# ENEA Develops Climate Models Bridging Research and User Needs

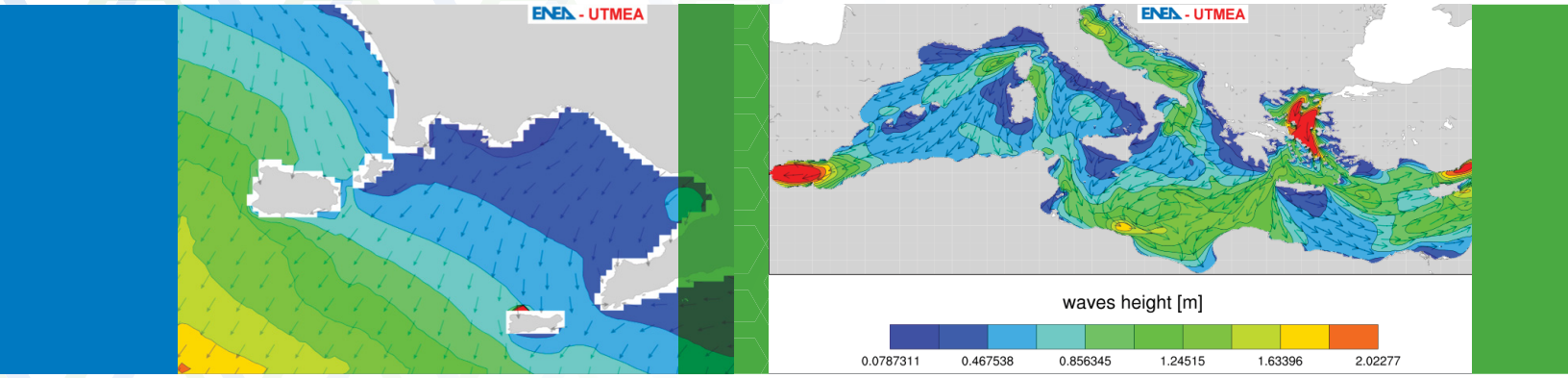
## SGI® UV™ 2000's Speed and Ease of Use Helps Researchers Develop Better Climate Models Faster

**Key Facts**

**Organization:**
ENEA

**Location:**
Italy

**Industry:**
Climate Research




## Business Overview

ENEA is the Italian National Agency for New Technologies, Energy and Sustainable Economic Development. Its purpose is to develop research and technology innovation, as well as to provide advanced services to the energy sector, and foster sustainable economic growth. ENEA has around 2,700 employees located in nine research centres. Their focus is on areas including energy efficiency, renewable energy sources, nuclear energy, climate and the environment, safety and health, new technologies and electric system research.

One of these centres (in Rome) houses UTMEA, the Unit for Environment and Energy Modelling. UTMEA is an ENEA research initiative that supports innovation in environmental management and develops technologies for sustainable economic development. Its research activities include modelling and observing regional climate systems, designing energy strategies, and providing new technologies for the adaptation of infrastructures and human activities to environmental changes, with a special emphasis on a low-carbon society.

## Challenges

UTMEA's climate research programs include satellite oceanography, ocean modelling, regional earth system modelling, climate analyses and processes, climate variability from ice core records, global climate and predictability, climate change and variability effects on crop production, and climate observations in Antarctica and at Lampedusa Island.

One of the activities developed at UTMEA concerns the study of wave energy climatology in the Mediterranean Sea. The aim of the work is to define the amount of available wave energy to support feasibility studies of energy plants, and includes the production of wave forecasts in order to provide wave characteristics that can be useful for the optimization of wave energy converters.

This analysis uses the WAVES system, which is based on two numerical wave models—WAM and SWAN—that are run one after the other.

- WAM uses atmospheric wind data from the Skiron weather forecast (from the University of Athens) obtained via ftp to perform a five day forecast of the waves over the entire Mediterranean basin. The grid uses about 769 million points with a resolution of 1/32° (approx. 3 km), and data produced daily amounts to about 25GB.
- WAM outputs are used as boundary conditions to the SWAN model, which produces higher resolution forecasts on ten sub-basins around the Italian peninsula. The grids use about 93 million points with a resolution of 1/200° (approx. 800m), and about 1.5GB of data are produced daily.
- Both models cover a five day period with output every hour, and the results are post-processed and plotted to produce graphics and videos providing hourly forecasts for the five day period.

For some time, UTMEA had been using an HP DL585 G7 solution, but this was not powerful enough to produce the WAVES forecasts required by its researchers. In addition

to WAVES, the unit's scientists also utilise a variety of other numerical models (e.g. the MIT General Circulation Model) which are run on two massively parallel supercomputers—CRESCO3 and CRESCO4—located at an ENEA facility in Portici, near Naples. As a shared resource, ENEA makes time available on these systems via a queuing system. Since the CRESCO systems are heavily used, the time to wait to get access to their queues is sometimes too long for program development and debugging to be practical. UTMEA was therefore looking for a solution that could:

- Maximise UTMEA's researchers' productivity, by allowing them to develop and debug programs locally in an easy-to-use environment, and get the maximum from the time available on CRESCO3 and CRESCO4 by using them only for long-duration production runs.
- Enable the WAVES system to produce the required forecasts as quickly and efficiently as possible.
- Scale to accommodate future demands, and allow UTMEA's IT team to easily segment the system's compute resources to meet the unit's diverse needs.

## SGI Solution

To meet these challenges, in 2013 UTMEA installed a new system—'Giotto'—based on an SGI® UV™ 2000 midrange supercomputer. The system has 128 Intel® Xeon® E5 4640 cores running at 2.40GHz, and includes 512GB RAM in a single system image. It is linked to a NetApp® FAS3240 storage array with 120, 3TB disks in a RAID-DP configuration.

The SGI UV 2000 solution was specified, configured, implemented and installed by Italian SGI partner E4 Computer Engineering Spa, which specializes in providing leading edge products for research, pharmaceutical, automotive, fluid dynamics and prototyping applications.

The SGI UV 2000 is the world's largest in-memory system for data-intensive applications. It allows users to address a broad range of their most demanding problems with fast, scalable performance and up to 64TB of memory.

## Results

By deploying SGI's UV 2000, UTMEA's IT team successfully:

- Processes the WAVES models in just 60 minutes for WAM and 40 minutes for SWAN, enabling forecasts to be produced on a regular daily basis.
- Created a general-purpose system that UTMEA's researchers can use for program development and debugging across the unit's major research areas.
- Invested in a system whose compute resources can easily be segmented to support particularly demanding new applications when required.

## Benefits

Without the SGI UV 2000, it would have been impossible for UTMEA to produce daily WAVES forecasts. But as well as its speed, one of Giotto's major benefits as a general purpose system is its flexibility and ease of management. This means, for example, that for the short amount of time that WAVES is being run, 96 of the system's 128 cores can be allocated to this task. But this still leaves 32 cores for program development and debugging, and means the system's resources can be utilised almost 100% of the time.

In addition to WAVES, UTMEA's IT team has also been able to allocate 16 cores to a new modelling system which provides the unit's scientists with similar forecasts to WAVES, but which analyses water temperature and salinity, rather than computing wave currents and speeds. Moving forward, UTMEA will also be able to use the system to develop and debug an expanding range of oceanography models, for example for water transport within the Mediterranean Sea, and water input and output flows into and out of the Mediterranean via the Straits of Gibraltar.

"From my point of view as the system manager, the SGI UV 2000 is a wonderful machine. It's a single machine with a single operating system, and for me it's incredible to have so many tasks running in a single machine, so easily, so quickly, and without any trouble. It's also very fast so our users are happy. And from an operational point of view, the scalability of the system is fantastic."

**Emanuele Lombardi,** IT Manager, UTMEA

## About SGI

SGI, the trusted leader in high performance computing (HPC), is focused on helping customers solve their most demanding business and technology challenges by delivering technical computing, Big Data analytics, cloud computing, and petascale storage solutions that accelerate time to discovery, innovation, and profitability.

For more information please contact an SGI sales representative at 1-800-800-7441 or visit www.sgi.com/contactus.

**Global Sales and Support**: sgi.com/global



E4 COMPUTER ENGINEERING

intel inside XEON

sgi