

Task 1.4. Make GoMRC model outputs viewable in COAST

GoMRC findings are being made available for viewing in COAST via a semi-automated step wherein the URL of an asset discovered in Noesis is passed as an associated argument associated with a COAST start up routine. The partial automation of the handoff between GoMRC and COAST is a function of the COAST and the Worldwind code capabilities to start a new COAST session while

simultaneously passing an argument to a custom routine inside of COAST which is dedicated to incorporating KML/KMZ or WMS services into COAST's layer manager.

OSU confirmed that COAST is capable of ingesting the shape file and raster output formats from the WFE. The downloading mechanism from 2007 is being used to transfer user's outputs from the WFE server to desktop for COAST display. It is the user's responsibility to download their significant results from the server before their scheduled expiration. GoMRC model outputs are made available to COAST by the WFE download mechanism.

Task 1.5. Enhance COAST by making research related to COAST imagery available to users

This task was accomplished by expanding the data assets or products being made available through the COAST layer manager. In some cases Noesis search results were identified and added to the layer manager. In other cases, research about COAST results are now being made available to users by virtue of the expanded GoMRC ontology and keyword definitions that are displayed in GoMRC as part of CME Viewer.

Although changes and enhancements have been made to the COAST tool and program library, all COAST improvements are outside the purview of this work order and are being addressed by NASA developers. The GoMRC contributions to enhance COAST were to enable semantic search of COAST-related terms, to invoke COAST when web search findings had suitable formats, and to offer GIS modeling products for display in COAST.