

User Guide & Tutorial for the Digital Shoreline Analysis System

(DSAS) version 3.2

Extension for ArcGIS v.9.0

Part of USGS Open-File Report 2005-1304



Table of Contents

1. Title Page
2. Table of contents
3. About DSAS / System requirements
4. Installing / Required Inputs / Shoreline Data
5. How to append (files)
6. Generating a baseline (approach 1)
7. Baseline continued (approaches 2 & 3)
8. Baseline flow direction
9. Geodatabases
10. Default Parameters (general, transect)
11. Setting Transect Parameters
12. Simple and Smoothed Baseline Transects
13. Baseline & Shoreline parameters
14. Importing ArcView transects
15. Casting Transects / shoreline.log file / Editing Transects
16. Transect Casting Order
17. Transect Notes
18. Recalculating Transects
19. Updating intersect table / DSAS toolbar buttons
20. Transect field descriptions
21. Statistics (EPR, JKR, LRR)
22. Weighted Least Squares (WLR) / binary limitations
23. Least Median of Squares (LMS)
24. Supplemental statistics (LSE, WSE; LCI, WCI)
25. R-squared statistic (LR2, WR2)
26. Intersect field descriptions / viewing intersect points
27. Distance field descriptions
28. Troubleshooting
29. FAQ
30. Transect – Intersect-Distance attribute table link
31. Baseline Field requirements
32. Shoreline Field Requirements
33. Contact Information

About DSAS

The Digital Shoreline Analysis System (DSAS) is an extension that enhances the normal functionality of ESRI ArcGIS software, and enables users to calculate shoreline rate-of-change statistics from a time series of multiple shoreline positions. The extension was designed to aid in historic shoreline change analysis. DSAS is also useful for datasets that use polylines as a representation of a feature's position at a specific point in time, such as the forward limit of a glacier, river channel boundaries, land use and land cover maps.

DSAS works by generating orthogonal transects at a user-defined separation and then calculates rates-of-change and associated statistics that are reported in an attribute table. The DSAS tool requires user data to meet specific field requirements. The steps and processes to conform to these requirements are explained in this guide for reference.

System Requirements

- ArcGIS v.9.0 with Microsoft .NET framework v.1.1 installed
- Sample Data or other available shoreline data (meeting field requirements as described on pp.31-32).

NOTE: A version for ArcView 3.x exists for those without access to Arc 9.0 (<http://woodshole.er.usgs.gov/project-pages/dsas/>). The link can be found under the Previous Version heading.

You need Microsoft .NET framework v.1.1 in order to run the DSAS extension.

Please go to: <http://www.microsoft.com/downloads>

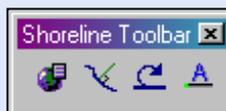
Type “.NET framework v.1.1” in the keywords section of the search to locate and download the redistributable package.

Installing DSAS

The DSAS ArcMap extension includes a setup wizard that guides users through the steps necessary to install the program.

Unzip the program and double-click the DSAS Installer.msi Windows Installer Package. Once complete, the shoreline toolbar will be opened when ArcMap is launched.

Note: In ArcMap, go to Tools -> Customize -> Shoreline Toolbar (if it does not turn on automatically)



Name	Size	Type
DSAS Installer.msi	2,309 KB	Windows Installer Package
DSAS_Jan_13_2005.zip	2,079 KB	WinZip File
Setup.Exe	108 KB	Application
Setup.Ini	1 KB	Configuration Settings

Required inputs

1) Sequential time series of vector shoreline positions

These are just some of the examples from which vector positions can be digitized:

- DOQQ aerial photographs
- NOAA T-sheets
- USGS quadrangle maps
- LIDAR derived shorelines

2) User-created reference baseline

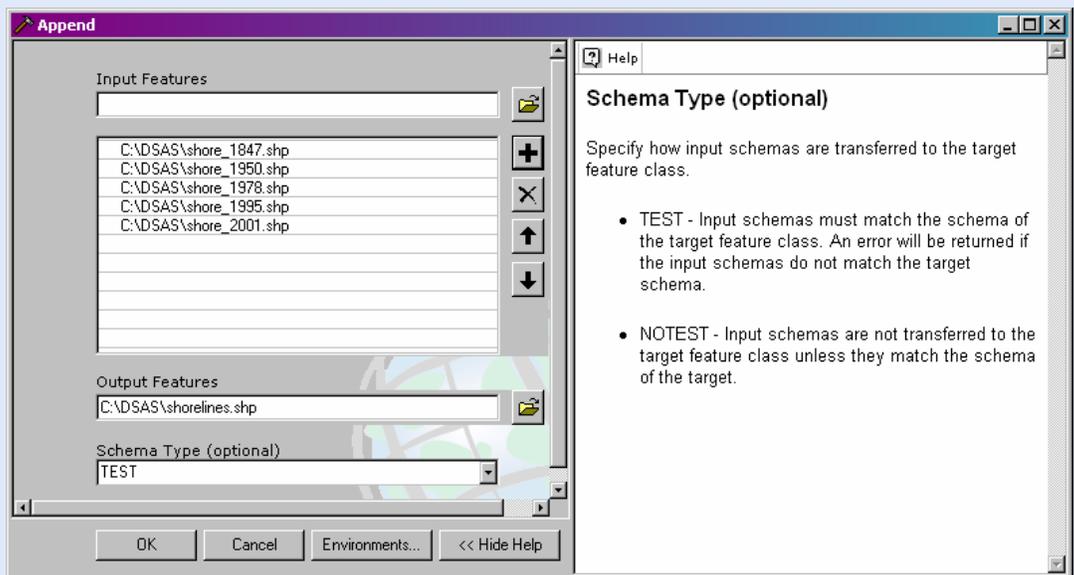
The baseline is created by the user and serves as the starting point for generating transects. The DSAS extension generates transects that are cast perpendicular to the baseline at a user-specified spacing alongshore. The transect/shoreline intersections are used by the program to calculate the rate-of-change statistics.

Shoreline Data

- 1) Assign appropriate attribute fields to the shoreline data (refer to p.32 for details).
- 2) Append multiple shoreline files into a single feature class (see following page for instructions).

How to append (files):

- 1) Confirm that all shoreline files have the same spatial reference and feature type requirements (refer to p.32 in this tutorial).
- 2) The append tool will add the multiple shapefile/coverage files into one of the existing files (**Hint: it is a good idea to first make a copy of the file you will append to and rename the copy as the combined shoreline file, such as “shorelines” so that you have a backup of your original data.**)
- 3) Open the Append tool from ArcToolbox (Data Management Tools -> General -> Append)
- 4) Add all shoreline shapefile/coverage files to the Input Features list in the Append window.
- 5) Designate the copied “shorelines” feature as the Output Features



Creating a baseline

The baseline is the starting point for all transects and is therefore one of the most important components of the shoreline change analysis process. Its shape and relative location to the shorelines impacts the rate calculations determined by the transect/shoreline intersections. The baseline must be contained in a single shapefile (and therefore is a single feature class once imported into the geodatabase). The user should take the time to manually edit and smooth the baseline based on their particular study area.

*The baseline can be created either onshore or offshore from the shoreline data.

Three ways to create a baseline:

- 1) Start with a new shapefile
- 2) Buffer a shoreline
- 3) Use a pre-existing baseline

*****You must also assign attributes to the baseline (refer to baseline field requirements on p.31.**

Approach one: Start with a new shapefile

Create a new polyline shapefile using ArcCatalog and then add it to the ArcMap project. Begin an edit session on the new baseline file and manually draw and edit the line using standard ArcMap editor tools (refer to the ArcGIS Desktop Help menu for further instructions; Keywords: lines, vertices, moving features).

Approach two: Buffer a shoreline

Generate a baseline from an offset of the existing shoreline. Select one of the shoreline segments (the most landward if onshore or seaward if offshore shoreline will often work best).



Buffered shoreline



Baseline (edited buffer)

Make sure you specify a distance that will offset the resulting buffer entirely landward or seaward of all other shoreline positions. Refer to the ArcGIS Desktop Help menu for more detailed information on how to: 1) create a buffer and isolate it in a separate annotation group from the shoreline features, 2) convert the polygon buffer to a polyline and 3) split and remove the unwanted segments (Keywords; buffering selected graphics, copying features, splitting features, polygon to line).

Approach three: Use a pre-existing baseline

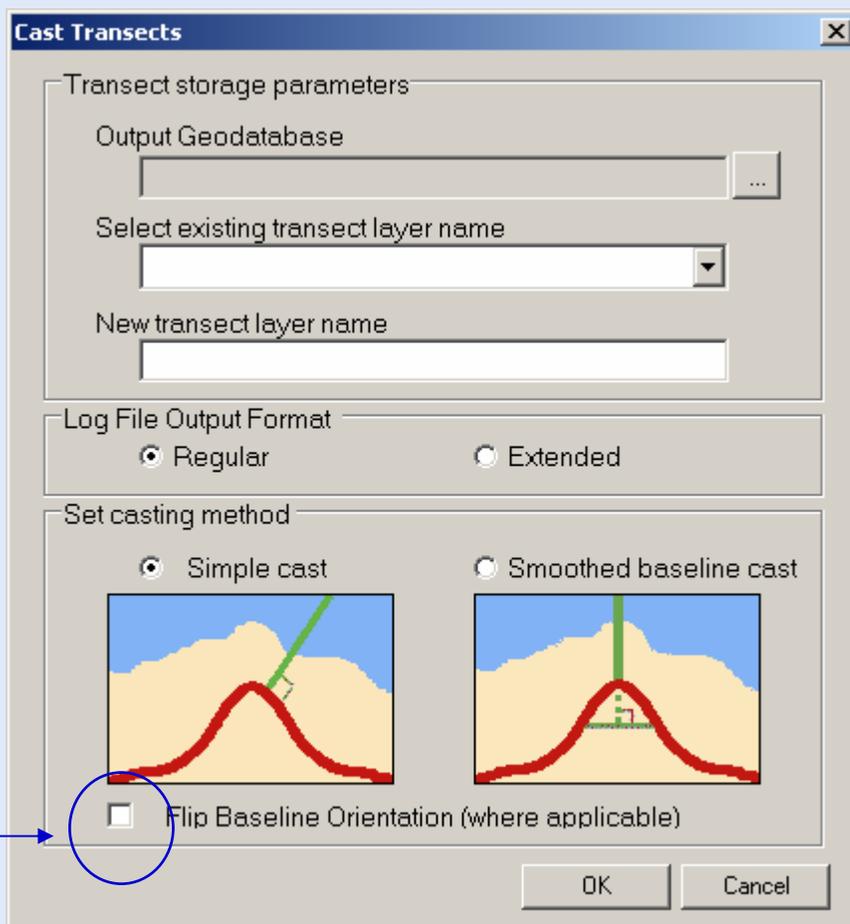
This is beneficial if a baseline was previously made and stored for future studies.

NOTE: The baselines cannot contain field names that will conflict with the DSAS extension. Check field requirements on p.31 for conflicts.

Baseline “flow” direction

In previous versions the user was required to manually adjust the “flow” direction of each vector in the baseline feature class so that all baseline segments had the first vertex at the end closest to the last vertex of the previous segment. Setting the line symbology to arrows enabled visualization of this flow direction.

DSAS is now set up to automate this process. By default this functionality is turned OFF. To activate, just check the “Flip Baseline Orientation” box at the bottom of the Cast Transects window before clicking OK to cast transects. Flow direction will be governed by the first baseline segment (ID=1; see p. 31).



Define Coordinate System

The spatial reference for both the shoreline and baseline files must be set in order for DSAS to accurately calculate the shoreline change statistics.

Note: DSAS requires the data to be in meter units in a projected coordinate system, such as UTM or State Plane (ArcGIS Desktop Help keyword: coordinate systems, projections).

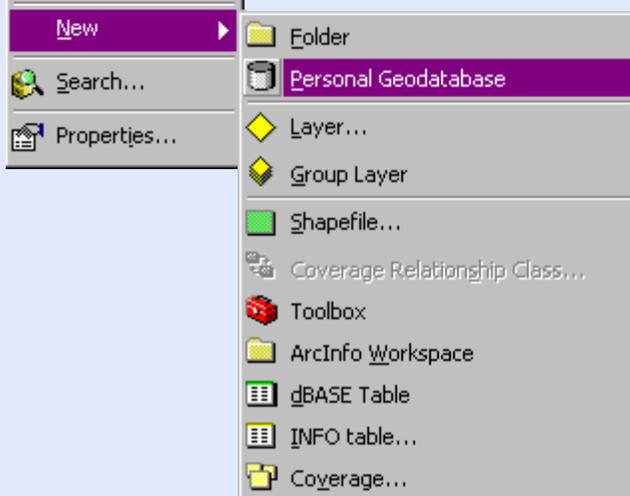
Geodatabases (ArcCatalog)

The baseline and shoreline data must be imported into a geodatabase in order for DSAS to recognize the data. For more information on how to create a personal geodatabase in ArcCatalog, refer to the ArcGIS Desktop Help (keyword: creating personal geodatabases).

To create a new Personal Geodatabase:



- 1) Open ArcCatalog and navigate to the location of your data in the file tree.
- 2) Right-click on the folder where you want the geodatabase to be stored



- 3) Navigate to New -> Personal Geodatabase in the pop-up menu

Make sure that the shoreline and baseline files have a defined spatial reference and meet the field parameters required by DSAS (see pp.31-32) before you begin importing data into the personal geodatabase.

Once a geodatabase has been created, the data can be imported as individual feature classes into a geodatabase within ArcCatalog (ArcGIS Desktop Help keyword: geodatabases importing data).

Default Parameters



← Default parameters button on Shoreline Toolbar

1. General Parameters

Before transects are generated several parameters can be set and saved in the default parameters windows. The user must specify which feature classes are to be used as the baseline and shoreline layers as well as the accuracy and date fields (which are further explained in the statistics section on pp. 21-25 in this tutorial).

If no Accuracy field value exists for a specific shoreline, a default value must be used. The user must specify this default value under the “Set data accuracy” section.

In previous versions of DSAS the confidence interval (CI) was 90%. DSAS now allows the user to choose the confidence interval from a drop-down list of options (90%, 95%, 98%, 99%, 99.8% or 99.9%). The chosen value will be used for calculating the supplemental statistics (see p.24 for more information).

Edit Default Parameters

Select feature classes

1.) Baseline layer
Baseline

2.) Shoreline layer
shorelines

Shoreline accuracy field
ACCURACY

Shoreline date field
DATE_

Set data accuracy

Default data accuracy
6 +/- meters

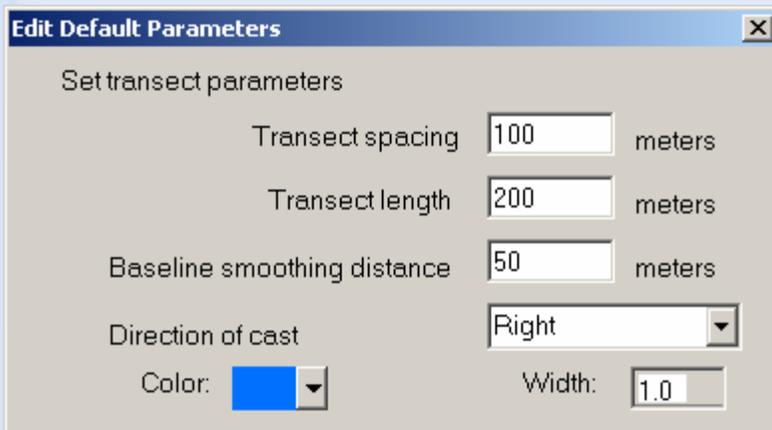
Confidence Interval
90 %

Restore Default Next > Cancel

Parameters continued

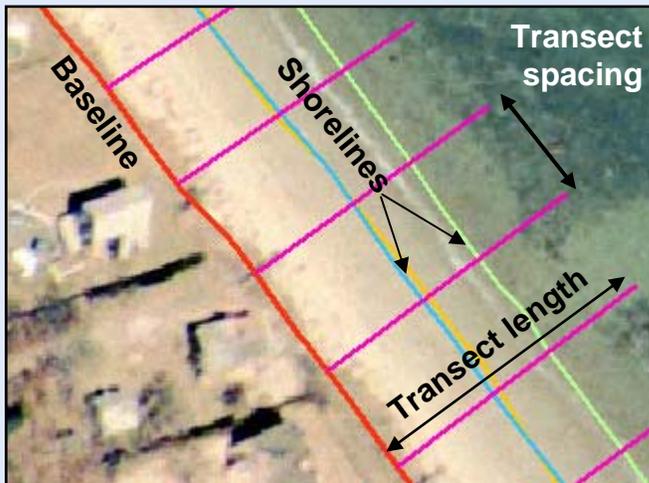
2. Set Transect Parameters:

The user must specify the spacing between transects along the baseline as well as the length of the transects for both simple or smoothed baseline casts (see next page for more information regarding smoothing distance).



The direction of cast (Left or Right), is determined by the “flow” direction of the baseline segments. Refer to pp.8 & 16 for more information.

DSAS computes the shoreline change statistics on the generated transects. All transects are cast from the baseline and intersect the multiple shoreline features. The transect layer’s attribute table provides the rate-of-change statistics.



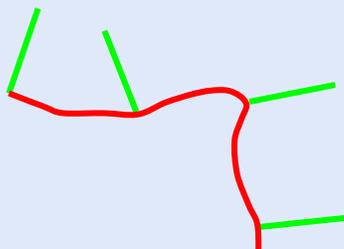
NOTE: Make sure to choose a transect length long enough to intersect all of your shorelines!

Simple and Smoothed Baseline Transects

The suite of shoreline change statistics that DSAS provides can be strongly influenced by the orientation at which the transects are cast from the baseline and through the shorelines. There are two types of transects that can be cast 1) Simple transects and 2) Smoothed Baseline Transects.

Simple Transects: Simple transects are cast at a 90 degree angle from the baseline segment from which it originates. Transects are generated at user specified intervals along the baselines.

Smoothed Baseline Transects: This option is useful in orienting transects along curved sections of baseline. The user-specified distance will be used to determine a supplemental baseline. Larger distance values will result in a straighter line (more smoothing).



Simple



Smoothed Baseline

In the simple transect above, curves in the baseline may result in some transects being cast at undesirable orientations.

The smoothed baseline option creates a supplemental baseline at the user-specified distance (with the transect being at the midpoint). This smoothing parameter is then used to determine the orientation of the transect (compare orientation of the middle transects in the simple and smoothed baseline examples above). There will be little to no difference in transects that occur along straight sections of baseline (compare first and last transects in examples above).

Note: Both casting methods use the same calculations to generate rate-of-change statistics.

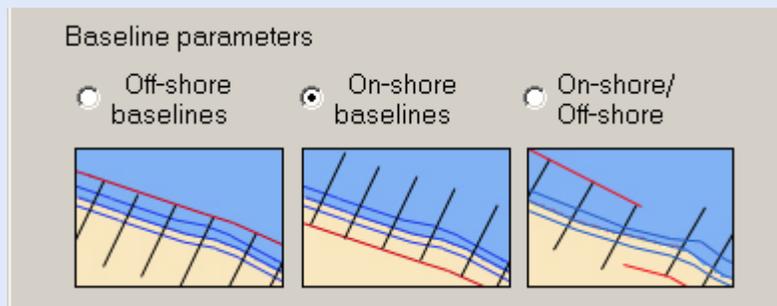
Parameters continued

3. Baseline parameters:

The baseline can be drawn off-shore, on-shore or can be a combination of both. By checking off-shore, rate calculations will be determined assuming transect origins are seaward of shorelines. The casting direction will be determined by the default parameters described on the previous page. Onshore transect origins are considered to be landward of the shorelines in rate calculations.

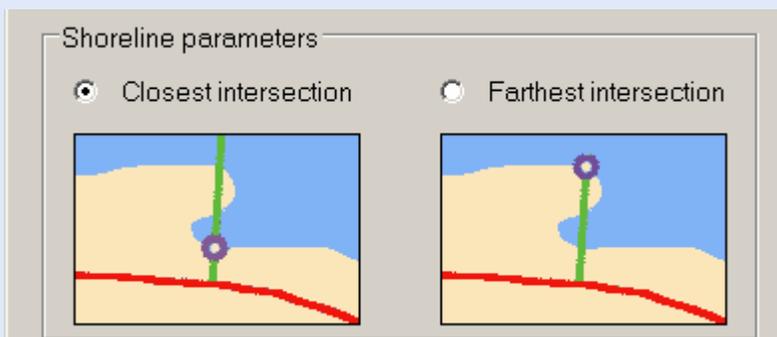
If baselines are drawn both landward and seaward of the shorelines choose both. Two additional fields must exist in the baseline attribute table (see p.31) to specify the location of the specific baseline segment with respect to the land, and the appropriate casting direction to intersect the shorelines.

This preference is not intended to be switched during a project and should only be set once. The chosen baseline parameter adjusts the reported statistics for positive and negative values to correctly indicate accretion and erosion.



4. Shoreline parameters:

In some instances, a transect may intersect a shoreline segment multiple times (for example, if backshore features are present). The user is able to specify which intersection to use under the Shoreline parameters section.



Importing ArcView transects

A stand-alone utility has been created to import transects that were created in DSAS 2.0 (ArcView 3.x) so that they can be used within DSAS 3.1.

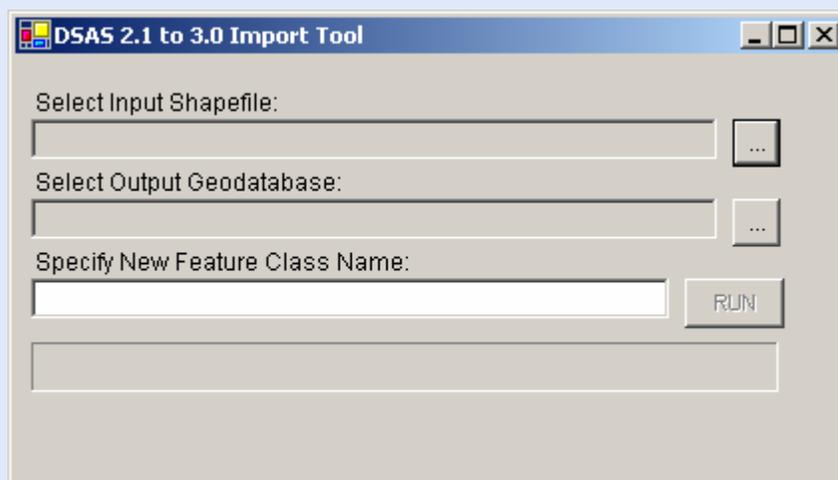
This import tool will create a feature class for the existing transects within the Geodatabase specified by the user.
NOTE: the geodatabase must be created before attempting to import!

The statistics will need to be updated using the recalculate button (see p.18). This import utility will be useful in situations where extensive editing of the transects was done using the previous version of DSAS software.

Once the transects have been imported and recalculated they will be updated with all improvements and modifications made to DSAS since the 2.0 release.

Please refer to the DSAS project page for information on how to download and use the stand-alone Import Utility.

<http://woodshole.er.usgs.gov/project-pages/dsas>



Casting Transects



Once the default parameters have been set, transects can be cast. The user must specify the location of the geodatabase where the resulting transect and intersect files will be stored.

The user is able to select either simple or smoothed baseline casts for newly generated transects (whose length and spacing parameters were specified in the default parameters window described on p.11).

Cast Transects

Transect storage parameters

Output Geodatabase

Select existing transect layer name

New transect layer name

Log File Output Format

Regular Extended

Set casting method

Simple cast Smoothed baseline cast

Flip Baseline Orientation (where applicable)

OK Cancel

DSAS generates a shoreline.log file which is placed in the C:/temp directory on your computer. If this “temp” folder does not exist, DSAS will ask you to create it.

The log file can be a useful way to troubleshoot if problems arise when using DSAS. The extended log file will provide more detailed information on the calculations done to determine the resulting statistics.

Please note that existing log files are deleted every time ArcMap is opened. If you want to keep a log file, copy it to a different location.

Editing Transects

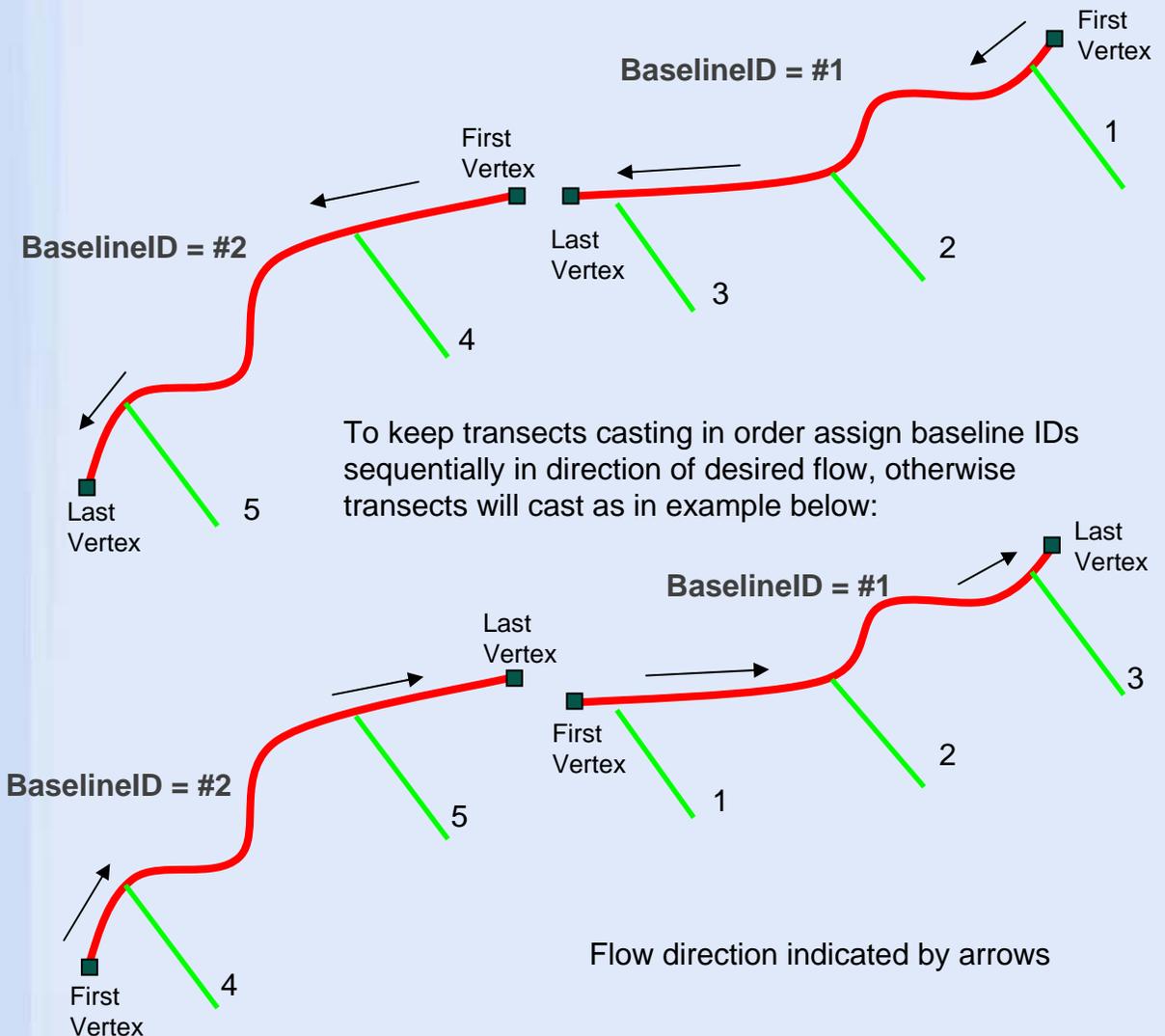
Transects can be moved, changed, deleted or otherwise edited individually using standard ArcGIS editor tools. Once changes have been made and saved, rates of change for the transects can be recalculated to update the transect and intersect attribute tables (ArcGIS Desktop Help keyword: vertices, moving).

Transect casting order

The user has control over the order in which transects are cast alongshore. If multiple baseline segments exist, the casting order will be determined by the ID value assigned to each baseline segment (if only one baseline segment exists, assign it a value of one).

If a baseline segment is assigned an ID value of zero, no transects will be cast.

To keep transect numbering in sequence, assign sequential ID numbers along the baseline. The transect attribute table will indicate which baseline segment the transect was cast from in the baselineID field (see p.20 for further description).



Transect Notes

- If a user edits an existing transect layer, newly created transects will be saved in the same feature class as the rest of the transects. New transects are appended to the existing transect file but must be recalculated to update the statistics in the transect attribute table as well as the associated intersect and distance tables. You cannot use the Modified Only option to recalculate when transects have been added or deleted.
- Recalculating All will update the TransOrder field in the transect attribute table. This will allow the user to continue using the TransOrder field to sort transects in geographical order (see p.20).
- The transect, intersect and distance feature classes are retained even if they contain no data. They will be saved within the geodatabase specified at the output location in the casting transects window.
- Deleting transect, intersect, and distance themes from the view will not remove them from the geodatabase. If the transect theme is modified by the user and recalculated, the resulting intersect and distance tables will update in ArcCatalog (see next page for more details).
- If the transect, intersect and distance names already exist, the new data will be appended to them.
- If specific transects are highlighted using the select tool, they will be the only ones recalculated. Output to a new feature class to maintain proper TransOrder sequencing.

Recalculating Transects



The recalculate button provides several options for the user to select how modified data will be updated. The “Choose Transect Layer” dialog box lists all feature classes. Select the existing transect feature class to be recalculated from the list.

Modified – can only be used when existing transects have been moved to new positions or if data in the transect attribute table has been modified (such as an accuracy value or date). Do not use if transects have been added or deleted.

All – forces DSAS to recalculate the statistics associated with every transect. This option will update the TransOrder field for every transect and will appropriately organize transects to account for added or deleted transects.

Find deletions –will remove rows from the intersect and distance tables when the corresponding feature has been deleted from the transect feature class. Again if you add or remove transects from the feature class, “Recalc All” will update all files appropriately.

Choose Transect Layer

Choose Existing Transect Layer

- simple_transects
- smoothed_transects
- transects

Select Recalc Option

Modified All Find deletions

Transect storage parameters

Overwrite Existing Output New

Log File Output Format

Regular Extended

Cancel OK

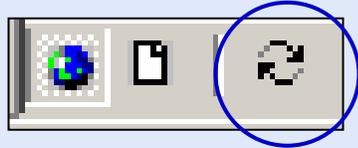
Overwrite Existing – replaces the current file with the newly calculated results. If the desired transects have been highlighted using the select tool, they would be the only ones recalculated. Please note that unselected transects will be removed when the file is overwritten.

Output New – creates a new feature class within the geodatabase.

The output format for the log file can be changed, but defaults to what was set in the edit parameters dialogue.

Updating Intersect & Distance tables

To view updates to the intersect and distance tables in ArcMap, the user must refresh the view.



Located at the lower left corner of the view window in ArcMap

The intersect and distance tables are automatically added to the Source View of the ArcMap project when transects are initially cast. The refresh button will update these attribute tables and the intersect points in the display area if they are being viewed as an event theme (see p.26 for display instructions).

DSAS tools



Set/Edit default parameters



Recalculate transects



Cast transects



About DSAS

Transect Field Descriptions

Object identifier	Unique number assigned to each transect
Geometry	Identifies feature type
BaselineID	Identifies the baseline segment the transect was cast from based on the ID field in the baseline attribute table.
TransOrder	Sorts transects in geographic order along baseline segments
ProcTime	Date and time at which rate calculation was generated.
AutoGen	Attributes whether or not the transect was generated automatically by the program or if it was manually edited or added. "1" indicates that the transect was automatically generated.
StartX	Starting position of the transect.
StartY	Starting position of the transect.
EndX	Ending position of the transect.
EndY	Ending position of the transect.
Azimuth	The transect's angular distance from North (Note this has been changed to the standard convention and no longer matches ESRI's default of East = zero).
ShorelineDates	Lists the dates of each shoreline that the transect intersects
PointCnt	Number of shoreline intersections included in the calculations

Statistics

- EPR** The end point rate (epr) is calculated by dividing the distance of shoreline movement by the time elapsed between the earliest and latest measurements (i.e., the oldest and the most recent shoreline). The major advantage of the epr is its ease of computation and minimal requirement for shoreline data (two shorelines). The major disadvantage is that in cases where more than two shorelines are available, the information about shoreline behavior provided by additional shorelines is neglected. Thus, changes in sign or magnitude of the shoreline movement trend, or cyclicity of behavior may be missed.
- JKR** The jackknife method is implemented as an iterative linear regression that calculates a linear regression fit to shoreline data points with all possible combinations of shoreline points, leaving out one point in each iteration. The slopes of the linear regression lines are averaged to yield the jackknife rate. The advantages of the jackknife are similar to linear regression; the jackknife is also less influenced by outliers of data clusters. The main disadvantage of the jackknife is a lack of increased statistical value given the typically small numbers of shoreline data points used to derive a shoreline rate-of-change. Most historical shoreline studies have < 10 shorelines; the statistical utility of the jackknife is best realized with an order of magnitude (or more) data points.
- LRR** A linear regression rate-of-change statistic can be determined by fitting a least squares regression line to all shoreline points for a particular transect. The rate is the slope of the line. The advantages of linear regression include: 1) all the data are used, regardless of changes in trend or accuracy; 2) the method is purely computational; 3) it is based on accepted statistical concepts; and 4) it is easy to employ. As pointed out by Dolan and others (1991; Journal of Coastal Research, v. 7, no. 3, p. 723-744), the linear regression method is susceptible to outlier effects, and also tends to underestimate the rate-of-change relative to other statistics, such as EPR.

WLR In weighted linear regression, more reliable data is given greater emphasis, or weight. The weight (“w”) is defined as a function of the variance in the uncertainty of the measurement (“e”) and is commonly defined as: $w = 1 / (e^2)$

The “Accuracy” field for the shoreline feature class in DSAS data is used to calculate a weight where: $w = [1 / (\text{accuracy}^2)]$

This is a typical method for determining weighting, but it is important to note that there is no standard equation for determining weighted linear regression (i.e. other, more sophisticated weighting schemes could be used). Our method of weighting results in a best-fit line that places greater emphasis on data points where the shoreline position accuracy is lower (years with a smaller +/- value in the accuracy field will have greater influence over the best-fit line).

When all of the shorelines have the same accuracy, there will be no emphasis on any given year, so the best-fit line should match the one calculated for Ordinary/Standard Linear Regression. All other associated statistics should match as well (LRR = WLR, LR2 = WR2, LSE = WSE, and LCI = WCI). One exception however, is that the equation used to calculate WSE has a weight component that only cancels out (when all shoreline weights are equivalent) when the weight equals a value of one. This results in different reported values for the standard error between weighted and ordinary linear regression. In those instances, there is no need for weighted regression (since all accuracies are the same) so the weighted linear regression values should be ignored.

PLEASE NOTE!

DSAS is limited to 15 significant digits for the field type Double (8-byte number). If your data produces very large numbers, the values for the above mentioned statistics (EPR, JKR, LRR and WLR) will only be approximate due to the limitations of binary number storage. For more information refer to ArcGIS Desktop Help > Keyword: “fields in tables, defined.” A detailed explanation on binary storage can be found under the Numeric data types > Floats for this keyword search.

The previously described statistics have all been examples of simple regression analysis. A drawback to that type of analysis is that a single outlier (anomalous data point) can significantly offset the calculated rate (LRR and WLR). Robust estimators are more complex mathematically, however they are better at producing rates that are less influenced by outliers in the data.

LMS A standardized equation to describe how the Least Median of Squares (LMS) is calculated does not exist. In DSAS LMS is determined using an iterative process that calculates all possible values of slope within a restricted range of angles.

For each of the input angles (iteration #1 uses -89 to 89), the slope of the angle and the input date (x) are used to calculate a new y intercept for the input points. The mode is then estimated from these new y intercepts.

The mode of the y intercepts is then compared against each of the originally calculated y intercepts and this value is squared. This is also known as the squared residual. The median of the squared residuals is then calculated. This value is saved and is referred to as the offset for the iteration. At this point during iterations, the offset, slope, and y intercept are stored.

When the iterations are complete, the stored offset values are used to determine which of the calculated slopes is saved and returned as the LMS value. The program finds the minimal offset value from the calculated offsets. It then returns the minimal offset, the slope, the Y intercept.

If the minimal offset returned from the LMS function is below the threshold of 0.1 then the returned slope is saved. If not then another iteration is performed iterating in tenths between input angles, then hundredths, then thousandths, etc., until the offset is below the threshold deemed appropriate.

For more information on the computation of Least Median Squares please refer to:

Rousseeuw, P. and Leroy, A., 1987. Robust Regression and Outlier Detection, John Wiley and Sons, New York

Supplemental Statistics

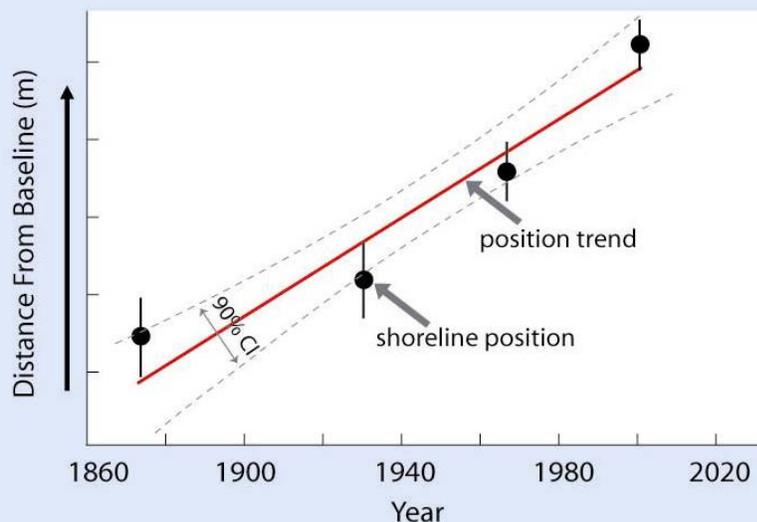
Supplemental Statistics for Least and Weighted regression:

Standard Error of the Estimate (LSE; WSE)

The “estimate” value of “y” is based on a known “x” in the equation for the regression line ($y = mx + b$). The standard error of the estimate reflects the degree to which the points diverge from the best-fit regression line. In other words, it reflects the accuracy of the prediction.

Standard Error of the Slope with Confidence Interval (LCI; WCI)

The standard error of the slope is the standard deviation of the sampling distribution. The standard error of the slope is used to construct a confidence interval. The user has the option of selecting one of the following: 90%, 95%, 98%, 99%, 99.8% or 99.9% (see p.10). If the 90% CI was selected in the default parameters, and given the underlying assumptions of linear regression, this means that one can be 90% confident that the two curved confidence bands (see figure) enclose the true best-fit linear regression line, leaving a 10% chance that the true line is outside those boundaries. This is not the same as saying that it will contain 90% of the data points and some data points will fall outside of the interval boundaries.



R-squared & Shoreline Distance Reports

R- Squared (LR2; WR2)

The R-squared statistic, or coefficient of determination, is the percentage of variance in the data that is explained by a regression. It is a dimensionless index that ranges from 1.0 to 0.0 and measures how successfully the best fit line accounts for variation in the data. In other words, it reflects the linear relationship between data sets.

The r-squared value quantifies the proportion of the variability in the dependent variable (Y) that is explained by the regression model through the independent variable (X). The smaller the variability of the residual values around the regression line relative to the overall variability, the better the prediction.

- r^2 values close to 1.0 imply that the best fit line explains most of the variation in the dependent variable. If X and Y are perfectly related then there is no residual variance and the ratio of variance would be 1.0.

- r^2 values close to 0.0 imply that the best fit line explains little of the variation in the dependent variable and may not be a useful model. If there is no relationship between the X and Y variables, then the ratio of the residual variability of the Y variable to the original variance is equal to 0.0.

Shoreline Distance Reports (SCE; NSM)

The shoreline distances between baseline and shoreline intersections are provided in the intersect table (p.26). Two additional measurements using these distances are provided in the distance table (p.27).

SCE, or Shoreline Change Envelope reports the distance between shorelines measured furthest and closest to the baseline for each transect. This represents the total change in movement and is not governed by the age of the shorelines.

NSM, or Net Shoreline Movement reports the distance between the oldest and youngest shoreline features for each transect.

Plus and minus values for each measurement are also provided. These are determined by calculating the difference between accuracy values recorded for each shoreline contributing to the calculation. The accuracy values are either provided by the user in the designated accuracy field of the shoreline attribute table (or the default value supplied by the user in the parameters dialog if no value exists in the attribute table).

Intersect Field Descriptions

object identifier	Unique number assigned to each intersection
TransectID	The object identifier value of the transect in the transect attribute table (see p.30).
BaselineID	Identifies which baseline the transect was cast from based on the baselines ID field. Useful when multiple baseline segments exists.
ShorelineID	Identifies which shoreline the transect is intersecting
Distance	The transect length between the identified baseline and shoreline
IntersectX	The x-coordinate for the location point of the shoreline/transect intersection
IntersectY	The y-coordinate for the location point of the shoreline/transect intersection

There will be an individual entry for each transect/shoreline intersection in the Intersect table (see p.30). Use the TransectID and ShorelineID fields to determine to which intersection the reported distance is referring.

How to view intersect table data within ArcMap

Display the table as an event theme:

- 1) Make sure the Table of Contents is set to Source view by clicking the tab at the bottom of the ArcMap program window
- 2) To view the intersect attribute table, right-click the “transect_Intersect” table and choose “Open”
- 3) To display point intersections in the view, right-click the “transect_Intersect” table and choose “display XY data...”
- 4) Set XField to IntersectX and YField to IntersectY and the point intersections will be added to the map view

Distance Field Descriptions

object identifier	Unique number assigned to each intersection
TransectID	The object identifier value of the transect in the transect attribute table (see p.30).
BaselineID	Identifies which baseline the transect was cast from based on the baselines ID field. Useful when multiple baseline segments exists.
ShorelineID	Identifies which shoreline the transect is intersecting
SCE	Shoreline Change Envelope; distance between shorelines measured furthest and closest to the baseline for a given transect
SCE_+-	The difference between the user-specified accuracy values of the furthest and closest shorelines
NSM	Net Shoreline Movement; distance between oldest and youngest shoreline features
NSM_+-	The difference between the user-specified accuracy values of the oldest and youngest shorelines

There will be an individual entry for each transect in the Distance table (see p.30). Use the TransectID field to identify the transect associated with the SCE and NSM values.

Refer to the previous page (p.26) for instructions on how to view transect/shoreline intersect values within ArcMap.

Troubleshooting

Transects do not intersect all shorelines

The length parameter was not set to a great enough distance in the default parameters window.

Some baseline segments do not have transects while others do.

If you have an ID field within the baseline, any fields that have a value of "0" will not produce transects (see pp. 16 and 31).

“Shoreline; Output Geodatabase: Please browse to a personal geodatabase!”

User did not specify the location of the Output Geodatabase in the Cast Transects window. Browse to the location of the geodatabase where you want your transect file stored.

“ThemeNames; Baseline layer is either not projected or the projection does not use Meter as linear unit! Edit projection for “name of baseline feature class”

User did not define spatial reference for baseline within geodatabase or the projection is not in meter units (see Define Coordinate System on p.9)

“FromObject; Cast from type ‘DBNull’ to type ‘Integer’ is not valid.”

An unprojected shoreline feature class will generate statistics on the first pass (auto-transect generation) but edits/ recalculate will result in error message above. To fix, assign a spatial reference to the shoreline feature class before calculating transects.

Transects are cast away from my shorelines

The direction of cast was set improperly in the default parameters window (p.11) or in the CastDir attribute field (p.31).

“Shoreline; ‘C:\temp\’ directory not found. Please create and try again.”

The shoreline log file is written to the C:\temp folder. If you do not have a temp folder when you open C:\ on your computer please create one.

LMS value = 32768

Due to limitations on the size of integer fields, if an extremely large rate is calculated for LMS, a value of 32768 will be returned indicating that the maximum integer value has been reached. This is not likely to occur in any real-world shoreline change examples.

Frequently Asked Questions (FAQ)

Q: I tried to cast transects but nothing happened.

A: Check to make sure that the ID field in the baseline attribute table has a value other than zero for each line segment.

Q: Can I create my own transects to use with the DSAS extension?

A: Yes, but you should have DSAS cast transects automatically to create the transect attribute table then, within an edit session, remove the undesired transects and manually add in new transects. Use the recalculate button to update the transect and intersect tables.

Q: I edited and recalculated my transects, but the intersect points haven't changed.

A: If you display the intersect table as an event theme in ArcMap, you must hit the ArcMap refresh button to update the view after a recalculate has been made.

Q: Where are my transects saved?

A: Transects are saved as a feature class within the geodatabase specified by the user in the cast transect window.

Q: Do transects need to be saved within the same geodatabase as the baseline and shoreline data?

A: No, but the designated geodatabase must be created before attempting to cast transects and have the same defined spatial reference as the geodatabase containing the shoreline data.

Q: Does the ArcMap project have to be projected in meters for the DSAS extension to work?

A: No, the view does not have to be projected in meters, but the data must be assigned a projection within a geodatabase in order for DSAS to cast transects.

Q: DSAS keeps producing errors, what should I do now?

A: Try using the sample data provided at the DSAS website to determine if the problem is data or program related.

Intersect & Distance table links

The three attribute tables below are examples of the Transect, Intersect and Distance attribute tables generated by DSAS. The object identifier value in the Transect attribute table serves as a link to the Intersect table and the Distance table where it is called the TransectID. This facilitates analysis and organization of the transects and provides users with the intersect point and distance values used in all rate-of-change statistics, as well as providing additional statistical information (Net Shoreline Movement and Shoreline Change Envelope calculations) found in the distance table (see pp. 25 & 27).

Example of a transect attribute table

Transect ID
Listed in transect
attribute table
with all statistics

Attributes of transect				
object identifier*	geometry*	BaselineID	TransOrder	Proc
61	Polyline	2	61	2006/03/1
62	Polyline	2	62	2006/03/1
63	Polyline	2	63	2006/03/1
64	Polyline	2	64	2006/03/1

Record: 0 Show: All Selected Records (0)

Example of an intersect attribute table

Attributes of transect_Intersect						
object identifier*	TransectID	BaselineID	ShorelineID	Distance	IntersectX	IntersectY
170	62	2	01/01/1847	59.116730	263205.746911	885127.053478
171	63	2	01/01/1978	48.144100	263212.957758	885102.562702
172	63	2	01/01/1950	24.999996	263195.707327	885087.133114
173	63	2	01/01/1847	59.892385	263221.714328	885110.394987
174	64	2	01/01/1978	39.332461	263224.559320	885073.508017

Record: 1 Show: All Selected Records (0 out of 526 Selected.) Options

Example of a distance attribute table

Attributes of transect_Distance								
object identifier*	TransectID	BaselineID	ShorelineID	SCE	SCE_+	NSM	NSM_+	
62	62	2	01/01/1978,01/01/1950,01/01/1847	34.05	2	-0.21	3	
63	63	2	01/01/1978,01/01/1950,01/01/1847	34.89	2	-11.75	3	
64	64	2	01/01/1978,01/01/1950,01/01/1847	35.38	2	-21.05	3	

Record: 1 Show: All Selected Records (0 out of 193 Selected.) Options

Baseline Field Requirements

Baseline			
Field Name	Data Type	Properties	Fields are generated automatically when a new shapefile/feature class is created.
OBJECTID	Object ID		
Shape	Geometry	Polyline	
Shape_Length	Double	Precision=0; Scale=0	
ID	Long Integer	Precision=0	Optional user-modified
OFFshore	Short Integer	Precision=0	User-created
CastDir	Short Integer	Precision=0	User-created

The ID field in the baseline feature class can be modified (optionally) by the user to control order of transect casting (see p.15 for details).

OFFshore = required when a combination of onshore and offshore baselines are used. A value of 0 indicates baseline is onshore, a value of 1 indicates baseline is offshore.

CastDir = required in conjunction with Offshore. A value of 0 indicates casting direction should be to left of baseline, based on direction of segment flow (first vertex to last vertex). A value of 1 indicates casting to right.

Shoreline Field Requirements

Shoreline			
Field Name	Data Type	Properties	
OBJECTID	Object ID		Fields are generated automatically when a new shapefile/feature class is created.
Shape	Geometry	Line	
Shape_Length	Double	Precision=0; Scale=0	
ID	Long Integer	Precision=0	
DATE_	Text	Length=10 or 22	
ACCURACY	Short Integer, Long Integer or Float (any numeric)	Precision=0	User-created

The Date_ and Accuracy fields must be manually created by the user and populated with appropriate attribute data.

Date_ = length can vary from 10-22 depending on the timing between shorelines:

Length = 10 for shoreline change spanning days, months or years and will have dates set up as mm/dd/yyyy

Length = 22 for shoreline change spanning different hours within the same day and will have dates set up as mm/dd/yyyy hh:mm:ss (using either 24-hour or AM/PM)

Accuracy = specifies accuracy of each shoreline. If a shoreline has an accuracy of zero it will use the value specified by the user in the default parameters window (see p.10).

E. Robert Thieler

U.S. Geological Survey
Coastal and Marine Geology Program
384 Woods Hole Road
Woods Hole, MA 02543-1598 USA
rthieler@usgs.gov
(508) 457-2350

<http://woodshole.er.usgs.gov/project-pages/dsas/>
<http://marine.usgs.gov/>
<http://woodshole.er.usgs.gov>

Tutorial created by:

Emily A. Himmelstoss
U.S. Geological Survey
384 Woods Hole Road
Woods Hole, MA 02543

Tara L. Miller
U.S. Geological Survey
600 4th Street South
St. Petersburg, FL 33701

Programming by:

Jessica Zichichi
GeoNet Systems
156 Herring Pond Road
Bourne, MA 02532