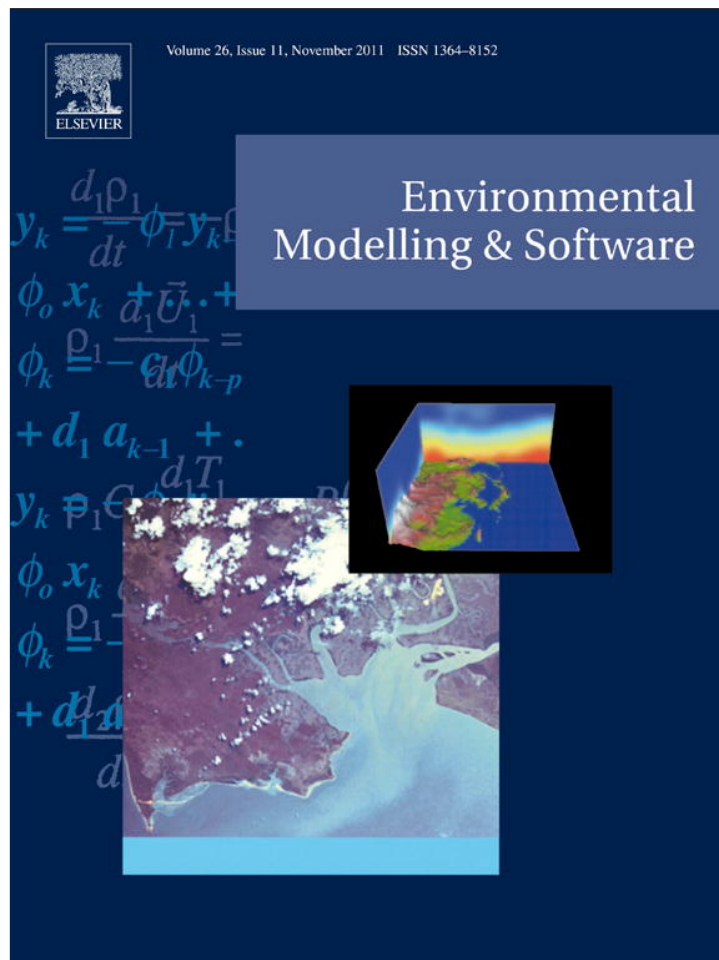


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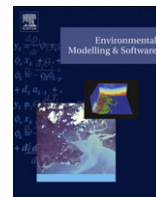
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## LiveROMS: A virtual environment for ocean numerical simulations

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### ABSTRACT

LiveROMS is a bootable DVD that contains an Linux-based computer operating system which has a complete, functioning version of the ROMS ocean circulation model and an Octave version of ROMSTOOLS. It allows students and scientists to experiment with this ocean numerical model, with just a basic knowledge of Linux.

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## 1. Introduction

The use of advanced numerical models in geosciences is increasing as the average computer becomes more powerful with multi-core CPUs, RAM in the order of gigabytes and terabytes of disk space. The computer code of many models is free or openly available, as well as the libraries and compilers needed. There are also packages that make the pre- and post-processing steps very friendly, in particular ROMSTOOLS (Penven et al., 2007) for the ROMS numerical ocean model (Shchepetkin and McWilliams, 2005). However a major limitation to their use are the skills needed to compile them and their dependencies. It is easy to realize, reading the discussion forums for most numerical models, that this is an important part of the learning curve.

Here we present LiveROMS, a live DVD that contains all the required programs to carry basic numerical simulations using ROMS. It includes an Octave-based version of ROMSTOOLS, netCDF libraries and handling packages such as NCO, all in a Linux-based (Ubuntu) distribution. LiveROMS allows scientists and students access to this numerical model without the need for an advanced knowledge of Linux, package dependency handling, or compiling procedures. This helps new users of ROMS model to quickly start to focus on the scientific questions related to its use. As most live DVD

systems, it can be run on the computer's RAM, in virtual environment such as VirtualBox, or installed on a computer. A similar idea has been used for engineering data and software (<http://www-mdp.eng.cam.ac.uk/web/CD/>) or to develop a common install base for scientific packages as with the Scientific Linux distribution.

## 2. Software description

LiveROMS is based on Ubuntu Linux. It includes a version of the ROMS model also known as ROMS-AGRIF. The computer code is compiled with gfortran. Pre- and post-processing is done using a version of ROMSTOOLS modified to run on Octave using the octcdf package to allow handling of netCDF files and OPeNDAP access.

The input and output of the ROMS model is in netCDF format. For visualization we have included Ncview, which allows a quick description of the files, time series, vertical profiles and vertical section plots of the variables. Permanent storage of results can be achieved by using a memory stick.

The main contribution of LiveROMS is the integration of all the packaged needed to run ROMS, and the development of an Octave-based version of ROMSTOOLS, which is very similar in syntax to Matlab and avoids the need of a license. From ROMSTOOLS the basic routines for reading, writing and creating netCDF files have been converted. Some plotting routines and those functions involving a GUI have been omitted but will be added or replaced in the near future. LiveROMS was created using remastersys and is available at <http://ronin.dgeo.udec.cl/LiveROMS>.

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### 3. Conclusion

Using LiveROMS one can do a numerical simulation of the ocean using ROMS in a virtual environment with a basic knowledge of Linux and no need of installing and compiling extra packages. LiveROMS can be used both in a computer's RAM or within a virtual machine inside a running operating system. This approach facilitates the understanding of the model itself and helps users to focus on model physics and analysis of results, rather than package dependency. For a permanent use, the complete system can be installed in the computer's hard drive. This same approach can be used for other numerical models of the ocean or atmosphere.

### Acknowledgments

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### Appendix. Main programs in LiveROMS

1. Octave is high level language widely used for numerical computations. Mostly based in a command line interface, it is compatible with Matlab to a large degree.
2. ROMSTOOLS is a collection of data sets and Matlab programs, integrated to provide the necessary files to do an ocean simulation using ROMS-AGRIF. The version included in LiveROMS is

partially adapted to Octave.

<http://code.google.com/p/romstoolsoctave/>.

3. ROMS-AGRIF is a version of the ROMS numerical model for ocean simulations. It can use a grid refinement procedure known as AGRIF.  
<http://roms.mpl.ird.fr/>.
4. netCDF is a set of software libraries used to create and manipulate array-oriented scientific data.  
<http://www.unidata.ucar.edu/software/netcdf/>.
5. Ncview is a simple visual browser for netCDF files.  
[http://meteora.ucsd.edu/~pierce/ncview\\_home\\_page.html](http://meteora.ucsd.edu/~pierce/ncview_home_page.html)
6. Remastersys can be used to make a full backup of a Debian distribution in a Live DVD.  
<http://www.geekconnection.org/remastersys/index.html>.

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