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The Virtual Center for Decadal Climate Variability

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A DAY IN THE LIFE OF PROFESSOR ‘SALTY’ GYRES AND DR. SEA-OH TU “Oh dear, I am late!”, Professor ‘Salty’ Gyres muttered to himself as he looked at his watch and walked briskly along the DecVar corridors, “Sea-Oh Tu will be waiting”. He passed through the Lounge on his way to the Discussion Room, replying to ‘Good mornings’ from some colleagues and declining invitations to join in their discussions. Professor Gyres entered the Discussion Room where, as expected, he found Dr. Sea-Oh Tu waiting for him with a slight frown on her face. “Let’s begin, Professor, when you are quite ready; you said in your message that you have some exciting results which we must discuss right away”, Dr. Tu said. The Professor quickly opened the file containing figures from his latest analyses of the various oceanographic data sets. “Look, Sea-Oh, these results show a clear interplay between decadal and interannual variabilities in the Pacific and if you run similar analyses on your rainfall and land surface temperature data, I am sure that they will show a clear interplay between decadal and interannual variabilities in continental climate also”, said the Professor. Dr. Tu was too engrossed in looking at the Professor’s figures to reply. Finally she said, “I would like to take this file, so that I can compare my results with yours”. “All yours, Sea-Oh, you know where to find me when you want to discuss your results”, said Professor Gyres.

Professor Gyres settled down with the latest issue of “Subtle Signals” to read the latest news about decadal variability, including abstracts of recently-published papers and upcoming Workshop/Conference information. Nodding appreciatively for its comprehensive coverage as he closed “Subtle Signals”, he headed to the Library to get the recent paper Dr. Model wrote about shallow tropical circulations, whose abstract Professor Gyres read in “Subtle Signals”; he would read the paper later over lunch. On his way to the Library, the Professor saw that there were a few messages of interest to him on the bulletin boards. After reading and replying to the

messages, the Professor continued to the Library. Putting a copy of Dr. Model's paper in his file in the Library, he went over to the Lounge and settled down for lunch. During lunch, the Professor read Dr. Model's paper. After lunch, filling a cup with hot coffee, the Professor began to draft a *Journal of Climate* manuscript he intended to write with Dr. Tu. It took him several hours to complete the draft to his satisfaction, with occasional visits to the Library to read published papers and a visit to the Auditorium to consult unpublished Workshop presentations made in the last Workshop on decadal climate variability. Satisfied with the progress, the Professor relaxed into a siesta.

After the initial discussion with the Professor, Dr. Tu went over the Professor's results file again, planned the analyses she thought would be nicely complementary to the Professor's analyses, and checked the Data Analysis and Visualization system to verify that the data sets she needed for her analyses were available. Just as the Professor was drifting off to sleep after lunch, Dr. Tu opened her file containing the analysis plans she had made. She quickly went up to the Data Analysis and Visualization system and quietly performed the calculations, occasionally smiling or frowning to herself as results flashed on her screen. After running through all calculations she had planned, Dr. Tu compared her results with the Professor's and became convinced that the Professor's speculation was correct; the interplay between decadal and interannual variabilities was clear over oceans and over continents. She summarized her results and conclusions neatly in a document.

Professor Gyres was slowly waking up from his siesta when Dr. Tu announced her presence with a roll of drums. He mumbled an excuse to Dr. Tu and ambled over to the coffee maker to pour fresh coffee in his cup. Returning to his chair, without any preamble, he said, "so, Sea-Oh, was I correct or not?" He opened the file containing Dr. Tu's results and scrutinized

them in detail, occasionally comparing them with his own results. Without looking up from the results, he pointed to the draft manuscript he had written earlier in the day. Dr. Tu gestured at the file where she had summarized her results and conclusions. Both of them laughed out and began editing the draft manuscript. Being the experienced collaborators they were, they finished editing the manuscript quickly for submission in the morning to the *Journal of Climate*. “Wait, Sea-Oh, don’t forget to thank DecVar in our manuscript”, said the Professor. “I have built it into my Acknowledgements template, Professor, because I use DecVar very often”, said Dr. Tu. “Good day, Sea-Oh”, said the Professor, as he realized that it was way past his bedtime. Looking up at the rising Sun, Dr. Tu said, “Good night, Professor”.

This is a very realistic, albeit hypothetical, description of research collaboration between two scientists half a world apart in space and time, both working in their offices or homes. The DecVar mentioned in this story is the Virtual Center for Decadal Climate Variability (<http://www.DecVar.org>).

WHY THE DECVAR SYSTEM WAS DEVELOPED The community of researchers interested in decadal climate variability problems is distributed across the world. The Internet and its associated Web software and hardware technologies make it unnecessary to physically collocate the researchers to tackle the immense problems of observing, analyzing, simulating, and predicting decadal and longer term climate variations. Also, progress in solving these problems can occur much quicker if researchers can share their problems and results freely, quickly, and easily with other researchers residing anywhere in the world.

Moreover, research on decadal and longer term climate variability requires past data, instrument-measured and proxy, for analysis, model validation, and predictability studies. Research on decadal and longer term climate variability also requires ensembles of centuries

long runs of Earth System models for simulation, data assimilation, and predictability studies. A Web-based Center can make the output from model runs immediately available to researchers irrespective of their physical location. Data sets and analysis and visualization systems built into



Figure 1: The DecVar.org home page. Each hexagonal section represents a single system module

such a Web-based Center would render it unnecessary for individual researchers to download and store large data sets. This would free them from routine data processing and software development tasks and the acquisition of resources necessary to perform these tasks. This would result in very efficient uses of computing power and researcher time. DecVar is a modest step in this direction.

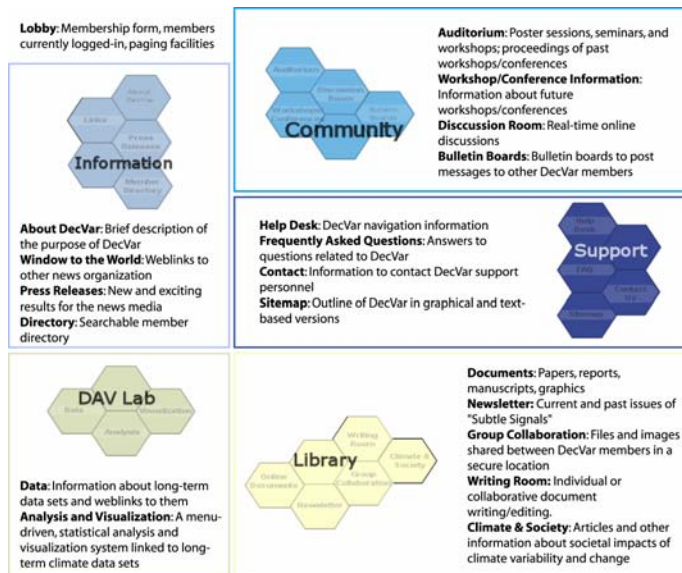


Figure 2: Brief descriptions of DecVar modules.

FACILITIES AND ACTIVITIES

The first operational version of DecVar was designed and developed by the Center for Research on the Changing Earth System, and was unveiled in June 2003.

DecVar.org (Figure 1) is designed to emulate a brick-and-mortar research center with a floor plan consisting of hexagonal

building blocks. Its main modules, shown in Figure 2, are Lobby, Community, Library, Information, Data Analysis and Visualization (DAV) Lab, and Support. The interactive and non-interactive facilities in these modules are also shown in Figure 2. The DecVar facilities used by Professor Gyres and Dr. Tu, briefly described in Figure 2, include:

- the Discussion room, the bulletin boards, the DAV Lab., and the Writing room,
- submission, review of abstracts, and complete presentation records of Workshops/Conferences on decadal climate variability, and
- papers on decadal climate variability published in American Meteorological Society publications in full and abstracts of papers on decadal climate variability published in American Geophysical Union publications available free of charge to all DecVar members.

The DAV Lab. contains many long-term climate data sets, and analysis and visualization software linked to these data sets. A sequential menu allows a user to select a data set by variable type or family, space and time domains of analysis, the analysis technique to be applied,

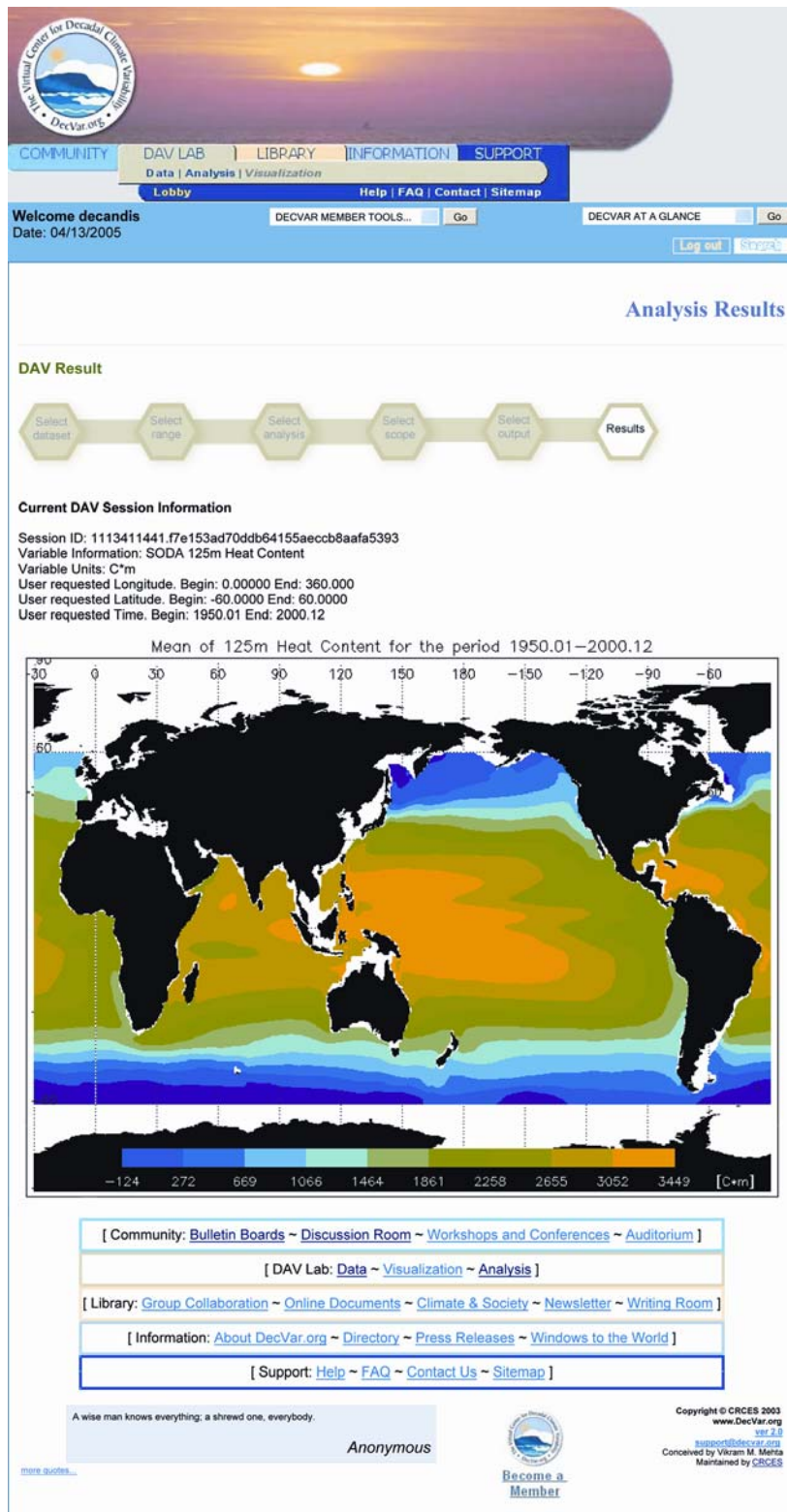


Figure 3: Sample Data Analysis and Visualization Lab. Output, showing average, surface to 125-meter ocean heat content for 1950 to 2000 from the Simple Ocean Data Analysis data set.

and the visualization format. It is also possible for a user to download data or results in a digital format to his/her computer. A sample output from the DAV Lab. is shown in Figure 3.

In spite of the underlying complexity of DecVar, only a basic computer, a Web browser, and an Internet connection are required to utilize DecVar's facilities. DecVar's design and construction are highly modular and flexible, allowing easy expansion and replication. The entire DecVar system consists of approximately 3,300 pages. DecVar currently has approximately 170 members from 27 countries on all continents except Antarctica. There is no membership fee, but

a justification for membership request is required.

Among special activities conducted via DecVar since its inception are a quarterly newsletter "Subtle Signals", which includes information about various aspects of decadal variability; and a monthly "Ask An Expert" program, started in June 2004, in which DecVar members can interact with invited experts on various aspects of decadal climate variability in a bulletin board setting. A "live" tutorial seminar about DecVar was given, using the DecVar seminar facility, to the WMO- and IOC-sponsored OceanOps04 Workshop in Toulouse, France, from the CRCES office in Columbia, Maryland, in May 2004.

Further development of the Virtual Center concept by the addition of audio and video capabilities, coupled with further developments in Internet and Web technologies, has the potential to revolutionize the conduct of Earth Science research and make true globalization of research possible. Also, this concept and associated software technologies can also be used in many other fields and applications. The Virtual Center concept has the potential to become as indispensable to an Earth Scientist as electronic mail.

SUMMARY The Virtual Center for Decadal Climate Variability (<http://www.DecVar.org>) is a unique and integrated research environment designed to foster speedier communication within the decadal climate variability community; serve as a facility to access long-term data sets of various types, integrated with analysis and visualization software; and allow planning and execution of collaborative research projects. The Virtual Center concept has the potential to revolutionize the conduct of Earth Science research and make true globalization of research possible.

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