CSHORE Execution

The CSHORE model is a combined wave, current, and sand transport model that operates under the assumption of longshore uniformity. Wave and current estimates derive from the numerical integration of the depth-averaged energy, momentum, and continuity equations. Process-based sediment transport algorithms for a nearshore breaking wave environment provide distinct estimates for bedload, suspended load, and wave-related sediment transport. Generally speaking, when applied in an appropriate manner, the CSHORE model provides more accurate results when compare to previously-used models.

The application of CSHORE is appropriate for cases of approximately alongshore-uniform beaches with waves approaching with angles less than 80 degrees with respect to a shore normal. The profile can be comprised of a mixture of sediment and hardbottom, although CSHORE is formulated for use with a single grain size, and so application to cases of wide or bimodal grain size distribution may be inappropriate. The CSHORE model was developed making use of the simplifying assumption that overtopping is wave-driven and intermittent. The officially-supported CSHORE code will terminate execution is the water level at the seaward boundary exceeds the highest bed elevation point in the domain. Users who are inclined to use CSHORE without his restriction can contact `Bradley.D.Johnson@usace.army.mil` for code without restriction, but advised to exercise caution in this model application.

CSHORE is distributed as `FORTRAN` code located in the `src-repo` directory. Two pre-compiled executables for Windows and Linux, with filenames `cshore_usace_win.out` and `CSHORE_USACE_LINUX.out`, respectively, are also included in the `usace_distribute_bundle/bin/` directory. CSHORE is version reporting is provided at time of execution, with a version date provided as output.

Model execution is completed through either scripting or execution at the command line. A Matlab script example is provided in `usace_distribute_bundle/example_application` as `run_model.m`. Command line execution is accomplished by calling the CSHORE executable from a directory that includes an input file named `infile`. For example, execution from a Windows operating system:

```
Z:\wes\cshore-git>cd usace_distribute_bundle\example_application

Z:\wes\cshore-git\usace_distribute_bundle\example_application>..\bin\cshore_usace_win.out
 CSHORE USACE version, 2014 last edit 2024-03-14
 ------------------------------------------------------------
 CSHORE applied to idealized planar slope
 ------------------------------------------------------------
```

Similarly, execution from a Linux system:

```
$ cd usace_distribute_bundle/example_application/
$ ../bin/CSHORE_USACE_LINUX.out
 CSHORE USACE version, 2014 last edit 2024-03-14
 ------------------------------------------------------------
 CSHORE applied to idealized planar slope
 ------------------------------------------------------------
```

CSHORE Parameters

The CSHORE family of models has dependencies on the following scalars:

$$\begin{aligned}
d_{50} &= \text{median sediment grain size} \\
sg &= \text{sediment specific gravity} \\
w_f &= \text{sediment fall velocity} \\
por &= \text{bed porosity} \\
e_B &= \text{breaking efficiency} \\
e_f &= \text{bottom dissipation efficiency} \\
slp &= \text{suspended load parameter} \\
slpot &= \text{suspended load parameter for over-topping} \\
blp &= \text{wave-related bed load parameter} \\
f_w &= \text{wave friction factor} \\
\gamma &= \text{ratio of breaking wave height to water depth}
\end{aligned}$$

Physical Parameters

Some parameters are physical and are prescribed by field measurements or estimation. The median grain size, d_{50}, for instance, is specified according to measured or assumed data. Likewise the sediment fall velocity w_f and porosity por are physical attributes of the model domain. Typical values of these parameters is given:

Parameter	Typical Value	Units
d_{50}	0.20	mm
w_f	0.026	m/s
sg	2.65	
por	0.40	

Table 1: Physical parameters

Empirical and Numerical Parameters

The 1-D CSHORE model formulation includes empirical devices for estimation of nearshore hydrodynamics and sediment transport. Typical values for the parameters is provided along with a range of acceptable values. It should be noted that the breaking model in CSHORE relies on a user-supplied γ, the ratio of wave height to water depth in the saturated breaking region. Strictly speaking, this is not an empirical model parameter, and data from the surf zone is usually available in the laboratory for guidance. In the typical application with field conditions, however, it is not practical to collect surf zone information, and typical values are provided in Table 2.

Parameter	Typical Value	Range
dx	1	0.1 (lab) – 1(field)
γ	0.7	0.5 – 0.9
e_B	0.005	0.001 – 0.01
e_f	0.01	
slp	0.5	0.2 – 0.5
$slpot$	0.1	0.05 – 0.2
$\tan\phi$	0.63	0.63
blp	0.001	0.0005 – 0.002
f_w	0.015	0.005 – 0.03
rwh	0.03	0.01 (lab) – .05(field)

Table 2: Empirical parameters

Input file structure

The CSHORE model developers, over time, have added capabilities and code branches to extend the range of application. The optional processes are included with an array of logical parameters that are given below. It is suggested, at present, to provide the user with a limited set of options to avoid unadvised application before complete scrutiny by the USACE. The following four tables detail the input file structure required by CSHORE.

Parameter	Allowed Values	Meaning and Conditional
ILINE	1	Single transect
IPROFL	0, 1	0=no sediment transport, 1=sediment transport
ISEDAV	0	unlimited sediment availability, Conditional on IPROFL = 1
IPERM	0	neglect permeability
IOVER	1	Allow overtopping and compute runup statistics
IWTRAN	0	No standing water in landward zone, Conditional on IOVER = 1
IPOND	0	No ridge and runnel, Conditional on IOVER = 1
INFILT	0	No infiltration landward of dune crest, Conditional on IOVER = 1 and IWTRAN=0
IWCINT	0	No wave-current interaction
IROLL	0	No roller effect
IWIND	0	No wind effect
ITIDE	0	No pressure effect
IVEG	0	No vegitation effect
DXC	dx	see above
GAMMA	γ	see above
D50 WF SG	d_{50} w_f sg	see above, Conditional on IPROFL = 1
EFFB EFFF SLP SLPOT	e_b e_f slp $slpot$	see above, Conditional on IPROFL = 1
TANPHI BLP	$\tan\phi$ blp	see above, Conditional on IPROFL = 1
RWH	rwh	See above
ILAB	0	Assume continuous and bounded boundary condition data
NWAVE		Number of wave conditions. Provide $nwave + 1$ conditions for interpolation with ILAB=0
NSURGE		Number of water level conditions. Provide $nsurge + 1$ conditions for interpolation with ILAB=0

time(s)	wave period(s)	root-mean-square wave height(m)	wave setup(m)

time(s)	water level(m)

Parameter	Allowed Values	Meaning and Conditional
NPINP		Number of bottom position data points

x(m)	z_b(m)	f_w

Sample INFILE For cases of fixed bed, IPROFL=0

```
3
------------------------------------------------------------
CSHORE applied to idealized planar slope
------------------------------------------------------------
1                                         ->ILINE
0                                         ->IPROFL
0                                         ->IPERM
1                                         ->IOVER
0                                         ->IWTRAN
0                                         ->IPOND
0                                         ->IWCINT
0                                         ->IROLL
0                                         ->IWIND
0                                         ->ITIDE
0                                         ->IVEG
     1.0000                                ->DXC
     0.8000                                ->GAMMA
     0.0200                               ->RWH
0                                         ->ILAB
5                                         ->NWAVE
5                                         ->NSURGE
       0.00     8.0000     2.1000     0.0000
    3600.00     8.0000     2.2000     0.0000
    7200.00     8.0000     2.3000     0.0000
   10800.00     8.0000     2.4000     0.0000
   14400.00     8.0000     2.5000     0.0000
   18000.00     8.0000     2.6000     0.0000
       0.00     0.0000
    3600.00     0.5000
    7200.00     0.8660
   10800.00     1.0000
   14400.00     0.8660
   18000.00     0.5000
301                                  ->NBINP
     0.0000    -8.0000     0.0150
     1.0000    -8.0000     0.0150
     2.0000    -8.0000     0.0150
     3.0000    -8.0000     0.0150
     4.0000    -8.0000     0.0150
     5.0000    -8.0000     0.0150
     .
     .
```

```
     .
   297.0000     7.7600     0.0150
   298.0000     7.8400     0.0150
   299.0000     7.9200     0.0150
   300.0000     8.0000     0.0150
```

For cases including sediment transport, IPROFL=1

```
3
------------------------------------------------------------
CSHORE applied to idealized planar slope
------------------------------------------------------------
1                                         ->ILINE
1                                         ->IPROFL
0                                         ->ISEDAV
0                                         ->IPERM
1                                         ->IOVER
0                                         ->IWTRAN
0                                         ->IPOND
0                                         ->INFILT
0                                         ->IWCINT
0                                         ->IROLL
0                                         ->IWIND
0                                         ->ITIDE
0                                         ->IVEG
     1.0000                                ->DXC
     0.8000                                ->GAMMA
     0.3000     0.0448     2.6500         ->D50 WF SG
     0.0050     0.0100     0.5000     0.1000       ->EFFB EFFF SLP  SLPOT
     0.6300     0.0010                    ->TANPHI BLP
     0.0200                               ->RWH
0                                         ->ILAB
5                                         ->NWAVE
5                                         ->NSURGE
       0.00     8.0000     2.1000     0.0000
    3600.00     8.0000     2.2000     0.0000
    7200.00     8.0000     2.3000     0.0000
   10800.00     8.0000     2.4000     0.0000
   14400.00     8.0000     2.5000     0.0000
   18000.00     8.0000     2.6000     0.0000
       0.00     0.0000
    3600.00     0.5000
    7200.00     0.8660
   10800.00     1.0000
```

```
   14400.00     0.8660
   18000.00     0.5000
301                                 ->NBINP
     0.0000    -8.0000     0.0150
     1.0000    -8.0000     0.0150
     2.0000    -8.0000     0.0150
     3.0000    -8.0000     0.0150
     4.0000    -8.0000     0.0150
     5.0000    -8.0000     0.0150
     .
     .
     .
   297.0000     7.7600     0.0150
   298.0000     7.8400     0.0150
   299.0000     7.9200     0.0150
   300.0000     8.0000     0.0150
```