



beta-LTRANS-ADCIRC

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This web site hosts the beta version of LTRANS-ADCIRC, **betaLTRANS-ADCIRC**, an open source model designed to run with ADCIRC circulation model predictions. A model description document and visualization resources are available. It is important to note that this is a BETA version of [LTRANS v.2b](#) and is still being tested.



beta-LTRANS-ADCIRC Model Description

beta-LTRANS-ADCIRC is based on the **Larval TRANSPORT Lagrangian model (LTRANS v.2b)**, an off-line particle-tracking model that runs with the stored predictions of a 3D hydrodynamic model. In this case, LTRANS v.2b has been substantially modified to be able to run with the finite-element circulation predictions of [ADCIRC](#). Although LTRANS was built to simulate oyster larvae, it can easily be adapted to simulate passive particles and other planktonic organisms. LTRANS v.2 is written in Fortran 90 and is designed to track the trajectories of particles in three dimensions. It includes a 4th order Runge-Kutta scheme for particle advection and a random displacement model for vertical turbulent particle motion. Reflective boundary conditions, larval behavior, and settlement routines are also included. A brief description of the beta-LTRANS-ADCIRC particle-tracking model can be found [here](#) (68 KB .pdf). For more information on LTRANS, please see the LTRANS web page. and the application of LTRANS to oyster larvae transport, see [a summary web page with animations](#), the publications [North et al. \(2008, 2011\)](#), and the [LTRANS v.2 User's Guide](#). Please cite [North et al. \(2011\)](#) when referring to LTRANS v.2b. The updates that were made for LTRANS v.2b are listed [here](#).

Elizabeth North of [University of Maryland Center for Environmental Science Horn Point Laboratory](#) implemented beta-LTRANS-ADCIRC. Funding was provided by the National Science Foundation Biological Oceanography Program**. Steven Suttles and Jason Spires provided valuable assistance.

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beta-LTRANS-ADCIRC Code

beta-LTRANS-ADCIRC Open Source Code. We would appreciate knowing who is using LTRANS. If you would like to share this information with us, please send us your name, contact information, and a brief description of how you plan to use this model to enorth@umces.edu with 'LTRANS-ADCIRC' in the subject line.

[betaLTRANS_ADCIRC_License.txt](#)

^x **License file.** This license was based on the ROMS license. Please note that this license applies to all sections of beta-LTRANS-ADCIRC except those listed in the 'External Dependencies and Programs' section below.

[betaLTRANS-ADCIRC.zip](#)
[betaLTRANS-ADCIRC.tgz](#)

^x **Code and Input Files.** This zip or tarball file contains the beta-LTRANS-ADCIRC code, license, example input and visualization files. Section II of the [LTRANS v.2 User's Guide](#) contains instructions for setting up and running LTRANS v.2b in Linux and Windows environments. Before using this model, please read the **External Dependencies and Programs** section below. This version of LTRANS is parameterized to run with the input files from a test case of ADCIRC which was set up for Shinnecock Inlet and provided by [Rick Luettich of UNC](#). These ADCIRC files are provided in this zip/tar file.

External Dependencies and Programs. beta-LTRANS-ADCIRC requires **NetCDF libraries** and uses the following programs to calculate random numbers (**Mersenne Twister**) and fit tension splines (**TSPACK**). Because beta-LTRANS-ADCIRC reads-in ADCIRC-generated NetCDF (.nc) files, it requires that the appropriate NetCDF libraries be installed on your computer (see files and links below). Also, please note that although the Mersenne Twister and TSPACK programs are included in the beta-LTRANS-ADCIRC in the Random_module.f90 and Tension_module.f90, respectively, they do not share the same license file as beta-LTRANS-ADCIRC. Please review and respect their permissions (links and instructions provided below).

[VF-NetCDF.zip](#)

^x **Windows Visual Fortran NetCDF libraries.** These NetCDF files that are compatible with Visual Fortran were downloaded from the [Unidata NetCDF Binaries Website](#) for LTRANS v.1. The NetCDF 90 files were downloaded from [Building the F90 API for Windows for the Intel ifort compiler](#) website. The VF-NetCDF.zip folder contains README.txt that describes where to place the enclosed files. If these files do not work, you may have to download updated versions or build

your own by following the instructions at the [UCAR Unidata NetCDF website](#).

NetCDF website

Linux NetCDF libraries. Linux users will likely have to build their own Fortran 90 libraries using the source code/binaries that are available on the [UCAR Unidata NetCDF website](#).

mt19937ar.f

Mersenne Twister random number generator. This program was recoded into F90 and included in the Random_module.f90 in LTRANS. See the [Mersenne Twister Home Page](#) for more information about this open source program. If you plan to use this program in LTRANS, please send an email to: m-mat @ math.sci.hiroshima-u.ac.jp (remove space) to inform the developers as a courtesy.

TSPACK website

TSPACK: tension spline curve-fitting package. This program (ACM TOMS Algorithm 716) was created by [Robert J. Renka](#) and is used in LTRANS as part of the water column profile interpolation technique. The original TSPACK code can be found at the link to the left and is copyrighted by the [Association for Computing Machinery \(ACM\)](#). With the permission of Dr. Renka and ACM, TSPACK was modified for use in LTRANS by removing unused code and call variables and updating it to Fortran 90. The modified version of TSPACK is included in the LTRANS source code in the Tension Spline Module (tension_module.f90). If you would like to use LTRANS with the modified TSPACK software, please read and respect the [ACM Software Copyright and License Agreement](#). For noncommercial use, ACM grants "a royalty-free, nonexclusive right to execute, copy, modify and distribute both the binary and source code solely for academic, research and other similar noncommercial uses" subject to the conditions noted in the license agreement. Note that if you plan commercial use of LTRANS with the modified TSPACK software, you must contact ACM at permissions@acm.org to arrange an appropriate license. It may require payment of a license fee for commercial use.

beta-LTRANS-ADCIRC Utilities. The following programs were developed to run LTRANS v.2 or visualize LTRANS v.2 model output. Unless specified otherwise within the program code, these open source programs are considered part of LTRANS and fall under the beta-LTRANS-ADCIRC license. Many thanks to LTRANS users who have made these contributions! If you would like to share a LTRANS utility or your modifications/additions to LTRANS source code, please send them to enorth@umces.edu.

LTRANS-ADCIRC_viz.BAS

End_polygons.blm

Surfer/Scripter code for visualizing beta-LTRANS-ADCIRC output developed by E. W. North. The .BAS file is the program and associated .blm files are needed to visualize the location of bottom habitat. [Here is an example animation \(MB\) of LTRANS v.2 model output made with Surfer](#) using the code and example input files provided above. Surfer is a Windows program for contouring and 3D surface mapping. Scripter is an object oriented scripting language (Active X Automation) that comes with, and automates, Surfer. Information on Surfer is available [here](#) and a free demo is available [here](#). Please note that the demo version will not allow export so it is likely that you will not be able to use the demo version to create .gif files for animations.

OceanView in R

OceanView, created by Dr. Karline Soetaert, is a set of R functions for visualizing 2-D and 3-D oceanographic data and model output. The package is on the official R site: <http://cran.r-project.org/web/packages/OceanView>. There is also a short manual with snapshots of the visualization functions, some of which use LTRANS output as examples: <http://cran.r-project.org/web/packages/OceanView/vignettes/OceanView.pdf>.

plot_results.m

MATLAB code for visualizing LTRANS v.2b output. Here is Matlab M-file which was designed by Yong Kim for LTRANS v.1 and adapted for LTRANS v.2b by Elizabeth North. It should work with beta-LTRANS-ADCIRC. It makes a 3D plot of the model bathymetry (from .nc input grid file) and particle locations from LTRANS v.2b .csv output files. [Here is an example animation \(MB\) of LTRANS v.2b model output made with MATLAB](#).

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LTRANS User's Guide and beta-LTRANS-ADCIRC Description

Please send comments or suggestions regarding the User's Guide to enorth@umces.edu. They will be posted on the [list of known LTRANS v.2 bugs and solutions](#). Also, here is a document that provides a (not elegant) solution to errors (Particle not in v (or u) element or particle jumped over v (or u) element) that can result from single-grid width channels in the hydrodynamic model domain ([link](#)).

North, E.W. 2016. beta-LTRANS-ADCIRC model description. University of Maryland Center for Environmental Science, Horn

Point Laboratory. Cambridge, MD. 9 pp. ([266 KB .pdf](#))

Mitchell, I. 2013. Updates in LTRANS v.2b. University of Maryland Center for Environmental Science, Horn Point Laboratory. Cambridge, MD. 2 pp. ([93 KB .pdf](#))

Schlag, Z. R., and E. W. North. 2012. Lagrangian TRANSport model (LTRANS v.2) User's Guide. University of Maryland Center for Environmental Science, Horn Point Laboratory. Cambridge, MD. 183 pp. ([1.7 MB .pdf](#))



LTRANS Publications

North, E. W., E. E. Adams, A. E. Thessen, Z. Schlag, R. He, S. Socolofsky, S. M. Masutani, and S. D. Peckham. 2015. The influence of droplet size and biodegradation on the transport of subsurface oil droplets during the Deepwater Horizon spill: a model sensitivity study. *Environmental Research Letters* 10: 024016 (doi:10.1088/1748-9326/10/2/024016). (<http://iopscience.iop.org/1748-9326/10/2/024016/>) ([request .pdf](#)).

North, E. W., E. E. Adams, S. Schlag, C. R. Sherwood, R. He, S. Socolofsky. 2011. Simulating oil droplet dispersal from the Deepwater Horizon spill with a Lagrangian approach. *AGU Book Series: Monitoring and Modeling the Deepwater Horizon Oil Spill: A Record Breaking Enterprise* 195: 217-226 ([request .pdf](#)).

North, E. W., R. R. Hood, S.-Y. Chao, and L. P. Sanford. 2006. Using a random displacement model to simulate turbulent particle motion in a baroclinic frontal zone: a new implementation scheme and model performance tests. *Journal of Marine Systems* 60: 365-380 ([request .pdf](#)).

North, E. W., Z. Schlag, R. R. Hood, L. Zhong, M. Li, and T. Gross. 2006. Modeling dispersal of *Crassostrea ariakensis* oyster larvae in Chesapeake Bay. Final Report to Maryland Department of Natural Resources, July 31, 2006. 55 p. ([request .pdf](#))

North, E. W., Z. Schlag, R. R. Hood, M. Li, L. Zhong, T. Gross, and V. S. Kennedy. 2008. Vertical swimming behavior influences the dispersal of simulated oyster larvae in a coupled particle-tracking and hydrodynamic model of Chesapeake Bay. *Marine Ecology Progress Series* 359: 99-115 ([request .pdf](#)).

Schlag, Z. R., and E. W. North. 2012. Lagrangian TRANSport model (LTRANS v.2) User's Guide. University of Maryland Center for Environmental Science, Horn Point Laboratory. Cambridge, MD. 183 pp. ([1.7 MB .pdf](#))

Schlag, Z., E. W. North, and K. Smith. 2008. Larval TRANSport Lagrangian model (LTRANS) User's Guide. University of Maryland Center for Environmental Science, Horn Point Laboratory. Cambridge, MD. 146 pp. ([739 KB .pdf](#))

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