

Application Description

The National Weather Service (NWS) developed a general flood wave routing application for predicting river conditions. FLDWAV, an unsteady flow model, is a combination of the DWOPER (models complex river systems including multiple rivers, levees, lock and dams, storm sewers, etc.) and DAMBRK (does dam failure analysis on single rivers with multiple dams and bridges, levees, etc.) models. It is based on an expanded version of the St. Venant equations allowing a variety of hydraulic conditions to be accounted for (e.g., wind effects, inactive storage, sinuosity, lateral flow, mixed flow, etc.). It is known as the general flood wave analysis model because it is developed to handle any hydraulic condition.

Release Version

The last official release of the NWS FLDWAV model, version 2-0-0, was released in 2000. A beta release (version 2-0-2-2) was released in 2005 to allow users to use the NWS FLDWAV Analysis Tool (FLDAT). The new model, FLDWAV Enhanced (FLDWAVE), although not affiliated with the National Weather Service, contains all of the capabilities and features of the NWS version 2-0-2-2. Since the beta version was not fully tested, FLDWAVE was compared to the last official release version 2-0-0. Several bugs were found in the 2-0-2-2 version of the model and were fixed in FLDWAVE. New capabilities were also added to FLDWAVE. FLDWAVE was tested with over 200 data sets. Although most results were identical to the FLDWAV 2-0-0 results, there were some differences that were a result of bug fixes or enhancements. The difference in output results between FLDWAV version 2-0-0 and FLDWAVE version 3-0-0 were less than one percent.

Changes to FLDWAVE

- Fixed problem with levee dimensioning
- Increased number of tributaries in summary information (format problems)
- Adjusted algorithm to get time step back on track after nonconvergence
- Allow missing data in observed hydrographs
- Allow initial conditions to be interpolated at interpolated cross sections when all values are read in at actual sections
- Fixed problem with LPI option when KRCHT(I,J) set equal to 6 – sometimes, the wrong number of routing reaches were defined.

New Features in FLDWAVE

The following enhancements have been added to FLDWAVE 3-0-0.

- Flood Inundation Mapping – FLDWAVE generates output files which can be read in by the NWS flood inundation mapping application, FLDVIEW. FLDVIEW is an ESRI Arcview 3.x application which can map multiple river reaches as well as animate flood maps.
- FLDWAV Analysis Tool – FLDWAV generates output files which can be read by the NWS FLDWAV Analysis Tool (FLDAT) which will graphically display the FLDWAVE results. FLDAT displays, hydrographs, profiles, rating curves, and cross sections anywhere in the river system. FLDAT is a Java GUI which replaces FLDGRF.
- Ice Effects – The effect of river ice is modeled in FLDWAVE based on the methodology developed by the USACE Cold Regions Research and Engineering Laboratory (CRREL).
- Adjust time series – If observed hydrographs are available, the computed hydrographs may be adjusted to account for errors in the calibration of the water surface elevations.
- Muskingum-Cunge routing method – The Muskingum-Cunge algorithm was added as another diffusion routing technique (KRCHT=7).

- Kinematic Wave routing method – Two kinematic wave algorithms were added (KRCHT=2 OR 3). The difference in the two methods is whether or not the friction slope is estimated as the bottom slope.
- Differential head vs. discharge rating curve – This DWOPER option was added to handle the case where the differential head (difference between head and tailwater elevations) is a function of the discharge. The rating curve is read in as an internal boundary at a dam.

Known Bugs

The FLDWAVE enhancements have not yet been added to FLDAT. To utilize these features, you must specify them manually. New features are highlighted in **blue** in the Fldwave 3-0-0 Input Structure.pdf file. These features will be added to FLDAT later this year.

System Information

Operating System – Windows 95, 98, 2000, XP, Vista (A Linux version is available upon request.)

Language – Fortran 77

Directory – C:\RiverMechanics\fldwave3-0-0

Files

- *Fldwave.exe* – Fortran executable for FLDWAVE application
- *Fldwave.ico* – FLDWAVE icon
- *Fldwave 3-0-0 Release Notes.pdf* – this file
- *Fldwav_doc.pdf* – the last NWS FLDWAV documentation
- *Fldwave 3-0-0 Input Structure.pdf* – input summary for FLDWAVE (this replaces chapter 20 in Fldwav_doc.pdf)
- *EX1.fwd* – *EX10.fwd* – 10 example input files for running FLDWAVE (each example is described in chapter 22 of fldwav_doc.pdf)
- *Datafile* – file instructing FLDWAVE on where to get the input/output files

How to Run

If you currently are a FLDWAV user, you can copy the fldwave.exe file into the directory containing the fldwav.exe for version 2-0-0 or 2-0-2-2 of FLDWAV. Rename fldwav.exe to nws-fldwav.exe, and rename fldwave.exe to fldwav.exe. Everything should run as it did previously. The output banner page will have the new date and version number.

If you are a new FLDWAV user, then run the install program, and FLDWAVE will automatically create a folder for you and put all of the necessary files into it. The 10 example data sets are documented in the fldwav_doc.pdf file and represent typical options that are used. To run, double-click on the FLDWAVE icon and you will be prompted for the name of the input and output files (e.g., ex1 and ex1.out, respectively). To create your own data set, you may modify one of the 10 example data sets with your data, or you may run FLDAT. To view your output results, you may view your output file (e.g., ex1.out) using a text editor or you may run FLDAT and select “Analyze output”.

Acknowledgements

FLDWAV was developed by members the River Mechanics Group in the Office of Hydrology of the National Weather Service for a period in excess of 20 years. Key developers included Dr. Danny Fread, Janice Sylvestre, Dr. Kuang-Shen Hsu, Dr. Ming Jin, and Yin-Yu Chen. The NWS ceased developing FLDWAV after 2005. The enhancements in FLDWAVE were done primarily by Yin-Yu Chen and Janice Sylvestre.

Warranty

There is no warranty (implied or otherwise) associated with FLDWAVE. It is made available as-is. The developer is not responsible for the results generated by the application.