ADAPTIVE HYDRAULICS

A TWO-DIMENSIONAL MODELING SYSTEM
DEVELOPED BY THE COASTAL AND HYDRAULICS LABORATORY
ENGINEER RESEARCH AND DEVELOPMENT CENTER

A PRODUCT OF THE SYSTEM-WIDE WATER RESOURCES PROGRAM

QUICK REFERENCE

A List of Cards used with the Adaptive Hydraulics Modeling System

AdH Version 4. 3

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DB LID	Dirichlet - Floating stationary lid assignment
DB BCH	Dirichlet – Breaching Elevation
NB DIS	Natural - Total Discharge
NB OVL	Natural - Flow
NB OTW	Natural - Tailwater elevation
NB TRN	Natural – Transport
NB SDR	Stage - Discharge Boundary
NB SPL	Spillway Boundary
OB OF	Outflow Boundary
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Time controls

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TC TF	Final Time
TC ATF	Auto Time Step Find
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TC STH	Quasi-Unsteady solution
TC DS0	DSS start time
TC DSF	DSS final time
TC FIN	File input (currently only used for wind fields, **WND**)

OP SW2

2D SHALLOW WATER PROBLEMS

Field	Type	Value	Description
1	char	OP	Card type
2	char	SW2	Specifies 2-D shallow water problem

OP INC

INCREMENTAL MEMORY

Field	Type	Value	Description
1	char	OP	Card type
2	char	INC	Parameter
3	int	> 0	Incremental memory allocation

When additional memory is required to store new elements and nodes created by the refinement process, ADH allocates this memory in specified block sizes. If the specified size is too small, the program will continually seek additional memory, slowing the run time of the program. Alternately, if the specified size is too large, the program will require excess memory not needed to run the code.

OP TRN

TRANSPORT EQUATIONS

Field	Type	Value	Description
1	char	OP	Card type
2	char	TRN	Parameter
3	int	≥ 0	Total number of transported materials

After finding a flow solution, an associated transport problem can be solved for the specified number of transported materials. If the problem does not involve transport, zero (0) quantities are specified. If transport equations are not being modeled, no transport properties or boundary conditions may be included. This card is a required input card.

OP BLK

BLOCK SPECIFICATION FOR PRE-CONDITIONER

Field	Type	Value	Description
1	char	OP	Card type
2	char	BLK	Parameter
3	int	> 0	Number of blocks per processor, used to perform pre-conditioning

Defines how many blocks per processor are to be used in the preconditioner. These are subdividing the problem to perform a direct solve on each block and the total group of all blocks can be used to perform a coarse grid solve. Which of these options is used is specified by the "OP PRE" card.

OP NF2

SW2 GRADIENTS

Field	Type	Value	Description
1	char	OP	Card type
2	char	NF2	Parameter
			(Optional card)

OP PRE

PRE-CONDITIONER SELECTION

Field	Type	Value	Description
1	char	OP	Card type
2	char	PRE	Parameter
3	int	3 ≥ # ≥ 0	Prec_value 0 No pre-conditioning 1 one level Additive Schwarz pre-conditioning 2 two level Additive Schwarz pre-conditioning 3 two level Hybrid pre-conditioning

Iterative solver pre-conditioner.

OP BT

VESSEL MOVEMENT LIBRARY INCLUSION (ENABLE VESSEL MOVEMENT)

Field	Type	Value	Description
1	char	OP	Card type
2	char	BT	Parameter

Simulate the effects of a moving vessel on the hydrodynamics of a model. This is done using a pressure field which applies a draft equal to that of the modeled vessel. All vessel characteristics are defined in the boat definition file.

OP TEM

SECOND ORDER TEMPORAL TERM

Field	Type	Value	Description
1	char	OP	Card type
2	char	TEM	Parameter
3	real	1 ≥ # ≥ 0	Coefficient for the second order temporal scheme

The OP TEM card is included to enable second order temporal terms when solving the time derivatives so that numerical dissipation is reduced. See the 2D shallow water manual further explanation for this card.

OP TPG

PETROV-GALERKIN COEFFICIENT

Field	Type	Value	Description
1	char	OP	Card type
2	char	TPG	Parameter
3	real	0.5 ≥ # ≥ 0	Coefficient for the Petrov-Galerkin equation (optional input card) The default value is 0.5.

OP BTS

ENABLE VESSEL ENTRAINMENT

Field	Type	Value	Description
1	char	OP	Card type
2	char	BTS	Parameter

Must first include the OP BT card then the PROP card in the boat definitions file. Calculates and outputs bed shear stresses due to vessels in dyn/cms. This currently requires use of metric units.

Iteration parameter cards

IP NIT

NON-LINEAR ITERATIONS (OPTION 1)

Field	Type	Value	Description
1	char	IP	Card type
2	char	NIT	Parameter
3	int	≥ 1	Number of non-linear iterations per time step, if at NIT the tolerance is not satisfied AdH will reduce the time step and recalculate

IP FNI

NON-LINEAR ITERATIONS (OPTION 2)

Field	Type	Value	Description
1	char	IP	Card type
2	char	FNI	Parameter
3	int	≥ 1	Number of non-linear iterations per time step, even if at FNI the tolerance is not satisfied then AdH will accept the solution and proceed to the next time step

IP NTL

NON-LINEAR TOLERANCE

Field	Type	Value	Description
1	char	IP	Card type
2	char	NTL	Parameter
3	real	≥ 0	Tolerance for Non-Linear Equations

IP ITL

INCREMENT TOLERANCE

Field	Type	Value	Description
1	char	IP	Card type
2	char	ITL	Parameter
3	real	≥ 0	Tolerance for maximum change in the velocity and depth solutions

Tolerance card that allows convergence to be determined by the change in the velocity, depth and concentration solutions. By default this tolerance is zero. Users can include either the IP NTL or IP ITL to determine convergence but if both are used then only one must be satisfied for convergence to be met.

IP MIT

LINEAR ITERATIONS (OPTION 1)

Field	Type	Value	Description
1	char	IP	Card type
2	char	MIT	Parameter
3	int	≥ 1	Maximum number of linear iterations per non-linear iteration by the interative solver. If the internal linear tolerance (0.0001* NTL) is not met at MIT the solution stops and the time step size is reduced.

IP FLI

LINEAR ITERATIONS (OPTION 2)

Field	Type	Value	Description
1	char	IP	Card type
2	char	FLI	Parameter
3	int	≥ 1	Maximum number of linear iterations by the iterative solver. If the internal tolerance (0.0001 * NTL) is not met at FLI the solution will proceed to the next nonlinear iteration.

IP RTL

RUNGE-KUTTA TOLERANCE FOR REACTIVE CONSTITUENTS

Field	Type	Value	Description
1	char	IP	Card type
2	char	RTL	Parameter

IP SST

QUASI-UNSTEADY TOLERANCE

Field	Type	Value	Description
1	char	IP	Card type
2	char	SST	Parameter
3	real	> 0	Tolerance for quasi-unsteady hydrodynamic convergence

This card is used to specify the tolerance for quasi-unsteady convergence so that it can differ from the tolerance set for the transport convergence.

Material property cards

MP EVS

CONSTANT EDDY VISCOSITY

Field	Type	Value	Description
1	char	MP	Card type
2	char	EVS	Parameter
3	int	≥ 1	Material type ID number
4	real	> 0	E_{xx}
5	real	> 0	E_{yy}
6	real	> 0	E_{xy}

The eddy viscosity is representative of the turbulence generated in the spreading of momentum that is smaller than can be represented by the grid resolution. Kinematic eddy viscosity has units of L^2/T and is related to the flow itself. The kinematic eddy viscosity is expressed as a tensor in the following form:

$$\begin{matrix} EV_{xx} & EV_{xy} \\ EV_{xy} & EV_{yy} \end{matrix}$$

If the hydraulic conductivity is independent of the direction of measurement, the formation is termed *isotropic*. In the isotropic case, $EV_{xx} = EV_{yy}$ and $EV_{xy} = 0$. Another option is to set all terms in the tensor equal to 0 and declare the total viscosity through the **MP MU** card. The **MP EVS** card is required.

MP EEV

ESTIMATED EDDY VISCOSITY

Field	Type	Value	Description
1	char	MP	Card type
2	char	EEV	Parameter
3	int	≥ 1	Material type ID number
4	real	0.1 ≤ coef ≤ 1	Coefficient (default = 0.5)
5	int	1, 2, or 3	1 for isotropic (legacy) formulation, 2 for anisotropic formulation, and 3 for Smagorinsky.

The estimated eddy viscosity is used as a means to calculate the eddy viscosity needed within the model as it runs. If the **EEV** card is used in place of the **EVS** card, the user will give only a weighting factor or coefficient on the following equation and the components of the eddy viscosity are then determined. See the AdH users manual for more details.

MP MU

KINEMATIC MOLECULAR VISCOSITY

Field	Type	Value	Description
1	char	MP	Card type
2	char	MU	Parameter
3	real	≥ 0	Uniform background viscosity (kinematic molecular Viscosity, units L^2/T)

MP COR

CORIOLIS LATITUDE

Field	Type	Value	Description
1	char	MP	Card type
2	char	COR	Parameter
3	int	≥ 1	Material type ID number
4	real	-90 ≤ # ≤ 90	Latitude

The 2-D shallow water equations also include the coriolis force due to the earth's rotation. The COR card requires the material number and the latitude in decimal degrees for each material. Negative values indicate the Southern Hemisphere.

MP G

GRAVITATIONAL ACCELERATION

Field	Type	Value	Description
1	char	MP	Card type
2	char	G	Parameter
3	real	≥ 0	Value of gravity induced acceleration

The acceleration due to gravity is defined as Length/Time^2. There must be at least 2 spaces after G.

MP RHO

DENSITY

Field	Type	Value	Description
1	char	MP	Card type
2	char	RHO	Parameter
3	real	≥ 0	Density

Density should be set to values corresponding to units of kg/m^3 or slugs/ft^3. In SI units, the value is 1000 kg/m^3 and 1.94 slugs/ft^3 for English units.

MP MUC

MANNING'S UNITS CONSTANT

Field	Type	Value	Description
1	char	MP	Card type
2	char	MUC	Parameter
3	real	> 0.0	Coefficient (1.486 for English units, 1.0 for SI standard)

The Manning's units constant is used to keep the units proper for shear stress calculation.

MP DTL

WETTING/DRYING LIMITS

Field	Type	Value	Description
1	char	MP	Card type
2	char	DTL	Parameter
3	real	≥ 0.0	Depth below which stability parameters are included, default is 0.0

Allow areas of the mesh to become dry and then wet again as the flow varies over time. The limit specified on the **DTL** card does NOT represent a depth below or above which the node is dry or wet, rather the value describes parameters that control the shock capturing and stability parameters applied within AdH. Nodes in AdH are considered dry when the depth at the node falls below 0.0, and wet when the depth is greater than 0.0 . The model does not have to begin completely wet and as time progresses it will wet and dry as necessary. This card is not required, but the limit will default to 0.0 if no other value is given.

MP DF

TURBULENT DIFFUSION RATE

Field	Type	Value	Description
1	char	MP	Card type
2	char	DF	Parameter
3	int	≥ 1	Material type ID number
4	int	> 0	Constituent ID number
5	real	≥ 0.0	Turbulent Diffusion Rate

The turbulent diffusion is set on this card for transported constituents and must be included when using the **EVS** option. The **DF** values for turbulent diffusion of constituent calculations will override the **EEV** values in wet/dry elements when included in the boundary condition file.

MP WND

WIND STRESS

Field	Type	Value	Description
1	char	MP	Card type
2	char	WND	Parameter
3	char	STR	Parameter
3	int	≥ 1	Material type ID number
4	real	0,1,2	Wind transform (0 = no transform, 1 = Wu, and 2 = Teeter**)**

Alternative wind formulations for different materials within AdH can be used by including the MP WND STR control card and specifying different wind stress computations for different areas of the domain. The default calculation of wind shear utilizes the Wu transformation. The following example tells AdH to use two different wind stress calculations for the two different material types. The Wu transformation is specified by “1” and the Teeter method by “2”. If wind stresses are supplied to the model then a “0” transformation option can be specified meaning that no computations will be performed to convert the supplied data.

MP WAT

WIND ATTENUATION

Field	**Type**	**Value**	**Description**
1	char	MP	Card type
2	char	WAT	Parameter
3	int	≥ 1	Material type ID number
4	real	0 ≤ #coef ≤ 1	Fraction applied to wind stress

The wind attenuation card is available to modify the wind stress by material. This is a means to account for structures or vegetation affecting the wind that are not included in the model's definition. The default is 1.0 such that the wind is applied fully. As the fraction decreases, less of the wind stress is applied for the specified material region.

MP ML

REFINEMENT LEVELS

Field	**Type**	**Value**	**Description**
1	char	MP	Card type
2	char	ML	Parameter
3	int	≥ 1	Material type ID number
4	int	≥ 0	Maximum number of refinement levels

MP SRT

FLOW REFINEMENT TOLERANCES

Field	**Type**	**Value**	**Description**
1	char	MP	Card type
2	char	SRT	Parameter
3	int	≥ 1	Material type ID number
4	real	≥ 0	Error tolerance for the refinement terms

The hydrodynamic equations solution error tolerance.

MP TRT

TRANSPORT CONSTITUENT REFINEMENT TOLERANCE

Field	Type	Value	Description
1	char	MP	Card type.
2	char	TRT	Parameter.
3	int	≥ 1	Material type ID number
4	int	≥ 1	Constituent ID number

5	real	≥ 0	Error tolerance for refinement terms

The transport equations solution error tolerance. Used when transport quantities are included in the model.

If the solution error on an element exceeds the refine error tolerance given, the element is split. This card is only a tolerance, however. The material must be set to allow refinement in order for any adaption to occur. The unrefine tolerance is currently set within the code as 10% of the refine tolerance. When the grid solution error improves, the elements are recombined. Different material types can have different levels of refinement. Some experimentation with the error tolerance is usually necessary to gain the desired level of refinement.

In models with transport, the larger of the flow refinement or the transport refinement will determine each element's value in the *project_name*_err.dat file. However, the non-normalized residual errors are provided for the hydrodynamics in the *project_name*_err_hydro.dat file and for the transport in the *project_name*_err_con#.dat file.

MP NBL

NUMBER OF SEDIMENT BED LAYERS

Field	Type	Value	Description
1	char	MP	Card type
2	char	NBL	Parameter
3	int	≥ 0	Number of bed layers for sediment transport (layer number begins with the bottom-most layer)

MP SBN

SEDIMENT BED INITIALIZATION APPLIED TO SELECTED NODES

Field	Type	Value	Description
1	char	MP	Card type
2	char	SBN	Parameter
3	int	> 0	Bed layer ID number
4	int	> 0	The node number from which to start
5	int	> 0	The node number at which to end
6	real	≥ 0.0	The bed layer thickness
7	real	≥ 0.0	The grain class fraction for the first sediment

8	real	≥ 0.0	The grain class fraction for the second sediment
#	real	≥ 0.0	The grain class fraction for the final sediment

Sediment bed description will be used for select nodes (the model writes over any prior designation so one could specify all first, followed by a few material types, followed by individual nodes). Layer numbering begins with the deepest layer (1st layer) and works up to the bed surface (final layer). The next numbers are the fractions of each of the sediments created with the " **CN SND**'', " **CN SLT**", or " **CN CLA**" cards. The implementation of boundary conditions is handled precisely the same as any other constituent.

MP SBA

SEDIMENT BED INITIALIZATION APPLIED TO ALL NODES

Field	Type	Value	Description
1	char	MP	Card type
2	char	SBA	Parameter
3	int	> 0	Bed layer ID number
4	real	≥ 0.0	The bed layer thickness
5	real	≥ 0.0	The grain class fraction for the first sediment
6	real	≥ 0.0	The grain class fraction for the second sediment
#	real	≥ 0.0	The grain class fraction for the final sediment.

Sediment bed description will be used for all nodes (the model writes over any prior designation so one could specify all first, followed by a few material types, followed by individual nodes). Layer numbering begins with the deepest layer (1st layer) and works up to the bed surface (final layer). The next numbers are the fractions of each of the sediments created with the " **CN SND**'', " **CN SLT**", or " **CN CLA**" cards. The implementation of boundary conditions is handled precisely the same as any other constituent.

MP SBM

SEDIMENT BED INITIALIZATION APPLIED BY MATERIAL

Field	Type	Value	Description
1	char	MP	Card type
2	char	SBM	Parameter
3	int	> 0	Bed layer ID number
4	int	> 0	Material type ID number
5	real	≥ 0.0	The bed layer thickness
6	real	≥ 0.0	The grain class fraction for the first sediment
7	real	≥ 0.0	The grain class fraction for the second sediment
#	real	≥ 0.0	The grain class fraction for the final sediment

Sediment bed description applied by material type (the model writes over any prior designation so one could specify all first, followed by a few material types, followed by individual nodes). Layer numbering begins with the deepest layer (1st layer) and works up to the bed surface (final layer). The next numbers are the fractions of each of the sediments created with the " **CN SND**'', " **CN SLT**", or " **CN CLA**" cards. The implementation of boundary conditions is handled precisely the same as any other constituent.

MP CBN

COHESIVE BED SEDIMENT PROPERTIES APPLIED TO SELECTED NODES

Field	Type	Value	Description
1	char	MP	Card type
2	char	CBN	Parameter
3	int	> 0	Bed layer ID number
4	int	> 0	The node number from which to start
5	int	> 0	The node number at which to end
6	real	≥ 0.0	The bulk density
7	real	≥ 0.0	The critical shear stress for erosion
8	real	≥ 0.0	The erosion rate constant
9	real	≥ 0.0	The erosion rate exponent

MP CBM

COHESIVE BED SEDIMENT PROPERTIES APPLIED BY MATERIAL

Field	Type	Value	Description
1	char	MP	Card type
2	char	CBM	Parameter
3	int	> 0	Bed layer ID number
4	int	> 0	Material type ID number
5	real	≥ 0.0	The bulk density
6	real	≥ 0.0	The critical shear stress for erosion
7	real	≥ 0.0	The erosion rate constant
8	real	≥ 0.0	The erosion rate exponent

MP CBA

COHESIVE BED SEDIMENT PROPERTIES APPLIED TO ALL NODES

1	char	MP	Card type
2	char	CBA	Parameter
3	int	> 0	Bed layer ID number
4	real	≥ 0.0	The bulk density

5	real	≥ 0.0	The critical shear stress for erosion
6	real	≥ 0.0	The erosion rate constant
7	real	≥ 0.0	The erosion rate exponent

MP NCP

CONSOLIDATION TIME SERIES SPECIFICATION

1	char	MP	Card type
2	char	NCP	Parameter
3	int	≥ 0	Number of time values in the consolidation time series for sediment transport

MP CPN

CONSOLIDATION TIME SERIES PROPERTIES APPLIED TO SELECTED NODES

1	char	MP	Card type
2	char	CPN	Parameter
3	int	> 0	Consolidation time value number
4	int	> 0	The node number from which to start
5	int	> 0	The node number at which to end
6	real	≥ 0.0	Elapsed time since sediment deposition (sec)
7	real	≥ 0.0	The bulk density
8	real	≥ 0.0	The critical shear stress for erosion
9	real	≥ 0.0	The erosion rate constant
10	real	≥ 0.0	The erosion rate exponent

MP CPM

CONSOLIDATION TIME SERIES PROPERTIES APPLIED BY MATERIAL

1	char	MP	Card type
2	char	CPM	Parameter
3	int	> 0	Consolidation time value number
4	int	> 0	Material type ID number
5	real	≥ 0.0	Elapsed time since sediment deposiiton (sec)
6	real	≥ 0.0	The bulk density
7	real	≥ 0.0	The critical shear stress for erosion
8	real	≥ 0.0	The erosion rate constant
9	real	≥ 0.0	The erosion rate exponent

MP CPA

CONSOLIDATION TIME SERIES PROPERTIES APPLIED BY LAYER

1	char	MP	Card type
2	char	CPA	Parameter
3	int	> 0	Consolidation time value number
4	real	≥ 0.0	Elapsed time since sediment deposiiton (sec)

5	real	≥ 0.0	The bulk density
6	real	≥ 0.0	The critical shear stress for erosion
7	real	≥ 0.0	The erosion rate constant
8	real	≥ 0.0	The erosion rate exponent

MP NDM

TURN OFF DISPLACEMENT BY MATERIAL TYPE

1	char	MP	Card type
2	char	NDM	Parameter
3	int	> 0	Material type ID number

Constituent cards

CN CON

ANY GENERIC CONSERVATIVE CONSTITUENT

Field	Type	Value	Description
1	char	CN	Card type
2	char	CON	Parameter
3	int	≥ 1	The constituent ID number
4	real	> 0	Characteristic concentration

This item describes any constituent that is passively transported. That is it doesn't settle due to its own weight or affect the flow due to its density. Sediment types other than clay, silt and sand can be categorized as a general constituent and use the `CON` card.

CN VOR

VORTICITY TRANSPORT - BENDWAY CORRECTION

Field	Type	Value	Description
1	char	CN	Card type
2	char	VOR	Parameter
3	int	≥ 1	The constituent ID number
4	real	> 0	Normalization factor
5	real	≥ 0	A_s term, default is 0.0 which sets $A_s = 5.0$
6	real	≥ 0	D_s term, default is 0.0 which sets $D_s = 0.5$

A method for correcting 2-dimensional models for the 3-dimensional effects of vorticity around bends. The vorticity is included as a transport constituent due to its constituent like behavior as it moves within the model and must therefore be included in the OP TRN card. The As and Ds terms are empirical coefficients determined by integrating against measured values. ADH used default values of A_S = 5.0 and D_S = 0.5 which will be set automatically if these terms are input as 0.0 in the boundary condition file.

CN SAL

SALINITY (BAROCLINIC TRANSPORT)

Field	Type	Value	Description
1	char	CN	Card type
2	char	SAL	Parameter
3	int	≥ 1	The constituent ID number
4	real	> 0	Reference concentration

By designating the constituent as salinity, the user expects the density of this saline constituent to impact the flow, i.e. baroclinic.

CN TMP

TEMPERATURE (BAROCLINIC TRANSPORT)

Field	Type	Value	Description
1	char	CN	Card type
2	char	TMP	Parameter
3	int	≥ 1	The constituent ID number
4	real	> 0	Reference concentration

CN CLA

COHESIVE SEDIMENT (CLAY AND/OR SILT)

Field	Type	Value	Description
1	char	CN	Card type
2	char	CLA	Parameter
3	int	≥ 1	The constituent ID number
4	real	> 0	Characteristic concentration
5	real	> 0	Grain diameter
6	real	> 1	Specific gravity
7	real	> 0	Bulk density
8	real	> 0	Critical shear for erosion
9	real	> 0	Erosion rate constant
10	real	> 0	Critical shear for deposition
11	real	> 0	Free Settling velocity

CN SND

COHESIONLESS SEDIMENT (SAND)

Field	Type	Value	Description

1	char	CN	Card type
2	char	SND	Parameter
3	int	≥ 1	The constituent ID number
4	real	> 0	Characteristic concentration
5	real	> 0	Grain diameter
6	real	> 1	Specific gravity
7	real	> 0	Grain porosity

For sand the reference concentration, like all concentration of suspended sediment in ADH, is in mass per unit mass multiplied by 1.E+6. That is, it is micromass per unit mass or parts per million.

Boundary string cards

NDS

NODE STRINGS

Field	Type	Value	Description
1	char	NDS	Card type
2	int	≥ 1	ID number of a node with a Dirichlet condition
3	int	≥ 1	String ID number

EGS

EDGE STRINGS

Field	Type	Value	Description
1	char	EGS	Card type
2	int	≥ 1	ID number of the first node of an edge element
3	int	≥ 1	ID number of the second node of an edge element
4	int	≥ 1	String ID number

MDS

MID STRINGS

Field	Type	Value	Description
1	char	MDS	Card type
2	int	≥ 1	ID number of the first node of an edge element
3	int	≥ 1	ID number of the second node of an edge element
4	int	≥ 1	String ID number

MTS

MATERIAL STRINGS

Field	Type	Value	Description
1	char	MTS	Card type
2	int	≥ 1	Material type ID number
3	int	≥ 1	String ID number

INS

ICE STRINGS

Field	Type	Value	Description
1	char	INS	Card type
2	real	#	X coordinate for center
3	real	#	Y coordinate for center
4	real	≥ 0	Radius
5	real	≥ 1	String ID number

Time Series cards

XY1

X-Y SERIES

Field	Type	Value	Description
1	char	XY1	Card type
2	int	> 0	ID number of the series
3	int	> 0	Number of points in the series
4	int	> 0	Input units. (0 = seconds; 1 = minutes; 2 = hours; 3 = days; and 4 = weeks)
5	int	> 0	Output units (0 = seconds; 1 = minutes; 2 = hours; 3 = days; and 4 = weeks)

XY2

X-Y-Y SERIES

Field	Type	Value	Description
1	char	XY2	Card type
2	int	> 0	ID number of the series
3	int	> 0	Number of points in the series
4	int	> 0	Input units. (0 = seconds; 1 = minutes; 2 = hours; 3 = days; and 4 = weeks)
5	int	> 0	Output units (0 = seconds; 1 = minutes; 2 = hours; 3 = days; and 4 = weeks)

Currently, only the data that is to be used for wind series is to be input via the X-Y-Y series.

XYC

WIND STATION COORDINATES

Field	Type	Value	Description
1	char	XYC	Card type
2	int	≥ 1	ID number of the series to which it is associated
3	real	#	X coordinate of the wind station
4	real	#	Y coordinate of the wind station
5	int		Method number:
		= 0	0 - input x and y shears in XY2 data
		= 1	1 - input x and y speeds, Wu method
		= 2	2 - input x and y speeds, Teeter method

DSS

DSS INPUT TIME SERIES DATA

Field	Type	Value	Description
1	char	DSS	Card type
2	char	*	Filename (with or without extension)
3	char	*	Full path (spaces are allowed)

This card allows the user to specify a DSS file name and a pathname from that file to use. The date in the pathname is ignored, and a time window is specified using two required time control cards. NOTE: DSS files are binary and therefore dependent on the precision of the machine used to generate them. If the DSS files are created on a 32 bit machine then a 32 bit version of AdH should be used to read them and vice versa for 64 bit.

Friction control cards

FR MNG

MANNING'S N ROUGHNESS

Field	Type	Value	Description
1	char	FR	Card type
2	char	MNG	Parameter
3	int	> 0	String ID number
4	real	≥ 0.0	Manning’s n

Either this or an equivalent roughness height must be in the boundary conditions file.

FR ERH

EQUIVALENT ROUGHNESS HEIGHT

Field	Type	Value	Description
1	char	FR	Card type
2	char	ERH	Parameter
3	int	> 0	String ID number
4	real	≥ 0.0	Roughness height

For equivalent sand roughness height, either this or a Manning's n roughness value must be included in the boundary conditions file.

FR SAV

SUBMERGED AQUATIC VEGETATION

Field	Type	Value	Description
1	char	FR	Card type
2	char	SAV	Parameter
3	int	> 0	String ID number
4	real	≥ 0.0	The effective roughness height of the SAV cover (e.g. 0.1 * the undeflected stem height)
5	real	≥ 0.0	Undeflected stem height

Friction parameters when string contains submerged aquatic vegetation.

FR URV

UN-SUBMERGED RIGID VEGETATION

1	char	FR	Card type
2	char	URV	Parameter
3	int	> 0	String ID number
4	real	> 0.0	Bed Roughness Height (not including the stems)
5	real	> 0.0	Average stem diameter
6	real	> 0.0	Average stem density

Friction parameters when a string contains unsubmerged rigid vegetation.

FR ICE

ICE THICKNESS

1	char	FR	Card type
2	char	ICE	Parameter
3	int	> 0	String ID number
4	real	> 0.0	Ice thickness
5	real	> 0.0	Ice density
6	int	= 0	0 – stationary
		= 1	1 – moving ice (not implemented yet)

FR IRH

ICE ROUGHNESS

1	char	FR	Card type
2	char	IRH	Parameter
3	int	> 0	String ID number
4	real	> 0.0	Ice roughness height

FR BRH

BED ROUGHNESS HEIGHT

1	char	FR	Card type
2	char	BRH	Parameter
3	int	> 0	String ID number
4	real	> 0.0	Bed roughness height

Solution control cards

DB OVL

DIRICHLET - VELOCITY

Field	Type	Value	Description

1	char	DB	Card type
2	char	OVL	Parameter
3	int	≥ 1	String ID number (node)
4	int	≥ 1	Series ID number for x-velocity component
5	int	≥ 1	Series ID number for y-velocity component

Typical subcritical inflow uses a node string across the entrance and a dirichlet boundary condition to specify the velocity components.

DB OVH

DIRICHLET - VELOCITY AND DEPTH

Field	Type	Value	Description
1	char	DB	Card type
2	char	OVH	Parameter
3	int	≥ 1	String ID number (node)
4	int	≥ 1	Series ID number for x-velocity component
5	int	≥ 1	Series ID number for y-velocity component
6	int	≥ 1	Series ID number for the depth

Supercritical inflow uses a node string across the entrance and a dirichlet boundary condition requiring that both components of velocity and the depth be defined.

DB TRN

DIRICHLET - TRANSPORT

Field	Type	Value	Description
1	char	DB	Card type
2	char	TRN	Parameter
3	int	≥ 1	String ID number (node)
4	int	≥ 1	Constituent ID number
5	int	≥ 1	Series ID number that contains the constituent concentration (units depend on the transport type)

DB LDE

DIRICHLET - STATIONARY LID ELEVATION

Field	Type	Value	Description
1	char	DB	Card type
2	char	LDE	Parameter
3	int	≥ 1	String ID number (node)
4	int	≥ 1	Series ID number that contains the elevation to be implemented

DB LDH

DIRICHLET - DEPTH OF WATER UNDER STATIONARY LID

Field	Type	Value	Description
1	char	DB	Card type
2	char	LDH	Parameter
3	int	≥ 1	String ID number (node)
4	int	≥ 1	Series ID number that contains the depth

DB LID

DIRICHLET - FLOATING STATIONARY OBJECT

Field	Type	Value	Description
1	char	DB	Card type
2	char	LID	Parameter
3	int	≥ 1	String ID number (node)
4	int	≥ 1	Series ID number that contains the draft of the lid

DB BCH

DIRICHLET – BREACH DISPLACEMENT

Field	Type	Value	Description
1	char	DB	Card type
2	char	LID	Parameter
3	int	≥ 1	String ID number (node)
4	int	≥ 1	Series ID number that contains the elevation of the string

NB DIS

NATURAL BOUNDARY CONDITION - TOTAL DISCHARGE

Field	Type	Value	Description
1	char	NB	Card type
2	char	DIS	Parameter
3	int	≥ 1	String ID number (edge)
4	int	≥ 1	Series ID number containing the total discharge across the string; positive in

Total flow along an edge string.

NB OVL

NATURAL BOUNDARY CONDITION - FLOW

Field	Type	Value	Description
1	char	NB	Card type
2	char	OVL	Parameter
3	int	≥ 1	String ID number (edge or face)
4	int	≥ 1	Series ID number containing the flow data; for face or material strings the series values represent the flow per unit area (positive in); for edge strings the series values represent the flow per unit length (positive in)

NB OTW

NATURAL BOUNDARY CONDITION - WATER SURFACE ELEVATION

Field	Type	Value	Description
1	char	NB	Card type
2	char	OTW	Parameter
3	int	≥ 1	String ID number (edge)
4	int	≥ 1	Series ID number that contains the time series of the water surface elevation

NB TRN

NATURAL BOUNDARY CONDITION - TRANSPORT

Field	Type	Value	Description
1	char	NB	Card type
2	char	TRN	Parameter
3	int	≥ 1	String ID number (edge)
4	int	≥ 1	Constituent ID number
5	int	≥ 1	Series ID number that contains the constituent concentration (units dependent of the transport type)

NB SDR

STAGE DISCHARGE BOUNDARY

Field	Type	Value	Description
1	char	NB	Card type
2	char	SDR	Parameter
3	int	≥ 1	String ID number
4	dbl	≥ 0	Coefficient A
5	dbl	≥ 0	Coefficient B
6	dbl	≥ 0	Coefficient C
7	dbl	≥ 0	Coefficient D
8	dbl	≥ 0	Coefficient E

NB SPL

NATURAL BOUNDARY CONDITION - SPILLWAY

Field	Type	Value	Description
1	char	NB	Card type
2	char	SPL	Parameter
3	int	≥ 1	String ID number (edge)
4	int	≥ 1	Series ID number that contains the time series of the Percent (%) flow out.

OB OF

OUTFLOW BOUNDARY

Field	Type	Value	Description
1	char	OB	Card type
2	char	OF	Parameter
3	int	≥ 1	String ID number (edge)

OUT

FLOW OUTPUT FROM INSIDE THE GRID

Field	Type	Value	Description
1	char	OUT	Card type
2	int	≥ 1	Outflow edge string
3	int	≥ 1	Inflow edge string
4	int	≥ 1	Series of outflow

WER

NUMBER OF WEIRS

Field	Type	Value	Description
1	char	WER	Card type
2	int	≥ 1	Number of weirs

WRS

WEIR PARAMETERS

Field	Type	Value	Description
1	char	WRS	Card type
2	int	≥ 1	Weir Number
3	int	≥ 1	String upstream of weir
4	int	≥ 1	String downstream of weir
5	int	≥ 1	Weir string on upstream

6	int	≥ 1	Weir string on downstream
7	real	≥ 0	Length of weir
8	real	≥ 0	Weir crest elevation
9	real	≥ 0	Weir height

FLP

NUMBER OF FLAP GATES

Field	Type	Value	Description
1	char	FLP	Card type
2	int	≥ 1	Number of flap gates

FGT

FLAP GATE PARAMETERS

Field	Type	Value	Description
1	char	FGT	Card type
2	int	≥ 1	Flap gate number
3	int	= 1	1 – User specified parameters
		= 2	2 – Automatic computation (not implemented).
4	int	≥ 1	String upstream of flap
5	int	≥ 1	String downstream of flap
6	int	≥ 1	Flap string on the upstream
7	int	≥ 1	Flap string on the downstream
8	real	≥0	Coefficient A
9	real	≥ 0	Coefficient B
10	real	≥ 0	Coefficient C
11	real	≥0	Coefficient D
12	real	≥0	Coefficient E
13	real	≥0	Coefficient F
14	real	≥0	Length of flap gate

EQ TRN

EQUILIBRIUM SAND TRANSPORT BOUNDARY CONDITION

Field	Type	Value	Description
1	char	EQ	Card type
2	char	TRN	Parameter
3	int	≥ 1	String ID number (node)
4	int	≥ 1	Constituent ID number
5	int	≥ 0	placeholder

When this condition is specified, the sediment concentration that is required for a state of equilibrium at that location is applied in suspension. An equilibrium condition is one in which no sediment would erode or deposit. The node string number where it is to be applied, the constituent number for the grain being applied, and an initial concentration value. If no sediment is included initially, then this value should be set to zero.

Time control cards

TC T0

STARTING TIME

Field	Type	Value	Description
1	char	TC	Card type
2	char	T0	Parameter
3	real	≥ 0	Starting time of the model
4	int	#	Units (optional; 0 = seconds, 1 = minutes, 2 = hours, 3 = days, 4 = weeks)

TC TF

FINAL TIME

Field	Type	Value	Description
1	char	TC	Card type
2	char	TF	Parameter
3	real	> 0	Ending time of the model
4	int	#	Units (optional; 0 = seconds, 1 = minutes, 2 = hours, 3 = days, 4 = weeks)

TC IDT

TIME STEP SIZE

Field	Type	Value	Description
1	char	TC	Card type
2	char	IDT	Parameter
3	int	> 0	Series ID number containing the length of timestep (Δt).

TC SDI

SEDIMENT TIME STEP CONTROL

Field	Type	Value	Description
1	char	TC	Card type
2	char	SDI	Parameter
3	real	> 0	The maximum allowable sediment time step. If the hydro time step exceeds this, then multiple sediment time steps

will be performed

TC STD

STEADY STATE SIMULATION

Field	Type	Value	Description
1	char	TC	Card type
2	char	STD	Steady state option turned on - omit to run dynamic simulation
3	real	> 0	Initial time step
4	real	> 0	Maximum time step

TC STH

QUASI-UNSTEADY SIMULATION

Field	Type	Value	Description
1	char	TC	Card type
2	char	STH	Parameter
3	int	> 0	Series ID number containing the steady state hydrodynamic condition
4	int	> 0	Maximum number of iterations for steady state solve
5	real	> 0	Initial time step size for steady state calculation

TC ATF

AUTO TIME STEP FIND

Field	Type	Value	Description
1	char	TC	Card type
2	char	ATF	Parameter
3	real	> 0	Initial time step size
4	int	> 0	Series ID number containing the maximum time step size

TC DS0

DSS STARTING TIME

Field	Type	Value	Description
1	char	TC	Card type
2	char	DS0	Parameter
3	char	*	Start date in format readable by DATJUL
4	char	*	Start time in format readable by IHM2M

TC DSF

DSS ENDING TIME

Field	Type	Value	Description
1	char	TC	Card type
2	char	DSF	Parameter
3	char	*	End date in format readable by DATJUL
4	char	*	End time in format readable by IHM2M

Parameters used with these two cards are dates and times, readable by the HECLIB Fortran functions, DATJUL and IHM2M, respectively. An example of the DSS card time series card is given here.

Output control cards

OC

OUTPUT

Field	Type	Value	Description
1	char	OC	Parameter
2	int	> 0	Series ID number that contains the time steps to be output

OS

AUTO-BUILD OUTPUT SERIES

Field	Type	Value	Description
1	char	OS	Card type
2	int	> 0	ID number of the series
3	int	> 0	Number of points in the series
4	int	> 0	Output units (Units 0 = seconds, 1 = minutes, 2 = hours, 3 = days, 4 = weeks)

The OS line is followed by the start time for the data output (the initial T0 and final TF values will always be saved regardless of their inclusion in this line), the final time for the data output, the time increment for the output, and the unit flag for the data in this line. See the AdH User's Manual for more information.

FLX

FLOW OUTPUT

Field	Type	Value	Description
1	char	FLX	Parameter
2	int	> 0	String ID number for the mid string or edge string for which flow is to be output

OFF

DEACTIVATE STRING

Field	Type	Value	Description
1	char	OFF	Card type
2	int	> 0	String ID number

PC ADP

ADAPTED MESH PRINTING

Field	Type	Value	Description
1	char	PC	Card type
2	char	ADP	Adaptive mesh printing turned on - omit to turn off

PC LVL

SCREEN OUTPUT FORMAT

Field	Type	Value	Description
1	char	PC	Card type
2	char	LVL	Screen output format – level 0 is default
3	int	0, 1, 2	0 gives short column format; 1 gives long column format 2 gives original AdH format

PC HOT

HOTSTART PRINT CONTROL OUTPUT

Field	Type	Value	Description
1	char	PC	Card type
2	char	HOT	Hotstart print control turned on - omit to turn off.
3	int	> 0	Number of time step increments between saving hot start file

PC ELM

NUMERICAL FISH SURROGATE OUTPUT

Field	Type	Value	Description
1	char	PC	Card type
2	char	ELM	Numerical Fish Surrogate output (optional card)

PC DSS

DSS PRINT CONTROL OUTPUT

Field	Type	Value	Description
1	char	PC	Card type
2	char	DSS	DSS output format from AdH simulation
3	int	> 0	Node string ID where DSS data is desired

This card and the node string are linked together, allowing for all data at each node in the node string to be printed to the DSS file at each output time. This creates an AdH output DSS file that shares the project name of the simulation being run.

PC MEO

MEO PRINT CONTROL OUTPUT

Field	Type	Value	Description
1	char	PC	Card type
2	char	MEO	MEO output from AdH simulation
3	int	0, 1	0 is the default (does not print), 1 prints the mass error output to screen

END

STOPPING THE MODEL

Field	Type	Value	Description
1	char	END	Close the model

SP CSV

SEDIMENT PROCESS: COHESIVE SETTLING VELOCITY

Field	Type	Value	Description
1	char	SP	Card type
2	char	CSV	Parameter
3	int	= 0	0 - Free Settling
		= 1	1 - Hwang and Mehta
4…	real	≥ 0	Process specific parameter(s)

SP WWS

SEDIMENT PROCESS: WIND WAVE SHEAR

Field	Type	Value	Description
1	char	SP	Card type
2	char	WWS	Parameter
3	int	= 0	0 – No applied wind-wave stress
		= 1	1 - Grant and Madsen
		= 2	2 - Teeter
4…	real	≥ 0.0	Process specific parameter(s)

SP NSE

SEDIMENT PROCESS: NONCOHESIVE SUSPENDED ENTRAINMENT

Field	Type	Value	Description
1	char	SP	Card type
2	char	NSE	Parameter
3	int	= 0	0 - Garcia-Parker
		= 1	1 - Wright-Parker
		= 2	2 – Van Rijn
4…	real	≥ 0.0	Process specific parameter(s)

SP NBE

SEDIMENT PROCESS: NONCOHESIVE BEDLOAD ENTRAINMENT

Field	Type	Value	Description
1	char	SP	Card type
2	char	NSE	Parameter
3	int	= 0	0 – Van Rijn
		= 1	1 – Meyer Peter Mueller
		= 2	2 – Meyer Peter Mueller with Wong Parker Correction
4…	real	≥ 0.0	Process specific parameter(s)

SP HID

SEDIMENT PROCESS: NONCOHESIVE HIDING FACTOR

Field	Type	Value	Description
1	char	SP	Card type
2	char	NSE	Parameter
3	int	= 0	0 – Karim Holly Yang
		= 1	1 - Egiazaroff
4…	real	≥ 0.0	Process specific parameter(s)

Hotstart Data Set Names

AdH requires the depth for the hotstart (initial) conditions for all simulations. Negative depths are allowable and are often better than hard zeros for dry areas. Additional data sets can be included from data available or a previous AdH simulation. The names necessary for AdH to read and understand the data are given in parenthesis.

***_dep.dat** (ioh)	Depth value
***_ovl.dat** (iov)	X, Y, and Z velocity magnitude (Z_vel = 0 for 2D)
***_con#.dat** (icon #)	Concentration (transport)
***_dpl.dat** (id)	Displacement (sediment)
***_alt.dat** (ialt)	Active layer thickness (sediment)
***_ald.dat** (iald)	Active layer distribution (sediment)

***_blt#.dat** (iblt #) Bed layer thickness (sediment)

***_bld#.dat** (ibld #) Bed layer distribution (sediment)

Footnotes

1
USAE Research and Development Center