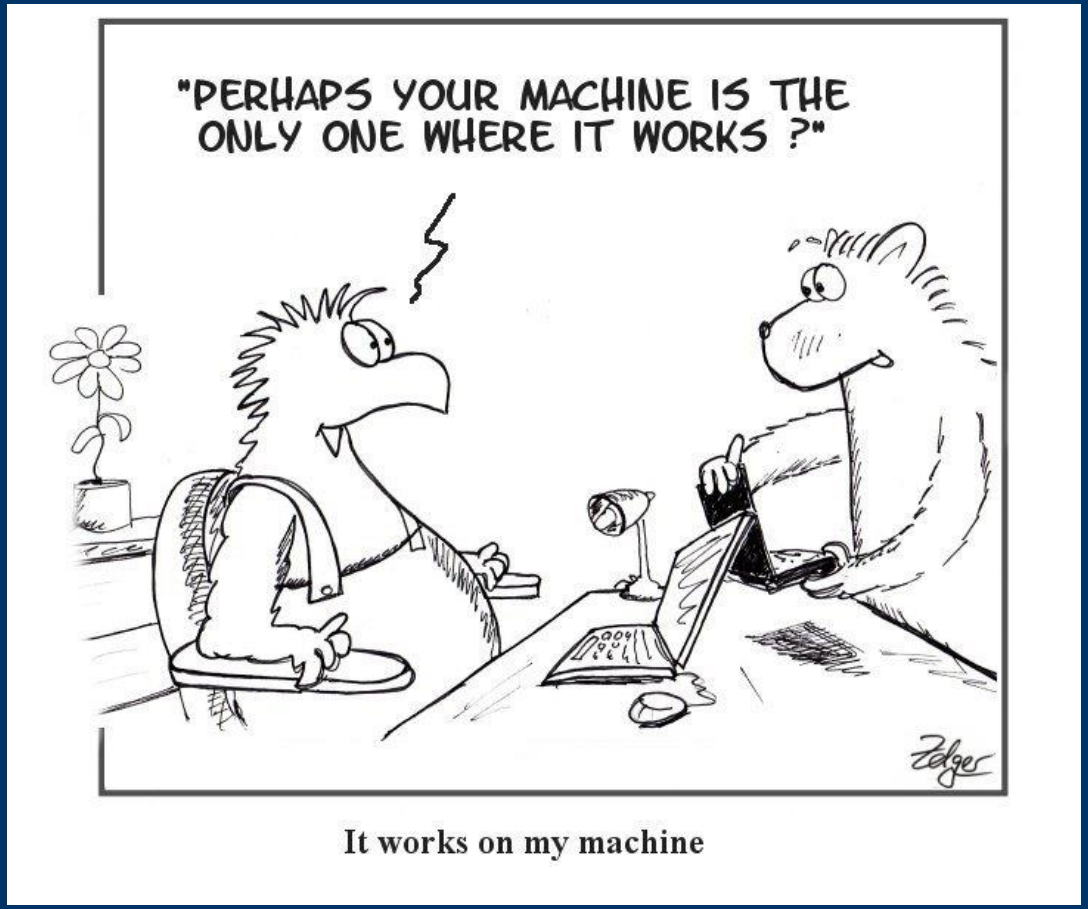
Setting up EFDC and running a simple example

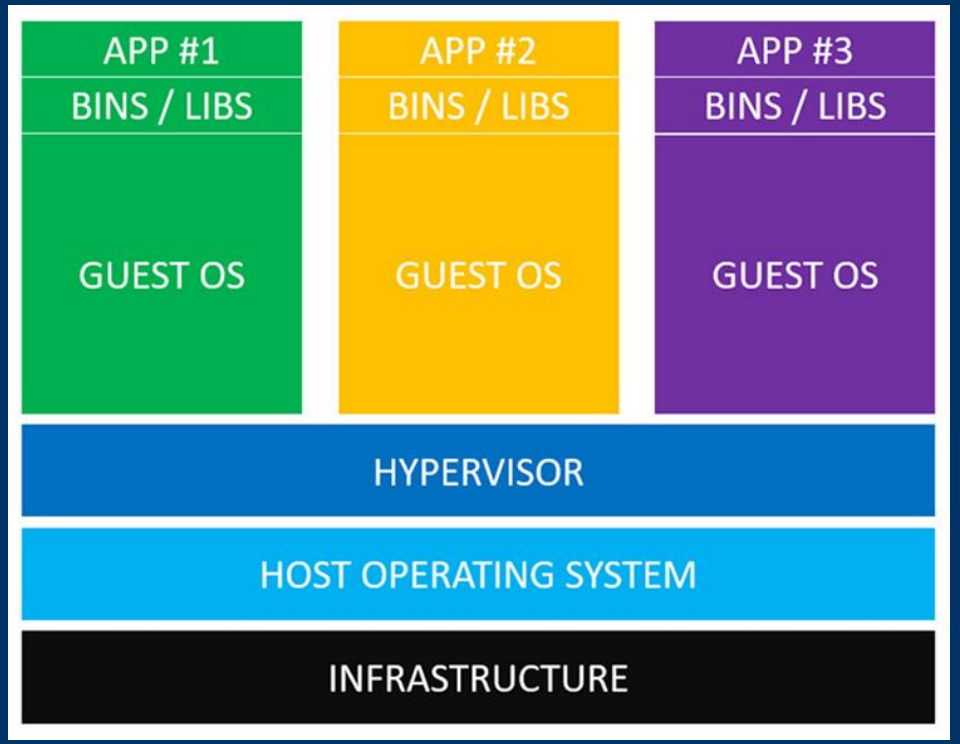
Vagrant – Crash course introduction 1



Solution – Automate the creation of local development environments right on your laptop or desktop

Vagrant – Crash course introduction 1

- Virtual Machines (VM) are created by emulating computer hardware in Software
- The emulation is provided by software called a Hypervisor
- Each Guest OS thinks it's talking to dedicated computer hardware but it is really talking to the hypervisor that is sharing a much larger system



What is VirtualBox?

- VirtualBox is a free Hypervisor that runs on OS X, Windows, and Linux
- Similar to VMware Workstation on a PC, or VMware Fusions and Parallels Desktop on a Mac
- Allows you to run your code in a virtual machine

What is Vagrant?

- Vagrant is a developers tool for creating lightweight, reproducible and portable virtual environments via command-line
- It supports VirtualBox, VMware, SoftLayer, Amazon AWS and Digital Ocean

"DevOps Principle of the Day:
AUTOMATE EVERYTHING!"

Let's get started

- Create a folder to work in
  $ mkdir lab-efdc-demo
  $ cd lab-efdc-demo

- Download the code and Vagrant configuration files
  $ git clone https://github.com/fearghalodonncha/EFDC-MPI.git

- Go from zero to running Ubuntu Trusty 64 with this simple command
  $ vagrant up

- That's it! To access our virtual machine
  $ vagrant ssh

Run our first model

- We are in root folder structure of our VM
  $ cd /vagrant/Src
  $ make

- Copy the built executable to a sample model setup configurations
  $ cp /vagrant/Src/EFDC /vagrant/SampleModels/BasicModel
  $ cd /vagrant/SampleModels/BasicModel
  $ ./EFDC

Time Parameters

```
------------------------------------------------------------------------------
C7 TIME-RELATED INTEGER PARAMETERS
*
*  NTC:     NUMBER OF REFERENCE TIME PERIODS IN RUN
*  NTSPTC:  NUMBER OF TIME STEPS PER REFERENCE TIME PERIOD
*  NLTC:    NUMBER OF LINEARIZED REFERENCE TIME PERIODS
*  NLTC:    NUMBER OF TRANSITION REF TIME PERIODS TO FULLY NONLINEAR
*  NTCPP:   NUMBER OF REFERENCE TIME PERIODS BETWEEN FULL PRINTED OUTPUT
*           TO FILE EFDC.OUT
*  NTSTBC:  NUMBER OF TIME STEPS BETWEEN USING A TWO TIME LEVEL TRAPEZOIDAL
*           CORRECTION TIME STEP, ** MASS BALANCE PRINT INTERVAL **
*  NTCNB:   NUMBER OF REFERENCE TIME PERIODS WITH NO BUOYANCY FORCING (not used)
*  NTCVB:   NUMBER OF REF TIME PERIODS WITH VARIABLE BUOYANCY FORCING
*  NTSMMT:  NUMBER OF NUMBER OF REF TIME TO AVERAGE OVER TO OBTAIN
*           RESIDUAL OR MEAN MASS TRANSPORT VARIABLES
*  NFLTMT:  USE 1 (FOR RESEARCH PURPOSES)
*  NDRYSTP: MIN NO. OF TIME STEPS A CELL REMAINS DRY AFTER INTIAL DRYING
*           -NDRYSTP FOR ISDRY=-99 TO ACTIVATE WASTING WATER IN DRY CELLS
C7   NTC  NTSPTC    NLTC    NTTC   NTCPP  NTSTBC   NTCNB  NTCVB  NTSMMT  NFLTMT NDRYSTP
      12   10286       0       0      10       4       0       0     960       1      16
 ------------------------------------------------------------------------------
C8 TIME-RELATED REAL PARAMETERS
*
*  TCON:     CONVERSION MULTIPLIER TO CHANGE TBEGIN TO SECONDS
*  TBEGIN:   TIME ORIGIN OF RUN
*  TREF:     REFERENCE TIME PERIOD IN sec (i.e. 44714.16S OR 86400S)
*  CORIOLIS: CONSTANT CORIOLIS PARAMETER IN 1/sec =2*7.29E-5*SIN(LAT)
*  ISCORV:   1 TO READ VARIABLE CORIOLIS COEFFICIENT FROM LXLY.INP FILE
*  ISCCA:    WRITE DIAGNOSTICS FOR MAX CORIOLIS-CURV ACCEL TO FILEEFDC.LOG
*  ISCFL:    1 WRITE DIAGNOSTICS OF MAX THEORETICAL TIME STEP TO CFL.OUT
*            GT 1  TIME STEP ONLY AT INTERVAL ISCFL FOR ENTIRE RUN
*  ISCFLM:   1  TO MAP LOCATIONS OF MAX TIME STEPS OVER ENTIRE RUN
*  DTSSFAC:  DYNAMIC TIME STEPPING IF 0.0.LT.DTSSFAC.LT.1.0
*
C8  TCON  TBEGIN    TREF CORIOLIS ISCORV   ISCCA   ISCFL  ISCFLM DTSSFAC
   86400       0    3600       0       0       1       1       0       0
------------------------------------------------------------------------------
```

Space Parameters

```
------------------------------------------------------------------------------
C9 SPACE-RELATED AND SMOOTHING  PARAMETERS
*
*  KC:      NUMBER OF VERTICAL LAYERS
*  IC:      NUMBER OF CELLS IN I DIRECTION
*  JC:      NUMBER OF CELLS IN J DIRECTION
*  LC:      NUMBER OF ACTIVE CELLS IN HORIZONTAL + 2
*  LVC:     NUMBER OF VARIABLE SIZE HORIZONTAL CELLS
*  ISCO:    1 FOR CURVILINEAR-ORTHOGONAL GRID (LVC=LC-2)
*  NDM:     NUMBER OF DOMAINS FOR HORIZONTAL DOMAIN DECOMPOSITION
*           ( NDM=1, FOR MODEL EXECUTION ON A SINGLE PROCESSOR SYSTEM OR
*             NDM=MM*NCPUS, WHERE MM IS AN INTEGER AND NCPUS IS THE NUMBER
*             OF AVAILABLE CPU'S FOR MODEL EXECUTION ON A PARALLEL MULTIPLE PROCESSOR SYSTEM )
*  LDM:     NUMBER OF WATER CELLS PER DOMAIN (LDM=(LC-2)/NDM, FOR MULTIPE VECTOR PROCESSORS,
*             LDM MUST BE AN INTEGER MULTIPLE OF THE VECTOR LENGTH OR
*             STRIDE NVEC THUS CONSTRAINING LC-2 TO BE AN INTEGER MULTIPLE OF NVEC )
*  ISMASK:  1 FOR MASKING WATER CELL TO LAND OR ADDING THIN BARRIERS
*            USING INFORMATION IN FILE MASK.INP
*  ISPGNS:  1 FOR IMPLEMENTING A PERIODIC GRID IN COMP N-S DIRECTION OR
*            CONNECTING ARBITRATY CELLS USING INFO IN FILE MAPPGNS.INP
*  NSHMAX:  NUMBER OF DEPTH SMOOTHING PASSES
*  NSBMAX:  NUMBER OF INITIAL SALINITY FIELD SMOOTHING PASSES
*  WSMH:    DEPTH SMOOTHING WEIGHT
*  WSMB:    SALINITY SMOOTHING WEIGHT
*
*
C
C9   KC   IC   JC   LC  LVC ISCO  NDM  LDM  ISMASK  ISPGNS  NSHMAX  NSBMAX    WSMH    WSMB
      3   15   55  563  561    1    1  561       0       0       0       0 0.03125 0.06250
------------------------------------------------------------------------------
C10 LAYER THICKNESS IN VERTICAL
*
*    K:  LAYER NUMBER, K=1,KC
*  DZC:  DIMENSIONLESS LAYER THICKNESS (THICKNESSES MUST SUM TO 1.0)
*
C10  K   DZC
     1  0.33333
     2  0.33333
     3  0.33333
------------------------------------------------------------------------------
```

Boundary Conditions - Flow

```
------------------------------------------------------------------------
C24 VOLUMETRIC SOURCE/SINK LOCATIONS, MAGNITUDES, AND CONCENTRATION SERIES
*
*  IQS:      I CELL INDEX OF VOLUME SOURCE/SINK
*  JQS:      J CELL INDEX OF VOLUME SOURCE/SINK
*  QSSE:     CONSTANT INFLOW/OUTFLOW RATE IN M*m*m/s
*  NQSMUL:   MULTIPLIER SWITCH FOR CONSTANT AND TIME SERIES VOL S/S
*            = 0  MULT BY 1. FOR NORMAL IN/OUTFLOW (L*L*L/T)
*            = 1  MULT BY DY FOR LATERAL IN/OUTFLOW (L*L/T) ON U FACE
*            = 2  MULT BY DX FOR LATERAL IN/OUTFLOW (L*L/T) ON V FACE
*            = 3  MULT BY DX+DY FOR LATERAL IN/OUTFLOW (L*L/T) ON U&V FACES
*  NQSMFF:   IF NON ZERO ACCOUNT FOR VOL S/S MOMENTUM FLUX
*            = 1  MOMENTUM FLUX ON NEG U FACE
*            = 2  MOMENTUM FLUX ON NEG V FACE
*            = 3  MOMENTUM FLUX ON POS U FACE
*            = 4  MOMENTUM FLUX ON POS V FACE
*  IQSERQ:   ID NUMBER OF ASSOCIATED VOLUMN FLOW TIME SERIES
*  ICSER1:   ID NUMBER OF ASSOCIATED SALINITY TIME SERIES
*  ICSER2:   ID NUMBER OF ASSOCIATED TEMPERATURE TIME SERIES
*  ICSER3:   ID NUMBER OF ASSOCIATED DYE CONC TIME SERIES
*  ICSER4:   ID NUMBER OF ASSOCIATED SHELL FISH LARVAE RELEASE TIME SERIES
*  ICSER5:   ID NUMBER OF ASSOCIATED TOXIC CONTAMINANT CONC TIME SERIES
*  ICSER6:   ID NUMBER OF ASSOCIATED COHESIVE SEDIMENT CONC TIME SERIES
*  ICSER7:   ID NUMBER OF ASSOCIATED NON-COHESIVE SED CONC TIME SERIES
*  QSFACTOR: FRACTION OF TIME SERIES FLOW NQSERQ ASSIGNED TO THIS CELL
*
C24  IQS     JQS     QSSE     NQSMUL  NQSMFF  IQSERQ  ICSER1  ICSER2  ICSER3  ICSER4  ICSER5  ICSER6  ICSER7   QSFACTOR  ! ID
       3      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
       4      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
       5      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
       6      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
       7      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
       8      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
       9      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
      10      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
      11      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
      12      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
      13      53  9.0000E+01       0       0       0       0       0       0       0       0       0       0  0.0000E+00  ! Inflow
------------------------------------------------------------------------
```

Boundary - Elevation

```
------------------------------------------------------------------------------
C18 PERIODIC FORCING (TIDAL) SURF ELEV OR PRESSURE ON SOUTH OPEN BOUNDARIES
*  IPBS:     I CELL INDEX OF BOUNDARY CELL
*  JPBS:     J CELL INDEX OF BOUNDARY CELL
*  ISPBS: 0 FOR ELEVATION SPECIFIED
*         1 FOR RADIATION-SEPARATION CONDITION, ZERO TANGENTIAL VELOCITY
*         2 FOR RADIATION-SEPARATION CONDITION, FREE TANGENTIAL VELOCITY
*  NPFORS:   APPLY HARMONIC FORCING NUMBER NPFORS
*  NPSERS:   APPLY TIME SERIES FORCING NUMBER NPSERS
*  NPSERS1:  APPLY TIME SERIES FORCING NUMBER NPSERS1 FOR 2ND SERIES (NPFORT.GE.1)
*  TPCOORDS: TANGENTIAL COORDINATE ALONG BOUNDARY                    (NPFORT.GE.1)
*
C18  IPBS    JPBS   ISPBS  NPFORS  NPSERS
       3       3       0       0       1
       4       3       0       0       1
       5       3       0       0       1
       6       3       0       0       1
       7       3       0       0       1
       8       3       0       0       1
       9       3       0       0       1
      10       3       0       0       1
      11       3       0       0       1
      12       3       0       0       1
      13       3       0       0       1
------------------------------------------------------------
```

```
C ** EFDC Training, pser.inp Time Series FILE,  DDD  09/10/2017
C **   REPEATS NPSER TIMES
C **
C **   MPSER(NS)   TCPSER(NS)  TAPSER(NS)  RMULADJ(NS)  ADDADJ(NS)
C **
C **   TPSER(M,NS)  PSER(M,1,NS)   !(mpser(ns) pairs for ns=1,npser series)
         2   86400       0       1       0 ' *** ConstandHead
      0.000    0.0000
     10.000    0.0000
```

Mixing Parameters

```
------------------------------------------------------------------------------
C12 TURBULENT DIFFUSION PARAMETERS
*
*  AHO:      CONSTANT HORIZONTAL MOMENTUM AND MASS DIFFUSIVITY m*m/s
*  AHD:      DIMESIONLESS HORIZONTAL MOMENTUM DIFFUSIVITY (ONLY FOR ISHDMF>0)
*  AVO:      BACKGROUND, CONSTANT OR EDDY (KINEMATIC) VISCOSITY m*m/s
*  ABO:      BACKGROUND, CONSTANT OR MOLECULAR DIFFUSIVITY m*m/s
*  AVMN:     MINIMUM KINEMATIC EDDY VISCOSITY m*m/s
*  ABMN:     MINIMUM EDDY DIFFUSIVITY m*m/s
*  VISMUD:   CONSTANT FLUID MUD VISCOSITY m*m/s
*  AVCON:    EQUALS ZERO FOR CONSTANT VERTICAL MOLECULAR VISCOSITY AND DIFFUSIVITY
*              WHICH ARE SET EQUAL TO AVO AND ABO, OTHERWISE SET TO 1.0
*  ZBRWALL:  SIDE WALL LOG LAW ROUGHNESS HEIGHT
*  ISAVBMN:  SET TO 1 TO ACTIVATE MIN VIS AND DIFF OF AVMN AND ABMN
*  ISFAVB:   SET TO 1 TO SQRT FILTER AVO AND ABO
*  ICHKCOUR: 0 - NO COURANT NUMBER DIAGNOSTICS
*            1 - WRITE COURANT NUMBER DIAGNOSTICS TO CFLMAX.OUT
*
C12  AHO     AHD     AVO     ABO    AVMN    ABMN   VISMUD  AVCON ZBRWALL ISAVBMN  ISFAVB  ICHKCOUR
       0       1 .000001   1E-08   1E-12   1E-12       0       1   1E-30       0       1       0
------------------------------------------------------------------------------
C13 TURBULENCE CLOSURE PARAMETERS
*
*  VKC:    VON KARMAN CONSTANT
*  CTURB1: TURBULENT CONSTANT (UNIVERSAL)
*  CTURB2: TURBULENT CONSTANT (UNIVERSAL)
*  CTE1:   TURBULENT CONSTANT (UNIVERSAL)
*  CTE2:   TURBULENT CONSTANT (UNIVERSAL)
*  CTE3:   TURBULENT CONSTANT (UNIVERSAL)
*  QQMIN:  MINIMUM TURBULENT INTENSITY SQUARED
*  QQLMIN: MINIMUM TURBULENT INTENSITY SQUARED * LENGTH-SCALE
*  DMLMIN: MINIMUM DIMENSIONLESS LENGTH SCALE
*
C13 VKC   CTURB1  CTURB2    CTE1    CTE2    CTE3   QQMIN  QQLMIN  DMLMIN
      .4    16.6    10.1     1.8    1.33     .53   1E-08   1E-12   .0001
------------------------------------------------------------------------------
```

Mixing Parameters

```
------------------------------------------------------------------------------
C12 TURBULENT DIFFUSION PARAMETERS
*
*  AHO:      CONSTANT HORIZONTAL MOMENTUM AND MASS DIFFUSIVITY m*m/s
*  AHD:      DIMESIONLESS HORIZONTAL MOMENTUM DIFFUSIVITY (ONLY FOR ISHDMF>0)
*  AVO:      BACKGROUND, CONSTANT OR EDDY (KINEMATIC) VISCOSITY m*m/s
*  ABO:      BACKGROUND, CONSTANT OR MOLECULAR DIFFUSIVITY m*m/s
*  AVMN:     MINIMUM KINEMATIC EDDY VISCOSITY m*m/s
*  ABMN:     MINIMUM EDDY DIFFUSIVITY m*m/s
*  VISMUD:   CONSTANT FLUID MUD VISCOSITY m*m/s
*  AVCON:    EQUALS ZERO FOR CONSTANT VERTICAL MOLECULAR VISCOSITY AND DIFFUSIVITY
*              WHICH ARE SET EQUAL TO AVO AND ABO, OTHERWISE SET TO 1.0
*  ZBRWALL:  SIDE WALL LOG LAW ROUGHNESS HEIGHT
*  ISAVBMN:  SET TO 1 TO ACTIVATE MIN VIS AND DIFF OF AVMN AND ABMN
*  ISFAVB:   SET TO 1 TO SQRT FILTER AVO AND ABO
*  ICHKCOUR: 0 - NO COURANT NUMBER DIAGNOSTICS
*            1 - WRITE COURANT NUMBER DIAGNOSTICS TO CFLMAX.OUT
*
C12  AHO     AHD     AVO     ABO    AVMN    ABMN   VISMUD  AVCON ZBRWALL ISAVBMN  ISFAVB  ICHKCOUR
       0       1 .000001   1E-08   1E-12   1E-12       0       1   1E-30       0       1       0
------------------------------------------------------------------------------
C13 TURBULENCE CLOSURE PARAMETERS
*
*  VKC:    VON KARMAN CONSTANT
*  CTURB1: TURBULENT CONSTANT (UNIVERSAL)
*  CTURB2: TURBULENT CONSTANT (UNIVERSAL)
*  CTE1:   TURBULENT CONSTANT (UNIVERSAL)
*  CTE2:   TURBULENT CONSTANT (UNIVERSAL)
*  CTE3:   TURBULENT CONSTANT (UNIVERSAL)
*  QQMIN:  MINIMUM TURBULENT INTENSITY SQUARED
*  QQLMIN: MINIMUM TURBULENT INTENSITY SQUARED * LENGTH-SCALE
*  DMLMIN: MINIMUM DIMENSIONLESS LENGTH SCALE
*
C13 VKC   CTURB1  CTURB2    CTE1    CTE2    CTE3   QQMIN  QQLMIN  DMLMIN
      .4    16.6    10.1     1.8    1.33     .53   1E-08   1E-12   .0001
------------------------------------------------------------------------------
```

Results
North direction velocity