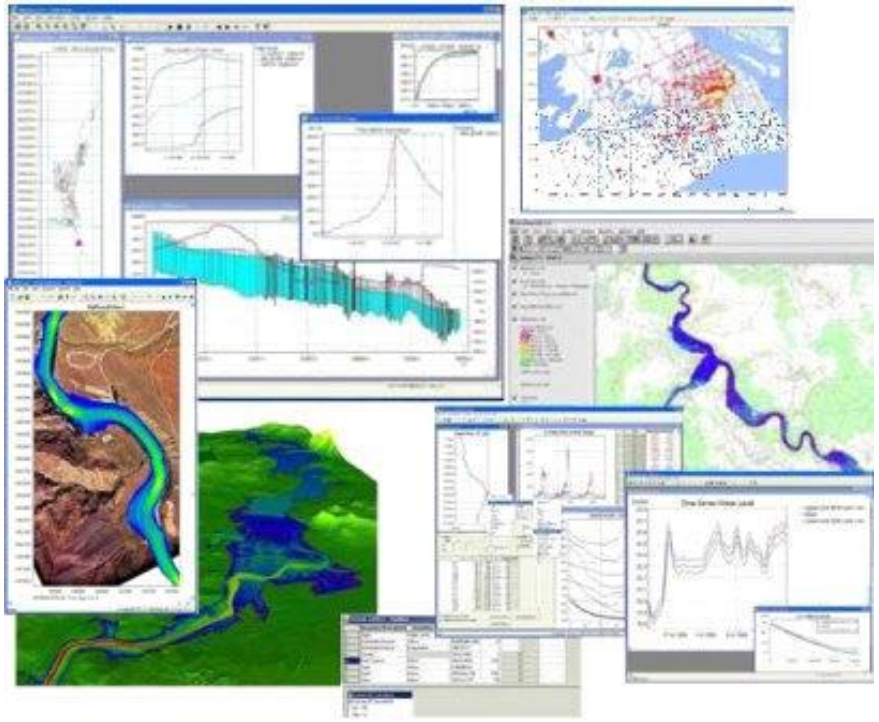
River Modelling



Assignment1: 1D Model Set-Up

Unsteady Model

Modelling Process

Typical Modelling Steps

- data collection and pre-analysis and -processing
- **model set-up (unsteady model)**
- model calibration
- model validation
- model application
- data post-processing
- ….

Model Set-Up: unsteady simulation

Model Scenario

- unsteady model set-up
  -> space and time discretization
  -> type of boundary conditions (Q upstream, Q/H downstream)
  -> model target definition (draught, flood, …)
- scenario definition and selection
  -> selection of specific time window (past)
  -> definition of artificial scenario (future)
- steady model can be used for initial conditions
  -> BC update: Q -> situation at begin of simulation window
  -> hotstart option

Model Set-Up: unsteady simulation

Model Set-Up Specification

- space discretization
  - -> MIKE11 cross section distance 500 m
  - -> HEC-RAS (limit 500 cross sections) selection
- time discretization
  - -> fixed time step (e.g. 5 min)
  - -> sensitive analysis / adaptive time step
- type of boundary condition
  - -> upstream Q time series
  - -> downstream H time series, Q/H relationship

Model Set-Up: unsteady simulation

Stammdaten des Pegels: Ruhrort / Rhein

Lage des Pegels (Fluß-km):	**780,80**	**rechte Seite**
Pegelnullpunkt (PNP):	**16,10**	**NHN+m**
Oberirdisches Einzugsgebiet (AEo):	**152895**	**km²**
Pegelnummer:		**2770010**
Bundesland:		**Nordrhein-Westfalen**
Betreiber:	**Wasser- und Schifffahrtsamt Duisburg-Rhein**	
Gebietskennzahl:		**2771 100**
TK 25:		**4506**
Koordinaten:	**R:**	**3.342.154**
(GK 3, Bessel 1841, DHDN)	**L:**	**5.704.752**
Beginn der Aufzeichnung:		**1.1.1818**

NQ		**m³/s**
GIQ(2012)	**1028**	**m³/s**
MNQ(1911-2011)	**1058**	**m³/s**
MQ(1911-2010)	**2236**	**m³/s**
HQ_1(1911-2010)	**5714**	**m³/s**
MHQ(1911-2010)	**6511**	**m³/s**
HQ_2(1911-2010)	**6959**	**m³/s**
HSQ I	**7336**	**m³/s**
HQ_5(1911-2010)	**8370**	**m³/s**
HQ_{10}	**9470**	**m³/s**
HSQ II	**10869**	**m³/s**
HQ_{20}		**m³/s**
HQ_{50}	**11500**	**m³/s**
HQ_{100}	**12400**	**m³/s**
HQ_{200}	**13400**	**m³/s**
HQ_{extrem}	**15800**	**m³/s**
NNW(07.11.1971)	**158**	**cm a.P**
GIW(2012)	**233**	**cm a.P**
MNW(2001-2011)	**238**	**cm a.P**
MW(2001-2011)	**426**	**cm a.P**
HSW I	**930**	**cm a.P**
HSW II	**1130**	**cm a.P**
HHW(02.01.1926)	**1300**	**cm a.P**

Model Set-Up: unsteady simulation

Stammdaten des Pegels: Wesel / Rhein

Lage des Pegels (Fluß-km):	**814,00**	**rechte Seite**
Pegelnullpunkt (PNP):	**11,22**	**NHN+m**
Oberirdisches Einzugsgebiet (AEo):	**154210**	**km²**
Pegelnummer:		**2770040**
Bundesland:		**Nordrhein-Westfalen**
Betreiber:	**Wasser- und Schifffahrtsamt Duisburg-Rhein**	
Gebietskennzahl:		**2779 000**
TK 25:		**4305**
Koordinaten:	**R:**	**3.334.432**
(GK 3, Bessel 1841, DHDN)	**L:**	**5.726.244**
Beginn der Aufzeichnung:		**1.1.1815**

NQ		**m³/s**
GIQ(2012)	**1041**	**m³/s**
MNQ(1911-2011)	**1072**	**m³/s**
MQ(1911-2010)	**2255**	**m³/s**
HQ_1(1911-2010)	**5679**	**m³/s**
MHQ(1911-2010)	**6464**	**m³/s**
HQ_2(1911-2010)	**6898**	**m³/s**
HSQ I	**7055**	**m³/s**
HQ_5(1911-2010)	**8285**	**m³/s**
HQ_{10}	**9450**	**m³/s**
HSQ II	**10551**	**m³/s**
HQ_{20}		**m³/s**
HQ_{50}	**11500**	**m³/s**
HQ_{100}	**12400**	**m³/s**
HQ_{200}	**13400**	**m³/s**
HQ_{extrem}	**15800**	**m³/s**
NNW(01.10.2003)	**111**	**cm a.P**
GIW(2012)	**177**	**cm a.P**
MNW(2001-2011)	**180**	**cm a.P**
MW(2001-2011)	**378**	**cm a.P**
HSW I	**870**	**cm a.P**
HSW II	**1060**	**cm a.P**
MHW(2001-2011)		**cm a.P**
HHW(03.01.1926)	**1116**	**cm a.P**

Model Set-Up: unsteady simulation

Model Set-Up Specification

- model target: flood situation
- scenario definition: typical flood event
- characteristic of Rhein section (100 years: 1911-2011)

	Ruhrort	Wesel	
MNQ	1058	1072	mean low discharge
MQ	2236	2255	mean discharge
MHQ	6511	6464	mean high discharge
HQ10	9470	9450	flood return period 10 years
HQ50	11500	11500	flood return period 50 years
HQ100	12400	12400	flood return period 100 years
HQ200	13400	13400	flood return period 200 years
HQextrem	15800	15800	rare event with high water level (regression Q/H)

Nov 1998 9104 -> ~ HQ10
Jan 1995 11887 -> ~ HQ50

Model Set-Up: unsteady simulation

Model Set-Up Specification

- time window
  -> HQ10 -> 01 Oct 1998 – 30 Nov 1998
- boundary condition
  -> upstream HYMOG Q_Ruhrort time series
  -> downstream Q/H relationship 1996/2005
- initial condition
  -> steady state for Q (01 Oct 1998)
  -> Mike11: steady state
  -> 20 year simulation -> hotstart (01 Oct 1998)