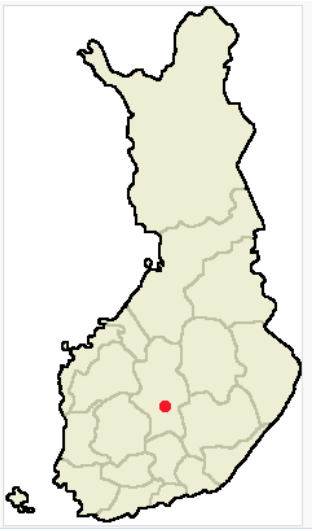
15.11.2016

Timo Huttula; Course on: Modeling in aquatic environment

Exercise 3.

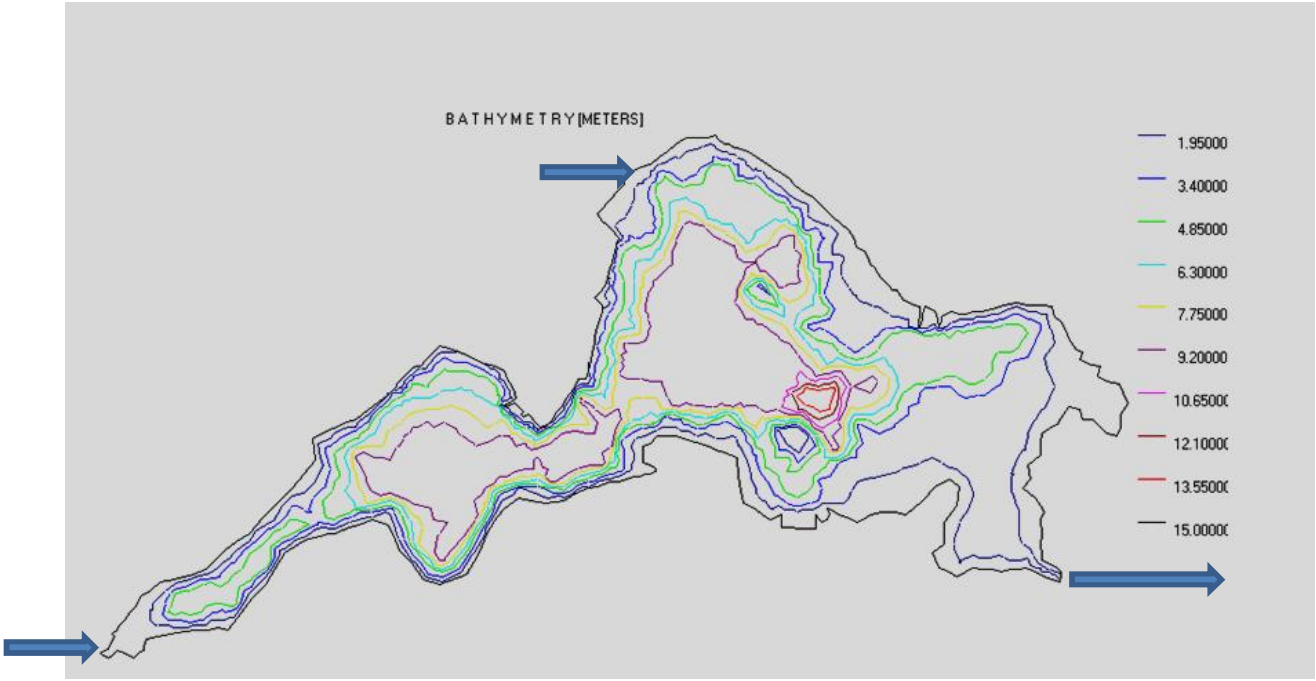
In this exercise we will use two dimensional lake model (FemFlow) for studying lake circulation and buoyant particle transport in it. Later model will be used for demonstrating suspended sediment transport. The model has been developed by Victor Podsetchine[i]. Papers describing the model are found on the course web site. You see the location of this lake in the map below. Also it's basic data is shown below.

Location	Finland
Coordinates	62.24°N 25.77°E
Primary outflows	Äijälänsalmi
Basin countries	Finland
Surface area	3.3 km²
Average depth	7 m (23 ft)
Max. depth	25 m (82 ft)
Surface elevation	78.3 m (257 ft)
Islands	1
Settlements	Jyväskylä

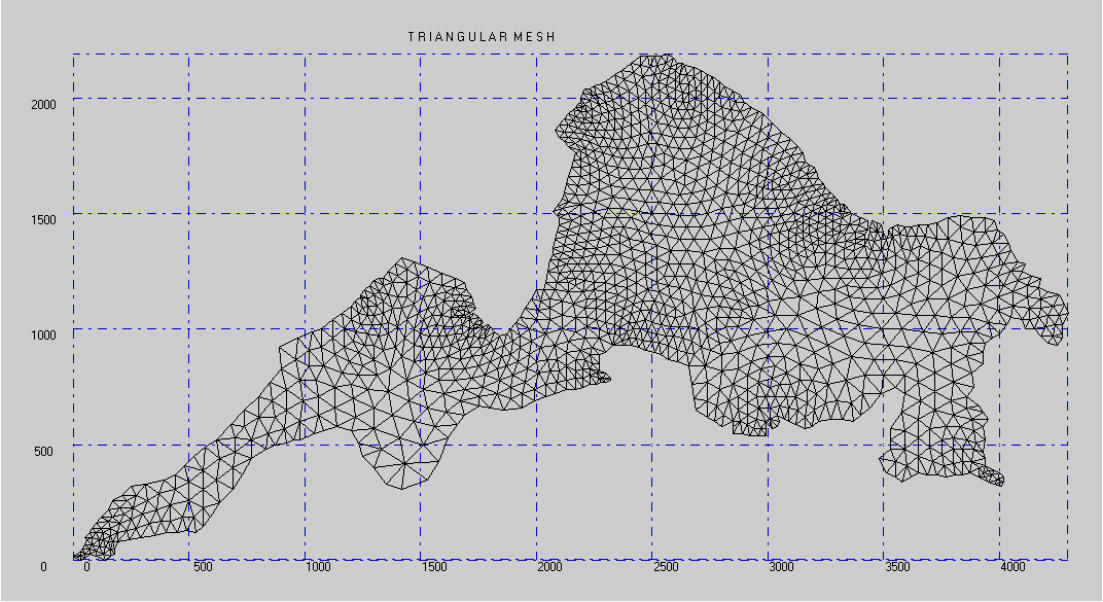


Jyväsjärvi map:

The bathymetric data of the lake is seen on the map below. Inflows and outflow are marked with blue lines.



In the model lake is divided to triangular mesh. The origo of coordinate system is on the left in the lower corner.



Parameter values:

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Jyväsjärvi - v. 1.0 PREC/Univ. of Jyvaskyla - 26.08.2002 VP
72                          ! Total integration (simulation) time (hours)
15.                         ! Integration timesteps of the simulation (sec)
600.0                       ! Timestep for sediment transport (Very large time step->SS module is not used)
0.25                        ! Output after integration time of x hours
1.0                         ! Time interval for model run message (hours)
0                           ! Coordinate units (0:m; 1:km)
1                           ! Check of input data (1:yes; 0:no)
0                           ! Print of input data file ECHOPR.OUT (1:yes; 0:no)
0                           ! Numbers of boundary nodes with fixed X-flow component
0                           ! Nodes with fixed water elevation
0                           ! Nodes with fixed Suspended Sediments (SS) concentration (not used)
0                           ! Numbers of nodes on open boundary
1.287E-4                    ! Coriolis force (latitude (case) dependent)
3.2E-6                      ! Wind drag force (empirical value)
0.25                        ! Turbulent exchange coefficient (0.01-100 m2/s)
0.25                        ! Turbulent diffusion coefficient - X component (SS part)
0.25                        ! Turbulent diffusion coefficient - Y component (SS part)
10.e-6                      ! Median (50%) SS grain size (m)
90.e-6                      ! 90% SS grain size (m)
0.00082                     ! Settling velocity (m/sec)
0.02                        ! Critical deposition shear stress (N/sq.m)
0.008                       ! Critical erosion shear stress (N/sq.m)
3.00                        ! Power of erosion term E=matconst*[(tbeff/tcrit_er-1.)**pow_er]
2.000E-05                   ! Material constant (g/sq.m/sec)
10.00                       ! Initial SS concentration (g/cubic meter)
60                          ! WMINT-wind recording interval(secs) info
Tuuli_04062003_3_vrk.txt    ! WINFNAM - wind data file name(<=30 characters)
roughint.inp                ! RGHFNAM - Manning roughness data file name(<=30 characters)
4                           ! Number of "mooring stations" (<=10) for extra output
989 666 224 237             ! nodes of these stations
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[i] Podsetchine, V. and Schernewski, G. (1999). The influence of spatial wind inhomogeneity on flow patterns in a small lake. Wat. Res., 33(15), 3348–3356.