

Preview of Award 1332257 - Annual Project Report

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Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
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PD/PI Name:	Anthony K Aufdenkampe, Principal Investigator
Recipient Organization:	Stroud Water Research Center
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Submitting Official (if other than PD\PI):	Anthony K Aufdenkampe Principal Investigator
Submission Date:	03/31/2014
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	Anthony K Aufdenkampe

Accomplishments

* What are the major goals of the project?

The “Integrated Data Management System for Critical Zone Observatories” (CZOData) Project was funded based on a solicited proposal submitted Aug. 1, 2011 by lead PI M.W. Williams, (Univ. Colorado at Boulder) and with an originally proposed start date of Oct. 1, 2011 and end date of Nov. 2013. The award (#1153164) was delayed but finally made with a start date of April 15, 2012. However, in July 2012, only a few weeks after subcontracts had been issued, PI M.W. Williams stepped down and requested that the project award be transferred to Anthony Aufdenkampe (Stroud Water Research Center). The effort to transfer the award to a new PI and institution (with a new award #1332257) unfortunately took until March 7, 2013 to be finalized. This very significant delay in funding (20 months total) is noted because it required substantial alterations in the project timeline and a number of important alterations to the project scope. Despite this, the first annual report was due on April 1, 2013, only three weeks after funding was secured, and subsequent annual reports are likewise out of phase with project-funded activities.

The **Year 1 Project Report** detailed accomplishments from Oct. 1, 2011 to March 31, 2013. Because funding was only awarded 3 weeks before the end of this reporting period, the Year 1 report primarily details volunteer efforts (i.e. unfunded by this project) by project senior personnel, who have been highly committed to project goals. However, without firm funding commitments in place before Mar. 7, 2013, most institutions would not allow the team to engage any technical staff toward product development. The project team back-dated the start date to Dec. 1, 2012 to allow the invoicing of any expenses incurred in autumn of 2012 (such as the Dec. 2012 workshop). Therefore, the Year 1 report documents both those accomplishments completed on a volunteer basis between Oct. 1, 2011 and Dec. 1, 2012, and the funded accomplishments from Dec. 1, 2012 to March 31, 2013.

This **Year 2 Project Report** describes accomplishments for the first full year the project was actively funded, from March 31, 2013 to March 31, 2014. Because of funding delays, we have requested (and been granted) a no-cost extension to March 31, 2015. Therefore, the project team considers that this Year 2 Project Report documents the midpoint of our project. We describe below our originally proposed Tasks and modifications to those tasks based on changing needs and realities.

The major CZOData Project Tasks are:

Task 0: Community Engagement and Project Management. Instigate and support a cross-CZO Information Management Committee (IMC) through online and face-to-face meetings and workshops.

Task 1: Website. Create a CZO-wide information portal, as the main communication platform between the CZO program and the user community

Task 2: CZO Display File Format v2. Develop consistent metadata profiles for other CZ domains, by extending the CZO Display File Format beyond hydrologic metadata best practices developed during the CZOData prototype phase

Task 3: Data Publication Tools. Create data and metadata publication tools and templates, to streamline data publication into the portal

Task 4: Web CZchemDB. Web-based user interface to CZchemDB.

Task 5: Shared Vocabulary. Enhance the shared vocabulary system, to enable cross-CZO search based on parameter names

Task 6: Sample Tracking. Implement an International GeoSample Number (IGSN) Registration Agent for CZO samples, to tracking unique sample identifiers for CZO data

Task 7: CZO Data Manager Support. Support site data managers with data publication, as well as identifying, analyzing and prioritizing their information management needs

Task 8: Central Catalog. Develop the CZO Central metadata catalog, data discovery portal and harvester, extending it to additional CZO data types, and integrating it with the CZO-wide information portal

Task 9: Central Repository. Enhance the central data repository of time series and point data.

Task 10: Geospatial Data. Extend the CZOData system to include publication and sharing of spatial data and LiDAR.

Task 11: EarthChem Integration. Integrating CZchemDB data into the EarthChem system

Task 12: Visualization Tools. Developing a CZO Visualization system (CZO-VS)

Observations Data Model 2.0 (ODM2).

Since early 2011, before this proposal was submitted, the CZOData project team recognized that solutions to most of these tasks would be constrained by the very different information models used by the different CZ domains and the existing cyber-infrastructures that we would be leveraging. An information model is an abstract representation of concepts, their properties and the relationships, constraints and operations between them. It forms the conceptual foundation for each component of a data system. Therefore, the CZOData team realized that solutions to many of our challenges would be both more straightforward and more durable if we could develop a common information model for all CZOData components. However, this seemed outside the scope of the CZOData project when we submitted it. Six months later, the CZOData team submitted a separate proposal to address this need, and in Aug. 2012 the project was funded: “Developing a Community Information Model and Supporting Software to Extend Interoperability of Sensor and Sample Based Earth Observations” (NSF #1224638).

Although the ODM2 project is funded with a separate NSF award, our project team (which is identical for both projects) has increasingly considered the two projects to be tightly interdependent. ODM2 depends on CZOData for its most important use cases and CZOData depends on ODM2 for the conceptual foundations for how to develop metadata standards and formats for data interoperability between CZ disciplines. We thus decided to put many CZOData tasks on hold (i.e. Tasks 2, 3, 4, 5,

11) until ODM2 development was complete. As such, our project team has put a substantial amount of effort over the last year into accelerating ODM2 development (ie. 2-3 hours a week of web conferences, 3 community workshops, 2 additional face-to-face meetings).

The result of ODM2 efforts has been a significant accomplishment that exceeded our original goals -- the Core of ODM2 has been stable for several months and has been successfully tested on a variety of use cases that suggest ODM2 will be a single data model than can manage nearly any CZ dataset! The final specification of the complete ODM2 is nearly completed, 4 months before the 2-year project ends. Furthermore, not only will ODM2 become the core data model underlying the major update to IEDA, the CUAHSI Water Data Center and the new BiG CZ SSI, but its capabilities are being noticed by others such as the Knowledge Network for Biocomplexity (KNB) and the Open Geospatial Consortium (OGC). We are very excited by our accomplishments and feel that our foresight and investment into ODM2 have been right on.

The sections below describe Activities, Results and Outcomes all in a single narrative organized by project Tasks but spread across these different headings.

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

Major Activities:

Task 0: Community Engagement and Project Management.

In 2012 and early 2013 (official Year 1), the CZOData project maintained regular lines off communication in 3 areas: (1) CZOData project management, with weekly conference calls with all CZOData project team members; (2) CZO website development, in weekly collaboration with CZO web staff; and (3) CZO investigator engagement, through the formation of the Information Management Committee (IMC), its first workshop (<http://criticalzone.org/national/events/event/2012-11-13-czodata-imc-meeting/>) and the convening of an EarthCube CZ-Domain End User workshop with over 100 participants from around the world (<http://criticalzone.org/national/events/event/2013-01-21-earthcube-czo-workshop/>). These activities are detailed in the Year 1 Report.

Since April 1, 2013, we substantially built on those activities.

The CZOData project team continued weekly web conference calls over the last year to manage project tasks, but we significantly intensified our efforts on the highly related (but separately funded) ODM2 effort by convening separate weekly ODM2 web conference calls and three different workshops.

The CZO website development continued intensive collaboration and weekly web conference calls even after successfully launching the integrated CZO website in late 2012 (<http://criticalzone.org/>). We continued to assist CZO web staff to fill out content well into spring 2013, but refocused our major effort toward collaborating on the development of Data and Dataset pages. This effort continued through the summer of 2013 when we publicly launched those web pages (more below in Task 1). We restarted regular website development conference calls in January 2014 to engage with web staff and PIs from the four new CZOs to train and assist them with developing content for the integrated website. These are ongoing, and will continue every 1-2 weeks until a month or two after we launch of all 10 CZO websites at <http://criticalzone.org/> (targeting mid-April).

Over the last year, CZOData team members have all participated very actively in EarthCube community efforts, which have been extremely intensive. CZOData team members were convenors for nine different EarthCube EndUser workshops! More than half of the team also participated in the EarthCube EndUser PI workshop (Tucson, Aug.

14-15, 2013), EarthCube meetings at the AGU Fall Meeting, and the EarthCube Stakeholder Assembly Workshop (DC, Mar. 18-20). Aufdenkampe personally attended six of these while primarily waving the CZO banner. Lehnert and Zaslavski have both developed strong leadership positions within EarthCube. These combined EarthCube activities have offered important opportunities for engaging the broader critical zone science community, developing collaborations with other, related cyber-infrastructure efforts, and successfully promoting the greater CZOData effort as a pilot for all of EarthCube. The result is that CZO community poised -- as much or more than any other geoscience community -- to take full advantage of the potential that EarthCube has to offer.

In addition to EarthCube activities, Aufdenkampe has presented invited talks on CZOData at the 2013 CUAHSI HydroInformatics Conference (<http://www.cuahsi.org/WDCconf2013.aspx>) and the 2014 Open Geospatial Consortium Technical and Planning Committee Meeting (<http://www.opengeospatial.org/event/1403tcagenda>).

Last, the CZO Information Management Committee (IMC) was reformed with new members in January 2014, after the four new CZOs had named their data management staff. In addition, a number of existing CZOs hired new data management staff with their renewals. To bring everyone up to speed on existing data management protocols and also on the substantial number of developments underway for 2014, we began a series of CZOData cyber-seminars. Five have been presented to date, and more are scheduled. All are recorded to allow anyone to watch at a later date. The schedule and recordings are at <http://criticalzone.org/national/news/story/2014-czodata-cyber-seminar-series/>.

Task 1: Website.

On June 3, 2013 we soft-launched the data pages section of the integrated CZO website (i.e. <http://criticalzone.org/christina/data/> etc.). The original scope for the integrated website was to exclude data pages, allowing each CZO to present their data files on their own website as they chose, as long as the data were ingested into the CZO Central Catalog and Repository. However, the CZOs had received feedback that enough people still searched for data via “old-fashioned” web browsing that it was important to have a uniform web layout of these pages to facilitate this searching. To avoid duplication of efforts that might require data managers to fill out metadata forms for both the website and the CZO Central Catalog, the IMC developed a plan at the Dec. 2012 meeting to use the website content management system (CMS) database as the primary means for logging files into the CZO Central Catalog. From Jan. to Aug. 2013, we collaborated with CZO web staff and investigators to develop the back-end CMS database and forms and the front-end user interface of the CriticalZone.org Dataset pages. We also developed data sharing and data use agreements (see Task 3, below). We continued to work on improving the front-end interface and Dataset content until Aug. 2013. These systems are now fully functional; CZO data managers are able to continually add new Datasets into the CMS system and the public can freely browse and download those datasets at <http://criticalzone.org>.

The substantial effort described above to develop DataSet browsing capabilities within CriticalZone.org was never within the original scope of the proposed work, but was rather requested by NSF and others in late 2012. As a result, by Aug. 2013, we had burned through our original web development budget without ever having begun the originally proposed work of enhancing the user interface to the CZO Data Portal (<http://search.criticalzone.org/>) and better integrating it into <http://criticalzone.org>. For this reason, and to add four new CZOs to CriticalZone.org, we submitted a

supplemental in Nov. 2013 after discussions with our program officer. Although this request has not yet been officially approved, we began to move forward on good faith.

In Dec. 2013 we began the process of developing automated metadata harvesters from the CriticalZone.org website CMS database into the CZO Data Portal system (<http://search.criticalzone.org/>) that is built upon ESRI Geoportal that allows metadata discovery and interoperability with other national data systems. We originally developed the CMS web form to follow a very enhanced version of the “Dublin Core” metadata standard, but since Dec. 2013 we have chosen to map the CMS database entries to the much “richer” ISO 19115 Geographic Metadata standard in order to fully export all of the metadata contained in DataSet pages. This approach is fundamentally so much better than what we had previously loaded into the CZO Data Portal that once the translators are completed, we will likely rebuild the entire CZO Data Portal content from scratch using this approach. At the moment, this effort has been put on hold in order to launch the four new CZOs at CriticalZone.org, but we plan to renew and complete this effort in early to mid spring 2014.

As mentioned above, in January 2014 we began working with CZO web managers from the new CZOs, and in April 2014 we expect to soft-launch the CriticalZone.org websites for the four new CZOs and an updated new navigation system for the entire website that better enables navigation between now 10 different CZOs. Helping the four new CZOs develop and load content into the CriticalZone.org web system has taken three months of weekly web-meetings and frequent email exchanges. As it was a year ago with the original six CZOs, getting complete content is the primary cause for delay in the launch.

Specific Objectives:

Task 2: CZO Display File Format v2.

The present CZO Display File Specification (v1) has served its purpose from 2010 to the present as being a human readable and machine parsable data sharing format for CZOs in which data could also be ingested into CUAHSI's Hydrological Information System. Despite these capabilities, the specification has shown a number of weaknesses over time and can only effectively handle time series data. It is completely inadequate for soil data and other datasets with complex relationships between specimens and/or sites. Therefore, since late 2012 the CZODATA Team and IMC has been compiling a list of requirements for the next version of the CZO Display File format.

Starting in Sept. 2013 we began exploring syntactic approaches CZO Display File Format v2 that would preserve the original goal of being both human readable and machine parsable, yet would significantly enhance machine parsing and validation.

Our decision has been to use a specification based on Java Script Object Notation (JSON format), or its YAML variant. In combination with the new JSON Schema structural validation tools (<http://json-schema.org/>), this approach offers much of the power of XML while still enabling human readability and the ability to open files as CSV format in Excel. Also, JSON is becoming an increasingly used data exchange format over XML, because its compactness improves performance, and nearly any programming language (including Matlab, R and Python) can natively parse JSON.

Furthermore, for these reasons JSON is being increasingly considered as an ideal choice for data archiving by IEDA and other data repositories. We have presented this approach to the IMC and received positive feedback.

Now that ODM2 has been developed, we have started the process of using its rich metadata semantics and relationships to design CZO Display File Format v2 to meet nearly all CZO data sharing, harvesting and archiving needs, including for soil data (i.e.

a CZchemDB data loading template and transfer format). We will collaborate with the IMC in this process over the next 3-6 months.

Task 3: Data Publication Tools.

Data publication tools will be developed to assist CZO data managers at producing CZO Display Files (v2). Because the CZO Display Files v2 specification is still under development (see above), this effort is scheduled to begin active development in 3-6 months. Nevertheless, we are beginning to think about how we might create these tools using a variety of tools (i.e. Excel templates, Python & R scripts, etc.).

An important but sometimes ignored foundation for data sharing and publication are data use and data sharing agreements. In spring 2013, we collaborated with CZO data managers and investigators to develop a draft set of agreements for CZOs. These are posted on our data pages at <http://criticalzone.org/national/data/access-czo-data-1national/#DataUsePolicy>. These are considered drafts because the CZOData project team proposed to PIs that we frame these policies as implementations of Creative Commons Copyrights (<http://creativecommons.org/about>), to which they conform quite readily (i.e. they were drafted with Creative Commons in mind). The benefits of doing so would be numerous. We have reminded the IMC of this issue and hope to have it settled in the next few months.

Task 4: Web CZchemDB.

The CZchemDB database has been finalized by the Penn State team who developed it and sent to the IEDA (Columbia) team to translate from the prototype desktop implementation in Microsoft Access to an enterprise server implementation on a Linux/Appache web server and using a PostgreSQL Relational Database Management System.

The initial evaluation of CZchemDB concluded that it would need to be significantly modified to enable an enterprise server implementation that would be interoperable with the CyberInfrastructure at IEDA. Furthermore IEDA's cyberinfrastructure has also begun a major foundational transition in last few months; IEDA is adopting ODM2 as it's underlying information model to enable a number of new capabilities. Therefore, our team has mapped CZchemDB to ODM2 and we have decided to implement CZchemDB as a profile of ODM2, in which the back-end data storage and transfer is 100% ODM2 and the front-end data loaders and other functions have the feel of the original CZchemDB. The translation process is actively underway at Columbia.

Task 5: Shared Vocabulary.

In 2012, the existing CZO Shared Vocabulary system (<http://sv.criticalzone.org/>) was moved by USU to a new set of servers along with the switch of criticalzone.org to SDSC. However, the CZOData team has long recognized that the CZO Shared Vocabulary system, which was based on CUAHSI's Controlled Vocabulary (<http://his.cuahsi.org/mastercvreg/>), would require a very substantial overhaul to meet the needs of the CZO community. Now that ODM2 is completed and can handle the majority of CZO community data needs, it now provides a strong guide on how to develop the new CZO Shared Vocabulary and the underlying system. The project team has thus made the following decisions:

- The CZO "shared vocabulary" will be merged back into the CUAHSI CV, and the current system/platform will cease to exist as it is now.
- The future CZOData system will look to existing domain vocabularies as much as

possible by enabling the use of pointers to those vocabularies.

- For example, if your dataset can be neatly described by CUAHSI CVs, the CZO Display File v2 would point to the CUAHSI CV registry for validation. If a dataset was better described by EarthChem CVs, then you could use and point to those.
- A new ODM2 CV management system and "resolver" will be implemented. It will both manage ODM2 and CZ specific vocabularies that do not have anything equivalent anywhere. It will also manage pointers to external vocabularies. This new CZO Shared Vocabulary system will require migrating to a new Simple Knowledge Organization System (SKOS) software (we are presently exploring the software under the Marine Metadata Interoperability system, <http://mmisw.org/orr/#http://mmisw.org/ont/odm2test/actiontype>).

During this transition period over the next year, the CZOData team has also made the following recommendations to CZOs:

- Continue to manage HydroServer data using CUAHSI CVs and CZO Display Files using CZO SVs.
- Both of those systems will be replaced, but the legacy terms will all be mapped to new terms and their resolvers, so no data will be orphaned.

Task 6: Sample Tracking.

Developing an IGSN registration agent within the CZO website has been set to be completed in 2014. This requires not only setting up a clone or new front-end for IEDA's System for EArth Sample Registration (SESAR: <http://www.geosamples.org/>), but also developing a new Shared Vocabulary that is relevant to CZ scientists. Presently SESAR SampleTypes and other Controlled Vocabularies (<http://www.geosamples.org/help/vocabularies>) are very much aligned to marine geological users. Therefore, finalizing Task 6 also involves finalizing Task 5 in collaboration with the IMC. However, with the major ODM2 development effort behind us, we have begun concrete discussions about software development so that the software system will be ready around the same time that the vocabularies are finalized.

Significant Results:

Task 7: CZO Data Manager Support.

As discussed above, under Task 0, we have regularly engaged CZO web and data managers throughout this project when we needed their input. The major efforts have focused around:

1. Training data managers how to produce and load CZO Display Files (v1), with nearly weekly meetings from about mid-2010 to mid-2011 (before this project period) and with assistance troubleshooting issues when they arise.
2. Developing the CriticalZone.org integrated website, in collaboration with CZO web managers and investigators, with nearly weekly meetings from spring 2012 to winter 2013.
3. Developing the CriticalZone.org integrated Data and Dataset webpages and approach, in collaboration with CZO data managers, web managers and investigators, with nearly weekly meetings from winter 2013 to August 2013. During this period we also developed CZO data use and sharing policies (see Task 3).
4. Assisting new CZO web managers to load content into the CriticalZone.org

integrated website, with meetings every 1-2 weeks from January to April 2014.

5. Informing and training data managers and investigators how use the existing CZOData system and providing background on the future system and decisions that they will need to make, via a Cyber-Seminar series that began in early March 2014 and will continue to late spring of 2014 and possibly beyond. Five have been presented to date. See <http://criticalzone.org/national/news/story/2014-czodata-cyber-seminar-series/>.

Task 7 is one that was substantially rescoped, with approval from NSF program officer Enriqueta Barrera, since the original proposal was submitted. In brief, we had originally proposed to send members of the CZOData team to visit each of the six CZOs to assist with local data management issues. However, we have modified this plan due to: (1) the heavy travel load brought about by EarthCube; (2) the reduced total labor hours due to funding delays; and (3) the funding of 4 new CZOs. Our new plan involves much more frequent cyber-seminars and CZO-specific virtual visits and working sessions (i.e. 4-6 hours long) with each of the CZOs which we will launch later in 2014 once other developments are nearing completion.

Tasks 8-9: Central Catalog & Repository.

The originally proposed scope for Task 1 (Web) was to redesign the user interface for <http://search.criticalzone.org/> to be more intuitive for the typical geoscientist. This effort overlaps substantially with Tasks 8-9. Over the last year, we explored many options, even putting substantial development effort into prototyping a CKAN data repository system (<http://ckan.org/>). However, we have finally settled on sticking with the ESRI Geoportal Server (<http://geoportal.sourceforge.net/>) as a back-end system for data interoperability, but adopting the new front-end user interface developed for <http://portal.westcoastcoceans.org/>. We are in the process of adapting the west coast data registry software (<https://github.com/ECotrust/wc-data-registry>) to meet the specific needs of the CZO Community, and hope to launch the new <http://search.criticalzone.org/> website sometime mid to late spring 2014.

In addition, in Dec. 2013 the SDSC team began working closely with our web developer at Boulder to develop automatic metadata transfer from the CriticalZone.org website Content Management System (CMS) databases that data managers fill out to create a Dataset webpage, as described under Tasks 0 and 1. We have nearly completed the mapping the CMS database entries to the much “richer” ISO 19115 Geographic Metadata standard. At the moment, this effort has been put on hold in order to launch the four new CZOs at CriticalZone.org, but we plan to renew this effort soon and finalize the automated harvesting approach by mid-spring 2014.

Task 10: Geospatial Data.

Last year, the SDSC team built on the Memorandum of Agreement signed in December 2011 and coordinated with OpenTopography developers to make LiDAR datasets discoverable through the CZO catalog search at <http://search.criticalzone.org>. This added 155 additional records to the CZOdata catalog, and will automatically add any new datasets as they get deposited at OpenTopography. By doing this, we have already completed everything that was originally proposed for Task 10.

In addition to what was proposed, we are further enhancing integration of geospatial data with developments described in Tasks 8-9, and in particular our full support for ISO 19115 Geographic Metadata, will enable nearly any geospatial dataset to be cataloged

by CZO Central. In addition, the development of ODM2 will allow the CZO Display File v2 to handle much more detailed geospatial information than ever before, including such things and sensor time series datasets on moving platforms such as aircraft or aquatic gliders.

Task 11: EarthChem Integration.

This project will integrate with IEDA's EarthChem through development of the CZO Display File v2 (Task 2), related publication tools (Task 3), a Web CZchemDB (Task 4) and a more expansive Controlled Vocabulary system (Task 5) that will enable CZO Data Managers to easily create files that will be archived in the EarthChem library and ingested into PetDB, IEDA's primary database. Developing a CZ-IGSN registration agent (Task 6) will further integration. Last, we have started down the path to full integration with IEDA's EarthChem through mutual adoption of ODM2 for CZchemDB, PetDB (IEDA's main data base), CUAHSI's Water Data Center and the recently funded BiG CZ SSI. Such integration would have been unthinkable when our project was originally proposed, but it is likely only 2 years from becoming a reality due to our successes with ODM2.

Task 12: Visualization Tools.

To transform the prototype CZO visualization system developed for the Christina River Basin CZO (<http://wikiwatershed-vs.org>) in 2012 to one that can function for all CZOs has required significant modifications to the software underlying the Northwest Association of Networked Ocean Observing Systems (NANOOS) Visualization System (NVS, <http://nvs.nanoos.org/Explorer>). In 2013, the UW-APL substantially re-written the back-end framework of NVS within releases of NVS versions 3.0, 3.1 and soon 3.2.

Much of this work has been motivated by the need to re-deploy and rebrand instances of NVS for each of the CZOs. With the release of version 3.2 in the next few weeks, this work will be completed and the redeployment for CZOs will begin.

Key outcomes or Other achievements: Described in above sections.

*** What opportunities for training and professional development has the project provided?**

The CZO IMC specifically targeted early-career cyber-savvy faculty to serve as investigator representatives of the data needs for their CZO. Likewise, the CZ-EarthCube workshop targeted early career participants. These were intentional choices to provide a training and professional development opportunities.

*** How have the results been disseminated to communities of interest?**

Results have been disseminated through cyber-seminars, web conferences, websites, workshops and workshop reports. See <http://criticalzone.org/national/news/story/2014-czodata-cyber-seminar-series/> and other accomplishments described above.

*** What do you plan to do during the next reporting period to accomplish the goals?**

See the task-by-task descriptions of accomplishments for mention of tasks set for completion in the final project year.

Products

Books

Book Chapters

Conference Papers and Presentations

Inventions

Journals

Zaslavsky, I., T. Whitenack, M. Williams, D. G. Tarboton, K. Schreuders, and A. Aufdenkampe (2011). The Initial Design of Data Sharing Infrastructure for the Critical Zone Observatory. *Proceedings of the Environmental Information Management Conference, Santa Barbara, CA, 28-29 September, EIM'2011*. 145. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Licenses

Other Products

Other Publications

Patents

Technologies or Techniques

Thesis/Dissertations

Websites

CZO Central Data Catalog Search

<http://search.criticalzone.org/>

CZO Shared Vocabulary System

<http://sv.criticalzone.org/>

Integrated Website for Datasets from US Critical Zone Observatory Program

<http://criticalzone.org/christina/data/>

The above dataset page for the CRB-CZO is an example of the 180 dataset web pages that have been created for original 6 CZOs.

Integrated Website for US Critical Zone Observatory Program

<http://criticalzone.org/>

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Aufdenkampe, Anthony	PD/PI	2
Horsburgh, Jeff	Co-Investigator	2
Lehnert, Kerstin	Co-Investigator	1
Mayorga, Emilio	Co-Investigator	2
Tarboton, David	Co-Investigator	1

Valentine, David	Co-Investigator	2
Zaslavsky, Ilya	Co-Investigator	1
Hsu, Leslie	Postdoctoral (scholar, fellow or other postdoctoral position)	2
Brooks, Heather	Other Professional	1
Lubinski, David	Other Professional	4
Whitenack, Thomas	Other Professional	2
Sun, Bruce	Consultant	2

Full details of individuals who have worked on the project:

Anthony K Aufdenkampe

Email: aufdenkampe@stroudcenter.org

Most Senior Project Role: PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: Aufdenkampe is the lead PI of the project. He oversees all activities.

Funding Support: The Stroud Water Research Center endowment has contributed additional salary resources to this project.

International Collaboration: No

International Travel: No

Jeff Horsburgh

Email: jeff.horsburgh@usu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Overseeing Shared Vocabulary, and lead PI for ODM2 project. Also co-leading interactions with CZO IMC.

Funding Support: none

International Collaboration: No

International Travel: No

Kerstin Lehnert

Email: lehnert@ldeo.columbia.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Leading IEDA team, including integration with EarthChem, IGSN and CZchemDB.

Funding Support: None

International Collaboration: No

International Travel: No

Emilio Mayorga

Email: mayorga@apl.washington.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Overseeing Visualization system based on NSV.

Funding Support: none

International Collaboration: No

International Travel: No

David Tarboton

Email: dtarb@usu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Participant in task prioritization

Funding Support: none

International Collaboration: No

International Travel: No

David Valentine

Email: valentin@sdsc.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Implementing CZO Central Catalog

Funding Support: none

International Collaboration: No

International Travel: No

Ilya Zaslavsky

Email: zaslavsk@sdsc.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Leading SDSC effort to develop CZO Central Catalog and Repository, and to host CZO website.

Funding Support: None

International Collaboration: No

International Travel: No

Leslie Hsu

Email: lhsu@ideo.columbia.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 2

Contribution to the Project: Leslie has assisted in a variety of tasks regarding integration of CZOData with IEDA-EarthChem.

Funding Support: This project.

International Collaboration: No

International Travel: No

Heather Brooks

Email: hbrooks@stroudcenter.org

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 1

Contribution to the Project: Website developer, assisting Lubinski

Funding Support: Christina River Basin CZO (NSF 0724971), and Stroud Water Research Center endowment

International Collaboration: No

International Travel: No

David Lubinski

Email: David.Lubinski@colorado.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 4

Contribution to the Project: Primary web developer

Funding Support: none

International Collaboration: No

International Travel: No

Thomas Whitenack

Email: twhitenack@sdsc.edu

Most Senior Project Role: Other Professional

Nearest Person Month Worked: 2

Contribution to the Project: Programmer implementing CZO Central Catalog

Funding Support: none

International Collaboration: No

International Travel: No

Bruce Sun

Email: bsun_98@yahoo.com

Most Senior Project Role: Consultant

Nearest Person Month Worked: 2

Contribution to the Project: Bruce has been hired as a consultant to assist in mapping CZchemDB to ODM2 and implementing it as an enterprise server PostgreSQL database.

Funding Support: this project.

International Collaboration: No

International Travel: No

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
CUAHSI	Other Nonprofits	Boston, MA

Full details of organizations that have been involved as partners:

CUAHSI

Organization Type: Other Nonprofits

Organization Location: Boston, MA

Partner's Contribution to the Project:

In-Kind Support

More Detail on Partner and Contribution: CZOData is largely based, at present, on CUAHSI HIS software stack.

Have other collaborators or contacts been involved? Yes

Impacts

What is the impact on the development of the principal discipline(s) of the project?

No other project that we know of has yet integrated data from such a broad range of disciplines represented by the CZO community. As a result, we proposed to the EarthCube community -- which has such a goal -- that the CZOData project might represent a pilot of the EarthCube endeavor. See Aufdenkampe's blog post at:

http://earthcube.ning.com/profiles/blogs/critical-zone-domain-pilot-for-earthcube?xq_source=activity. This seems to be as true today as it was nearly a year ago.

What is the impact on other disciplines?

CZ science itself represents 16 geoscience disciplines, and by leading by example within the larger EarthCube community we can have an even broader impact. CZOData project team members have given over a dozen invited talks on experiences and accomplishments from CZOData, which is a testimony to our broad impact on other disciplines.

What is the impact on the development of human resources?

We have focused significant efforts in training data managers and investigators from all six CZOs, and have placed a significant effort on engaging early career scientists. Participants in all our activities have provided very positive feedback on the value and effectiveness of our project and it's outreach activities.

What is the impact on physical resources that form infrastructure?

Nothing to report.

What is the impact on institutional resources that form infrastructure?

The intense effort to develop a complex, modern, integrated website has elevated the web-development capabilities of the Stroud Water Research Center.

What is the impact on information resources that form infrastructure?

The purpose of this project is to develop information infrastructure that can be a resource to all CZOs and their partner institutions.

What is the impact on technology transfer?

A secondary purpose of this project is to develop within the CZO community the skills to use the technology and information infrastructure that we will develop.

What is the impact on society beyond science and technology?

Sustainability of our natural resources requires effective and efficient information and data sharing, not only between scientists but also for use by resource managers, citizen-scientist volunteers, educators, students, the media and the general public.

Changes/Problems

Changes in approach and reason for change

Nothing to report.

Actual or Anticipated problems or delays and actions or plans to resolve them

Nothing to report.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.