

**Ирригация ва мелиорация  
йўналишида таълим ва илм  
мақсадида моделлардан  
фойдаланиш**

# Мавзу долзарблиги:

*Университетда ўқуш жараёнида моделлардан фойдаланиш ривожланган мамлакатлар университетларига нисбатан бир неча баравар камроқ. Буннинг натижасида:*

- Университет ўқитувчилари халқаро илмий журналларда кўпроқ мақолалар нашр этиш имкониятидан тўла фойдаланилмаслиги.
- Талабаларнинг ўқишга ва ўз билимини оширишга қизиқиши паст
- Илмий изланишларнинг якуний хулосалари кўпинча дала шароитида бажарилган илмий изланишларга асосланиб келажак башоратларини, хилма хил сценарийларни шаклантиришга имкон бермаяпти.

# Таклиф:

*Муаммога босқичли ёндашув:*

- 1) Очиқ юклаб олиш мумкин бўлган дастурларни ўқиш жараёнига ва илмий изланишларга кенг жорий қилиш;
- 2) Факультетда махсус техник шароит ва дастурлар тўпламига эга бўлган бир неча марказлар яратиш;
- 3) Бир неча дастурлардан, уларни мақсадли бирлаштирган ҳолда, фойдаланиб илмий муаммоларни ечиш.

# Очиқ дастурлар тўплами:

1. ИНА – гидрологик ўзгаришларни тахлил қилиш дастури

[www.conservationgateway.org/ConservationPractices/Freshwater/EnvironmentalFlows/MethodsandTools/IndicatorsofHydrologicAlteration/Pages/ИНА-Software-Download](http://www.conservationgateway.org/ConservationPractices/Freshwater/EnvironmentalFlows/MethodsandTools/IndicatorsofHydrologicAlteration/Pages/ИНА-Software-Download)

2. MODFLOW – ер ости сувларини моделлаштириш дастури

<https://www.usgs.gov/software/modelmuse-a-graphical-user-interface-groundwater-models>

3. HYDRUS 1D – тупроқ намлиги ва шўрланишини башорати, суғориш кунини аниқлаш....

<https://www.pc-progress.com/en/Default.aspx?hydrus-1d>

# Очиқ дастурлар тўплами:

- **CROPSYST** = иқлим ўзгаришини экинлар ҳосилига таъсирини баҳолаш дастури

<https://www.quantitative-plant.org/model/CropSyst>

[http://bioearth.wsu.edu/cropsyst\\_model.html](http://bioearth.wsu.edu/cropsyst_model.html)

- **Visual MINTEQ** = сувдаги (тупроқдаги) ионлар ҳолатини аниқлаш дастури

<https://vminteq.com/download/>

- **DSSAT** = сув ва ўғитлардан фойдаланишнинг экинлар ҳосилига таъсирини баҳолаш

<https://dssat.net/>

<https://dssat.net/plant-growth-modules-in-dssat-csm/>

- **GAMS** = алгебраик тенгламалар тизими, сув ва энергия ресурсларини бошқариш, тақсимлаш, сув омборларини бошқариш ва бошқа масалаларини ечишда кенг қўлланадиган дастур

<https://www.gams.com/>

- **WEAP** = Сув ресурслари баҳолаш ва режалаштириш тизими

<https://www.weap.com/>



Shared methods. Smarter conservation.

Conservation Planning Conservation Practices Conservation By Geography

Conservation Gateway » Conservation Practices » Water » Environmental Flows » Methods and Tools » Indicators of Hydrologic Alteration

# IHA Software Download

## Conservation Practices

- Water
- Corporate Water Use
- Environmental Flows
  - Concepts
  - Methods and Tools
    - Environmental Flow Components
    - Hierarchy Method
    - The Savannah Process
    - ELOHA
    - Indicators of Hydrologic Alteration
  - Libraries
  - IHA Publications and Other Documents
  - Frequently Asked Questions
  - Training
    - IHA Software Download



### Indicators of Hydrologic Alteration (IHA): Software for Understanding Hydrologic Changes in Ecologically-Relevant Terms

The Indicators of Hydrologic Alteration (IHA) is a software program that provides useful information for those trying to understand the hydrologic impacts of human activities or trying to develop environmental flow recommendations for water managers. Nearly 2,000 water resource managers, hydrologists, ecologists, researchers and policy makers from around the

world have used this program to assess how rivers, lakes, and groundwater basins have been affected by human activities over time, or to evaluate future water management scenarios.

- Manual (English)
- Manual (Spanish)
- Tutorial (English)
- Tutorial (Spanish)
- Training (English)
- Training (Spanish)

### Publications & Other Documents

google.com

Google

IHA hydrological alteration

BCE ВИДЕО НОВОСТИ КАРТИНЫ

www.conservationgateway.org > ...

**Indicators of Hydrologic Alteration (IHA)**

Indicators of Hydrologic Alteration (IHA) is a software program that provides useful information for those trying to understand the hydrologic impacts of ...

www.conservationgateway.org > ...

**IHA Software Download - Conservation Gateway**

The Indicators of Hydrologic Alteration (IHA) is a software program that provides useful information for those trying to understand the hydrologic

# Гидрологик кўрсаткичлар ўзгариши (ИНА) модели кўриниши



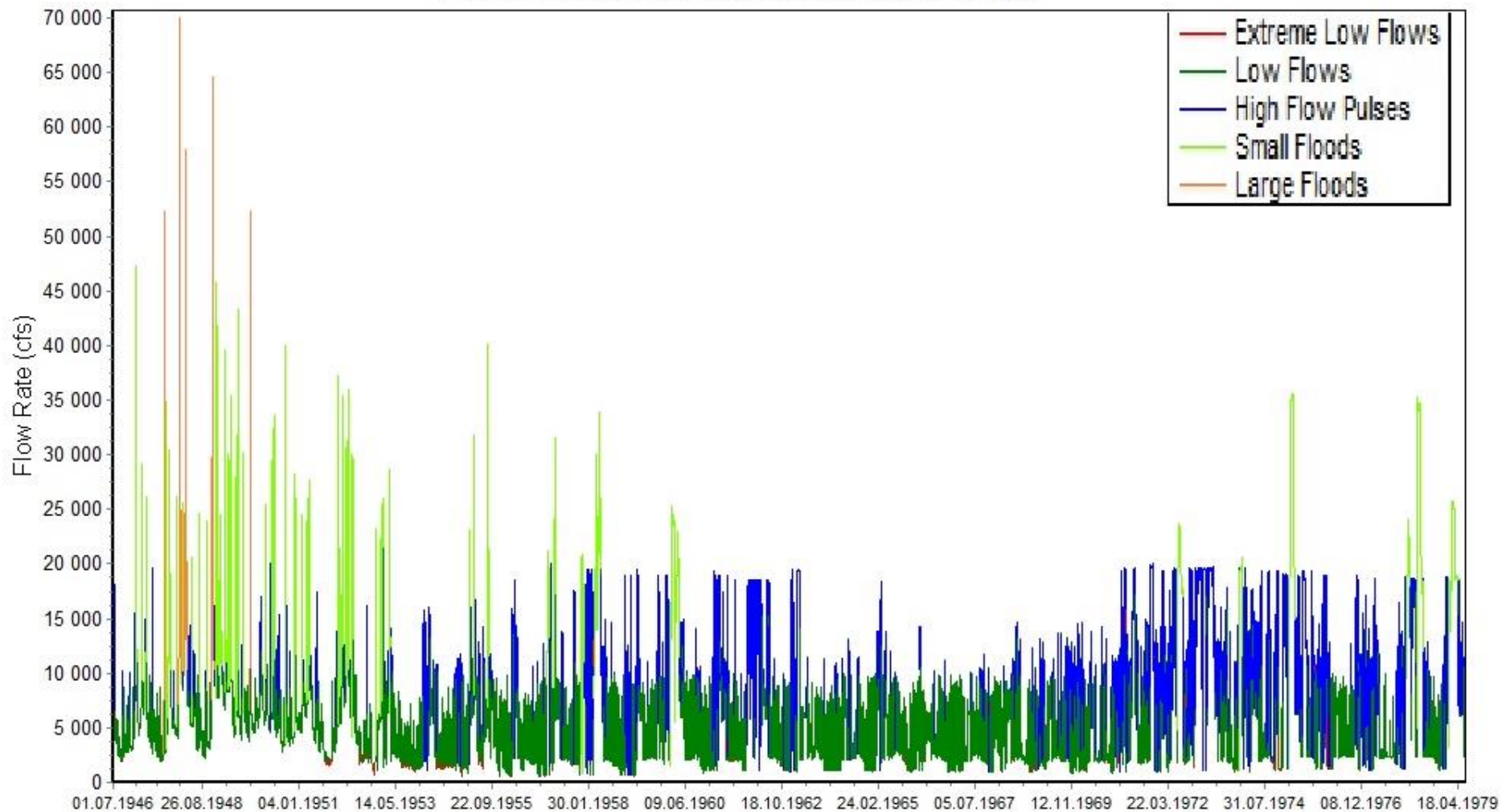


Hydrologic Alteration - [Graph: test / test1 / test1 - Environmental Flow Components (1947-1979)]

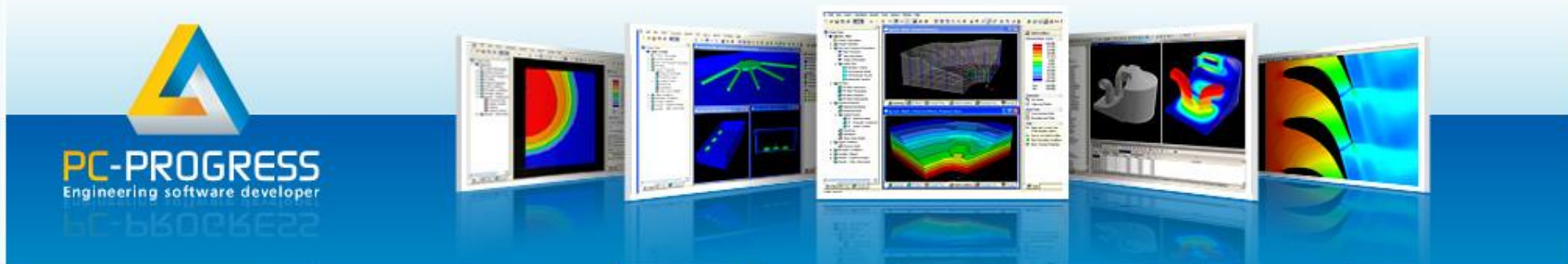
File Edit View Options Window Help



### Environmental Flow Components (1947-1979)







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- ▶ HYDRUS-1D
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- ▶ DREAM Suite
- ▶ Hydrus-2D
- ▶ COCHEM Flow

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### Announcement

**Announcement:** Note that the **Hydrus-1D** software package has been **discontinued**. While Version 4.17 of **HYDRUS-1D** will remain available to the public as is, any new developments will from now on be implemented only in **Version 5 of HYDRUS**. Note that version 4.17 of **HYDRUS-1D** has recently been fully updated and merged with **HYDRUS (2D/3D)** (version 3.04) to result in **Version 5 of HYDRUS**. New features of the one-dimensional part of Version 5 of **HYDRUS** include **new modules** [PFAS](#), [Cosmic](#), [DPU](#), [Particle Tracking](#), and [C-Ride](#), as well as updated graphical capabilities, such as two-dimensional z-t graphs of selected variables. More details about [Version 5 of HYDRUS](#).

### Hydrus-1D for Windows, Version 4.xx

**Hydrus-1D** is a **public domain** Windows-based modeling environment for analysis of water flow and solute transport in variably saturated porous media. The software package includes the one-dimensional finite element model **HYDRUS** for simulating the movement of water, heat, and multiple solutes in variably saturated media. The model is supported by an interactive graphics-based interface for data-preprocessing, discretization of the soil profile, and graphic presentation of the results.

#### Program Description

- ▶ [The Hydrus-1D Model Description](#)
- ▶ [User Interface](#)
- ▶ [Post-Processing](#)
- ▶ [System Requirements](#)
- ▶ [Source Code](#)

#### Examples and Extensions

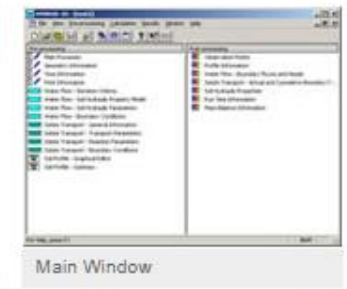
- ▶ [Hydrus-1D References](#)
- ▶ [Public Library of Hydrus-1D projects](#)
- ▶ [HP1 – Coupled H1D and PHREEQC model](#)
- ▶ [HYDRUS Package for MODFLOW](#)
- ▶ [The Unsatchem Module](#)

#### Downloads and Support

- ▶ [Hydrus-1D Downloads](#)
- ▶ [Hydrus-1D Tutorials](#)

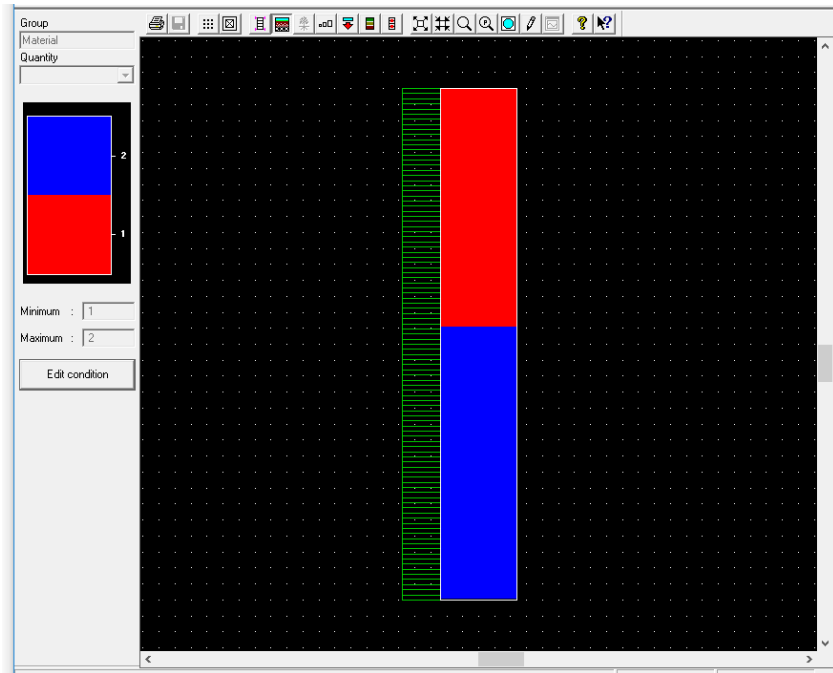
#### Other Programs

- ▶ [HYDRUS 2D/3D](#)
- ▶ [HYDRUS Reviews](#)

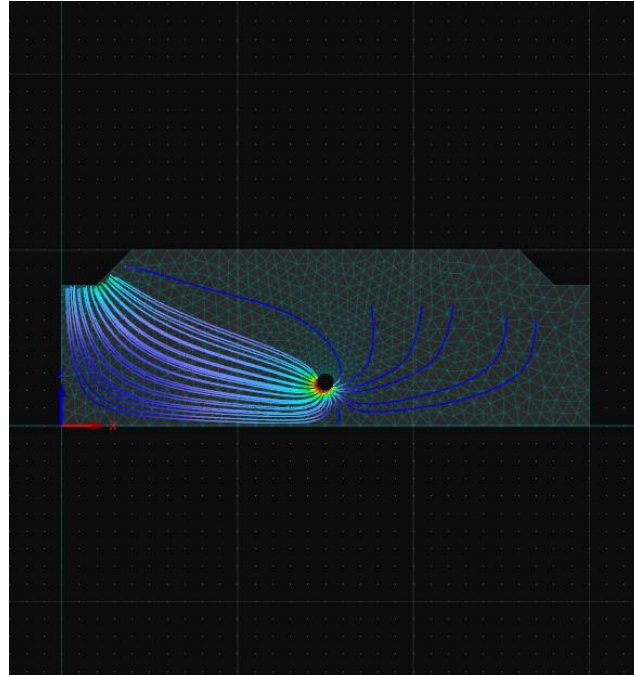


# Hydrus модели 1D, 2D 3D дастурлари

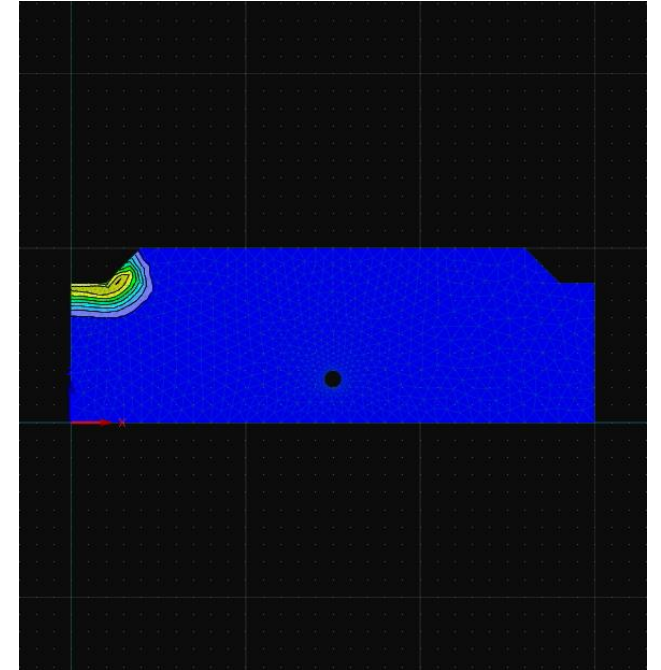
1D



2D Streamline animation



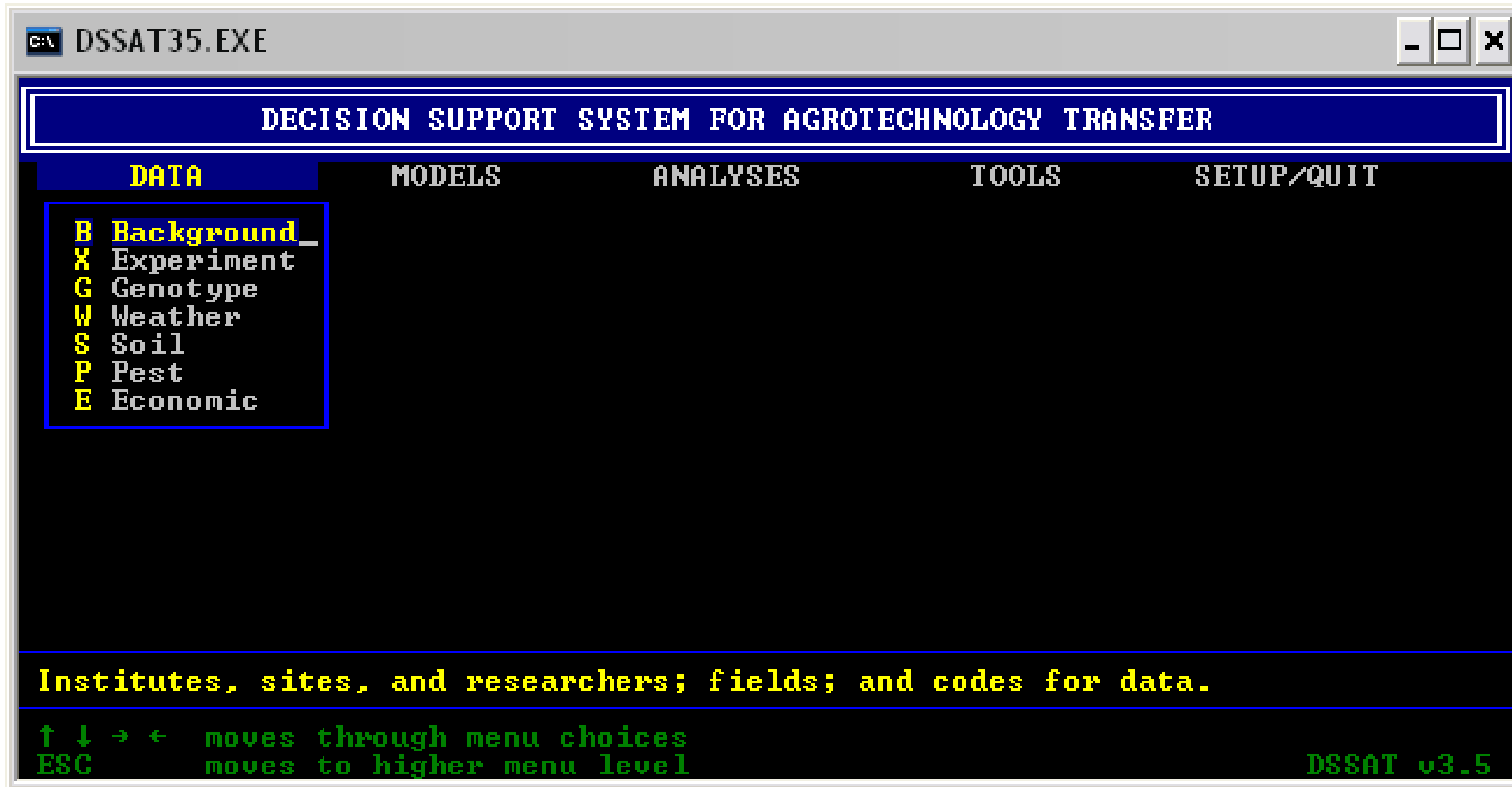
2D Concentration



# DSSAT (Decision Support System for Agrotechnology Transfer) ( Дехқончилликда Ечимларни ассослаш тизими)

Компонентлари	Характеристика
Маълумотлар базаси	Иқлим, тупроқ, генетика, зараркунандалар, тажрибалар, иқтисодиёт
Моделлар	Экинлар дастурлари (maize, wheat, rice, barley, sorghum, millet, soybean, peanut, dry bean, potato, cassava, etc.)
Дастурлар тўплами	Графика, иқлим, зараркунандалар, тупроқ, генетика, тажрибалар, иқтисодий таҳлил
Фойдаланиш мақсади	Тажрибалар натижаларини таҳлил қилиш ва ресурслардан фойдаланиш стратегиясини ишлаб чиқиш (Validation, sensitivity analysis, seasonal strategy, crop rotations)

# DSSAT моделига маълумотларни киритиш ойнаси





# DSSAT моделига маълумотларни киритиш.

## Мисол.

```
Command Prompt - dssat3
C:\DSSAT3\WEATHER\RORO6701.WTH
WEATHER : Rothamsted, England
P INSI  LAT  LONG  ELEV  TAU  AMP  REPHI  WNDHT
RORO   53.00  0.00  -99  -99  -99  -99  -99
ODATE  SRAD  TMAX  TMIN  RAIN
67060  10.3  8.9  2.2  0.0
67061  10.2  10.6  4.4  0.0
67062  4.6  10.0  3.9  0.0
67063  7.0  10.0  5.6  1.0
67064  6.3  12.2  3.9  0.0
67065  3.3  12.2  3.3  0.0
67066  7.0  10.6  5.6  4.1
67067  7.6  10.6  5.0  13.2
67068  3.1  10.6  5.0  8.1
67069  8.9  10.0  3.9  0.8
67070  10.0  7.2  2.8  0.0
67071  7.9  7.8  2.2  0.0
67072  10.0  9.4  1.7  0.0
67073  9.6  13.3  2.8  0.0
67074  11.0  11.7  6.1  0.3
67075  9.7  11.1  1.7  0.0
67076  4.3  10.0  2.8  0.5
1:1
F2 Save F3 Open Alt-F3 Close F5 Zoon F6 Next
```

Иқлим

```
Command Prompt - dssat3
C:\DSSAT3\SOIL\SOIL2.SOL
IB00000000  IBSMAT  SALO  150  DEFAULT - MEDIUM SANDY LOAM
PSITE  COUNTRY  LAT  LONG  SCS  FAMILYV
Generic  Generic  -99  -99  Generic
P SCOM  SALB  SLU1  SLDR  SLRO  SLNF  SLPF  SMHB  SMPX  SMKE
-99  0.13  6.0  0.50  70.0  1.00  1.00  IB001  IB001  IB001
P SLB  SLMN  SLLL  SDUL  SSAT  SRGF  SSKS  SBDM  SLOC  SLCL  SLSI  SLCF  SLNI
5  -99  .086  .220  .320  1.000  -99  1.61  0.70  10  30  0  .070
15  -99  .086  .220  .320  1.000  -99  1.61  0.70  10  30  0  .070
30  -99  .086  .220  .320  0.819  -99  1.61  0.66  10  30  0  .066
45  -99  .086  .220  .320  0.607  -99  1.61  0.58  10  30  0  .058
60  -99  .086  .220  .320  0.607  -99  1.61  0.58  10  30  0  .058
70  -99  .087  .219  .319  0.368  -99  1.62  0.43  10  30  0  .043
1  -99  1.62  0.26  10  30  0  .026
1  -99  1.62  0.12  10  30  0  .012
0  DEFAULT - SHALLOW SANDY LOAM
LONG SCS FAMILYV
-99 Generic
P SLPF  SMHB  SMPX  SMKE
0  1.00  IB001  IB001  IB001
Zoon F6 Next F10 Menu
```

Тупроқ

```
Command Prompt - dssat3
C:\DSSAT3\GENOTYPE\MZCER940.CUL
MAIZE GENOTYPE COEFFICIENTS - GECER940 MODEL
The P1 values for the varieties used in experiments IBWA8301 and
UFGA8201 were recalibrated to obtain a better fit for version 3
of the model.
The reason for this is that there was an error in PHASE1 in
version 2.1 that had TLNO=IFIX(SUMDIT/21.+6.) rather than
TLNO=IFIX(SUMDIT/21.+6.); see p. 74 of Jones & Kiniry.
-Walter Bowen, 22 DEC 1994.
QUARN  URNAME.....  ECON  P1  P2  P5  G2  G3  PHINT
1  2  3  4  5  6
IB0001  CORNL281  IB0001  110.0  0.300  685.0  825.4  6.60  75.00
IB0002  CP170  IB0001  120.0  0.000  685.0  825.4  10.00  75.00
IB0003  LG11  IB0001  125.0  0.000  685.0  825.4  10.00  75.00
IB0004  F7 X F2  IB0001  125.0  0.000  685.0  825.4  10.00  75.00
IB0005  P10 3995  IB0001  130.0  0.300  685.0  825.4  8.60  75.00
IB0006  INRA  IB0001  135.0  0.000  685.0  825.4  10.00  75.00
IB0007  EDO  IB0001  135.0  0.300  685.0  825.4  10.40  75.00
IB0008  A654 X F2  IB0001  135.0  0.000  685.0  825.4  10.00  75.00
IB0009  DEKALB XL71  IB0001  140.0  0.300  685.0  825.4  10.50  75.00
1:1
F2 Save F3 Open Alt-F3 Close F5 Zoon F6 Next F10 Menu
```

Экин ва унинг  
сорти





maximum flow target requirements.

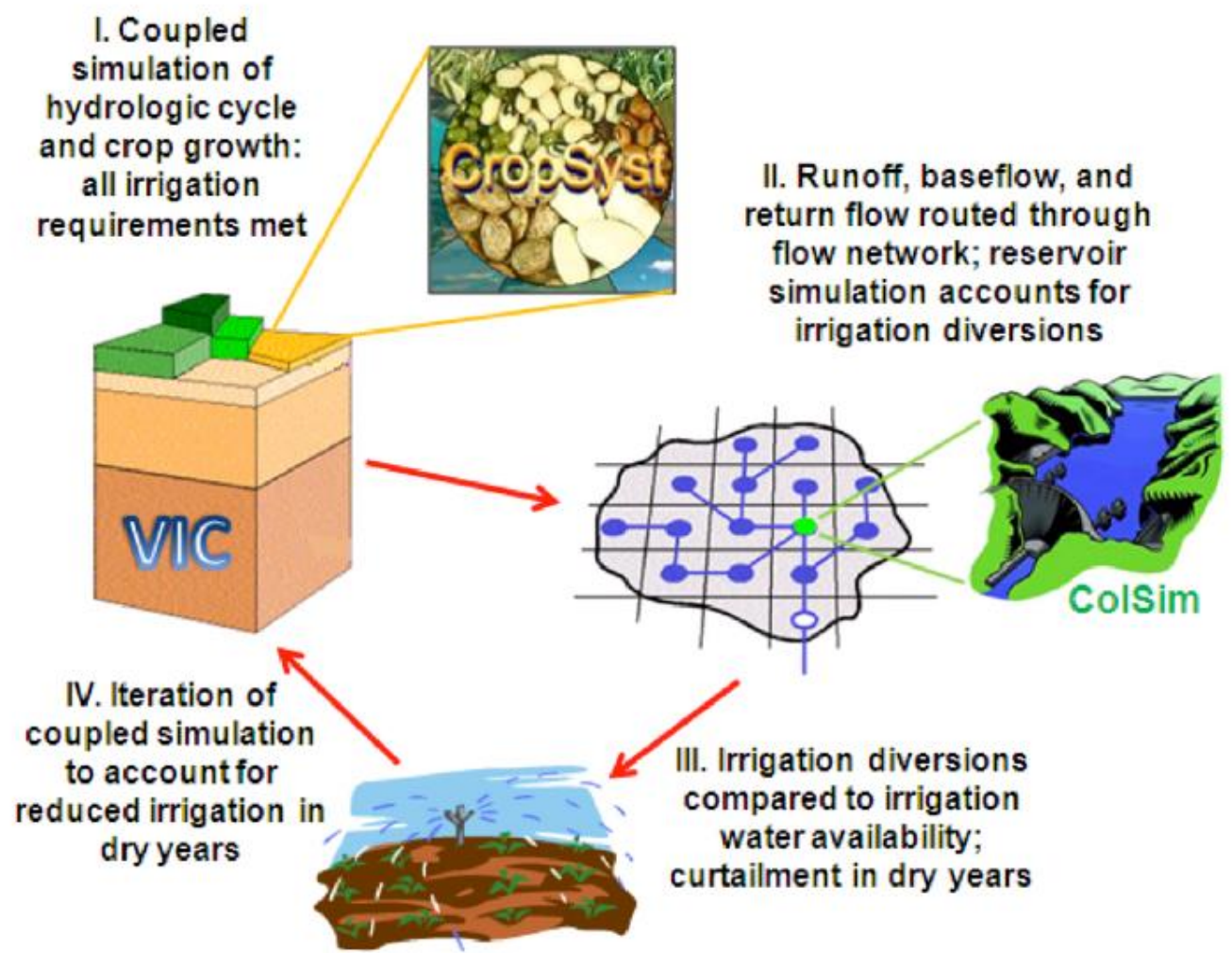
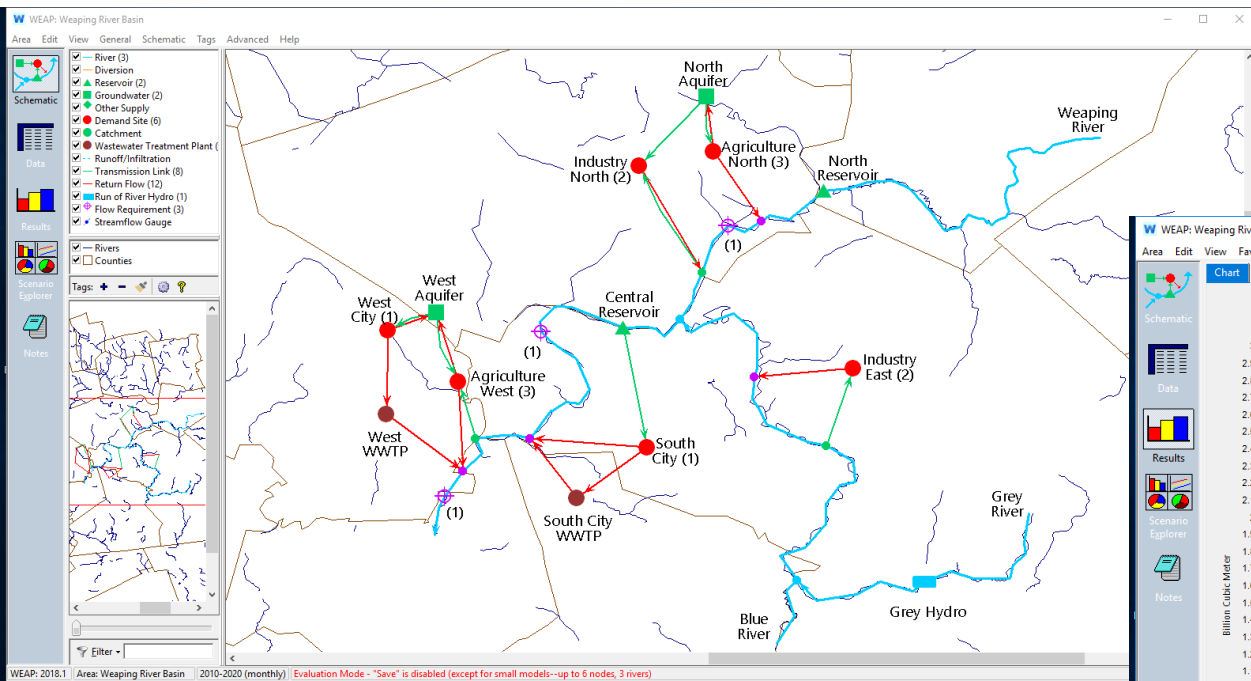


Figure 3. VIC-CropSyst as part of an integrated modeling framework to assess the impacts of water scarcity in irrigated systems. (Figure from Rajagopalan et al., 2013, in preparation)

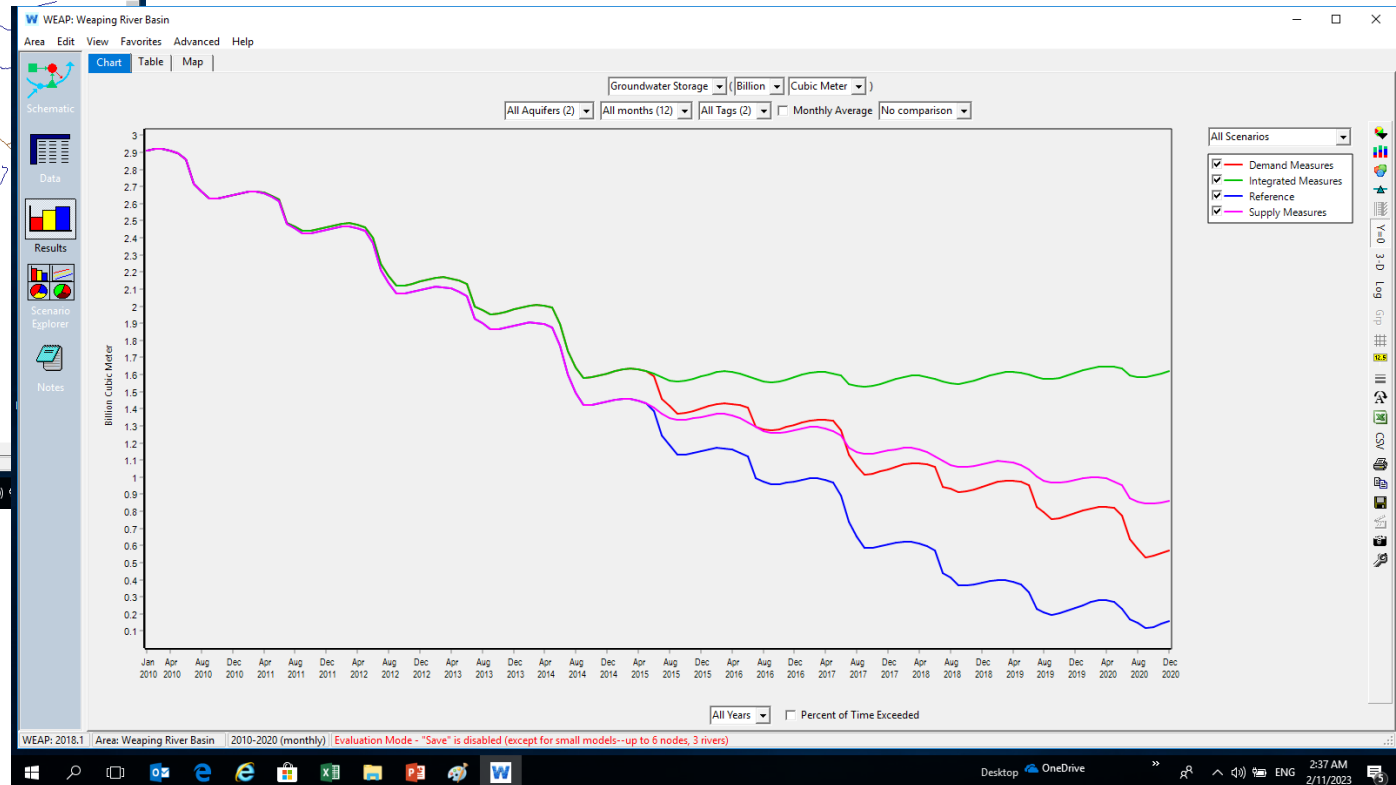


# Water evaluation and planning system (WEAP) = Сув ресурслари баҳолаш ва режалаштириш тизими

## Маълумотни киритиш



## Хар хил сценарийлар натижалари





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Version: 42 (latest) ▾

1	trnsport	A Transportation Problem	LP	Management Science and OR
2	blend	Blending Problem I	LP	Management Science and OR
3	prodmix	A Production Mix Problem	LP	Management Science and OR
4	whouse	Simple Warehouse Problem	LP	Management Science and OR
5	jobt	On-the-Job Training	LP	Management Science and OR
6	sroute	The Shortest Route Problem	LP	Management Science and OR
7	diet	Stigler's Nutrition Model	LP	Micro Economics
8	aircraft	Aircraft Allocation Under Uncertain Demand	LP	Management Science and OR
9	prodsch	APEX - Production Scheduling Model	MIP	Management Science and OR
10	pdi	ARCNET - Production Distribution and Inventory	LP	Management Science and OR
11	uimp	UIMP - Production Scheduling Problem	LP	Management Science and OR
12	magic	Magic Power Scheduling Problem	MIP	Management Science and OR
13	ferts	Egypt - Static Fertilizer Model	LP	Micro Economics
14	ford	Egypt - Dynamic Fertilizer Model	MIP	Micro Economics

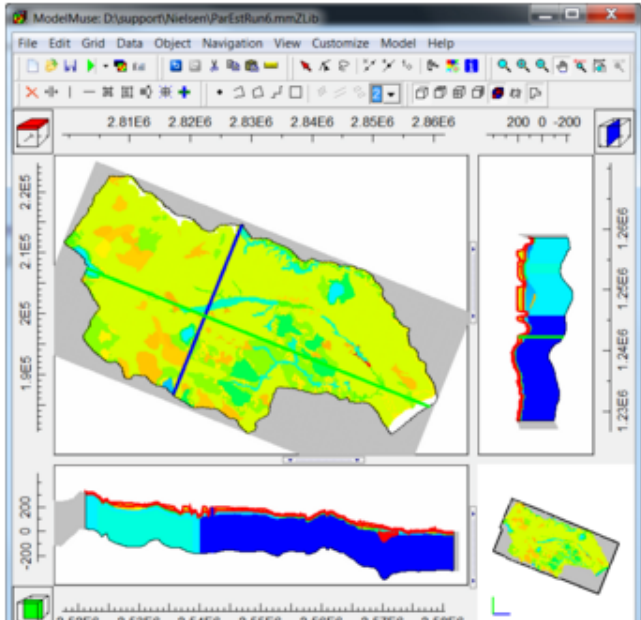
# ModelMuse: A Graphical User Interface for Groundwater Models

November 21, 2022

[View Software Release](#)

## Overview of ModelMuse

ModelMuse is a graphical user interface (GUI) for the U.S. Geological Survey (USGS) models MODFLOW 6, MODFLOW-2005, MODFLOW-LGR, MODFLOW-LGR2, MODFLOW-NWT, MODFLOW-CFP, MODFLOW-OWHM, MODPATH, ZONEBUDGET, PHAST, SUTRA 2.2, SUTRA 3.0, MT3D-USGS, and WellFootprint and the non-USGS model MT3DMS. This software package provides a GUI for creating the flow and transport input file for PHAST and the input files for the other models. In ModelMuse, the spatial data for the model are independent of the grid, and the temporal data are independent of the stress periods. Being able to input these data independently allows the user to redefine the spatial and temporal discretization at will. ModelMuse supports parameter estimation with UCODE in MODFLOW-2005 and MODFLOW-NWT models and with PEST in MODFLOW and SUTRA models except for MODFLOW-LGR models.



## Contacts

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Hydrologist

Water Resources

Email: [rbwinst@usgs.gov](mailto:rbwinst@usgs.gov)

Phone: 703-648-5988



Explore Search

# График интерфейс орқали MODFLOW га малумот киритиш ва натижа олиш

The image displays the TriShell (Version 3.0) software interface, which is used for managing MODFLOW models. The main window shows a project named 'TriDemo' with a menu bar (Project, Parameter, Scenario, Tools, Window, Help) and a toolbar. A central table lists various model components and their properties.

Type	Base	Transient	Phreatic	Interfa	Description	St
Grid	n/a	No	No	No	Grid	Grid
Grid	n/a	No	Yes	No	Basic	Basic
Grid	Basic	Yes	Yes	No	Calib	Calib
Grid	Calib	Yes	Yes	No	Trans	Trans
Grid	Final	Yes	No	No	Final	Final
Scenario	Final	Yes	No	No	scena	scena
Path line	Calib	No	Yes	No	lines	Streamlines
Unsaturated	n/a	No	No	No	watera...	GWA
Path line	Trans	Yes	Yes	No	TransPath	TransPath
Grid	n/a	n/a	n/a	n/a	FDGrid	FDGrid
Calibration	FDGrid	B	B	B	MfCal	MfCal

Below the table, there are sections for 'TriDemo:scena' and 'Inherited parameters' with a table of parameters:

Name	Type	All
RP2	NODE	Arr
RP1	NODE	Co

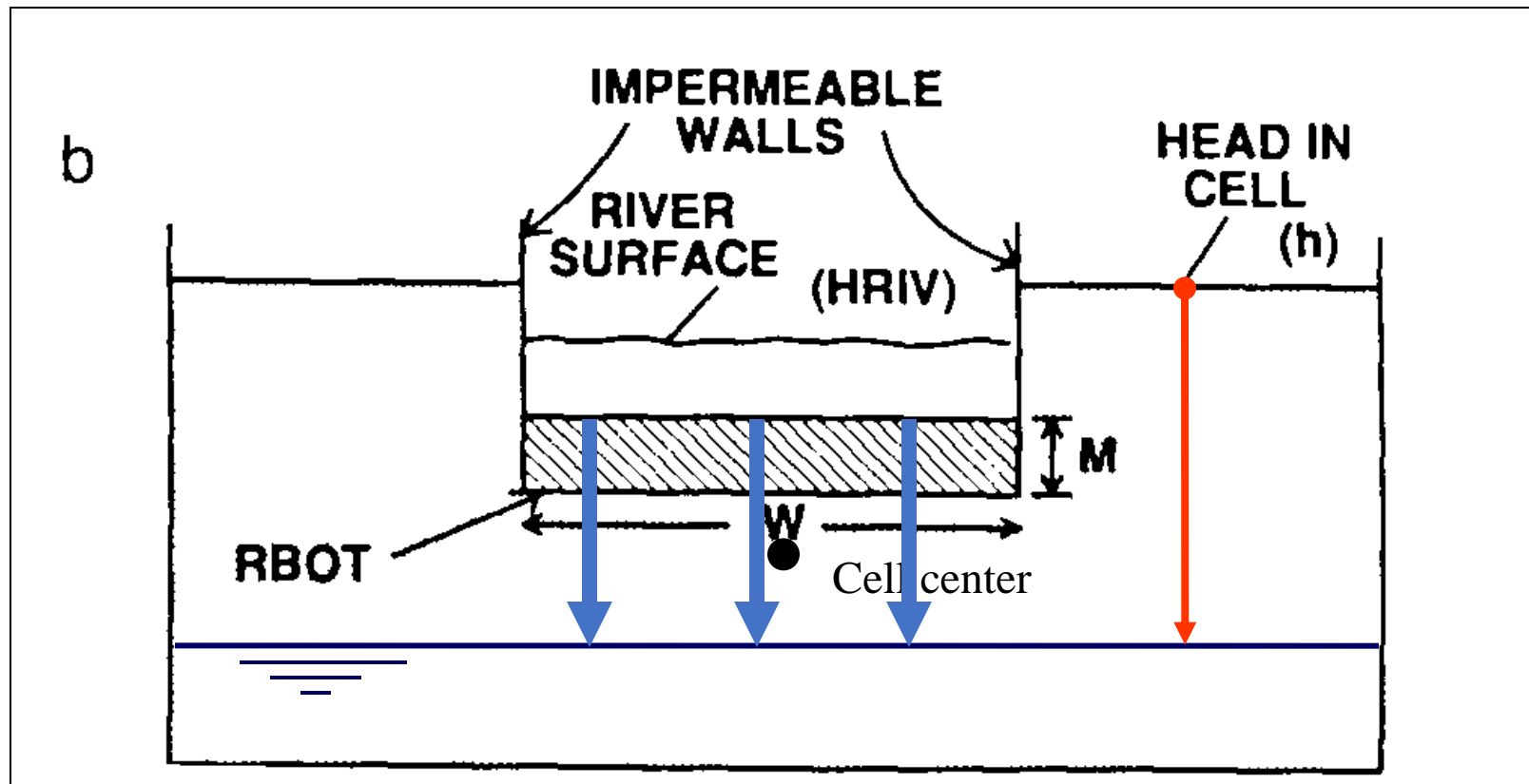
Three inset windows illustrate the workflow:

- Left Inset:** A schematic diagram of a model domain with various boundaries and features labeled: 'waterloop', 'onttrekings- of infiltratieput', 'modelgrens', and 'verdichtingszone'.
- Bottom Inset:** A grid view showing the spatial discretization of the model domain.
- Right Inset:** A contour plot showing the results of a simulation, with colors ranging from green to yellow, indicating different values across the domain.

Blue arrows indicate the flow of information from the schematic diagram to the grid, and from the grid to the contour plot.

Пакет RIV,  $h_n$  RBOT<sub>n</sub> ( $h_n < RBOT_n$ ) дан пастда

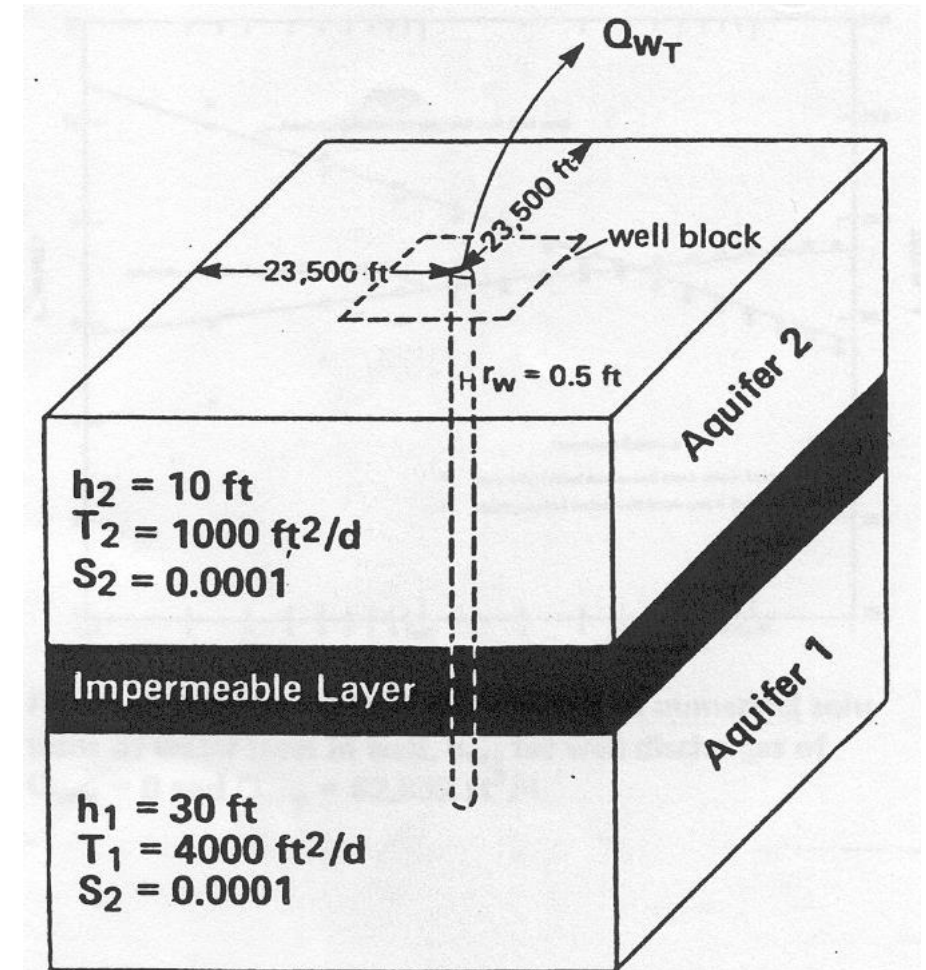
Дарёдан ер ости сувларига сингидиган сув миқдори қанча ?





# Ер ости сувини тортиб оладиган қудуқлар

- Пакет Well (WEL)
  - Киритиладиган маълумот: қатлам, қатор, устун, сувни тортиб олиш сарфи (нисбий, агар сув олинса)
  - Савол: Агар қудуқ бир неча қатламни кесиб ўтса, хат бир қатламдан қанча сув олади ?





# A GAMS моделини тузиш

## МИСОЛИ



# GAMS ўзи нима?

- General Algebraic Modeling System = Алгебраик моделар умумий тизими
- Чизиқли, но-чизиқ, аралашган,... оптимизация муамолари
- Катта, мураккаб муаммоларни ечишда анча фойдали

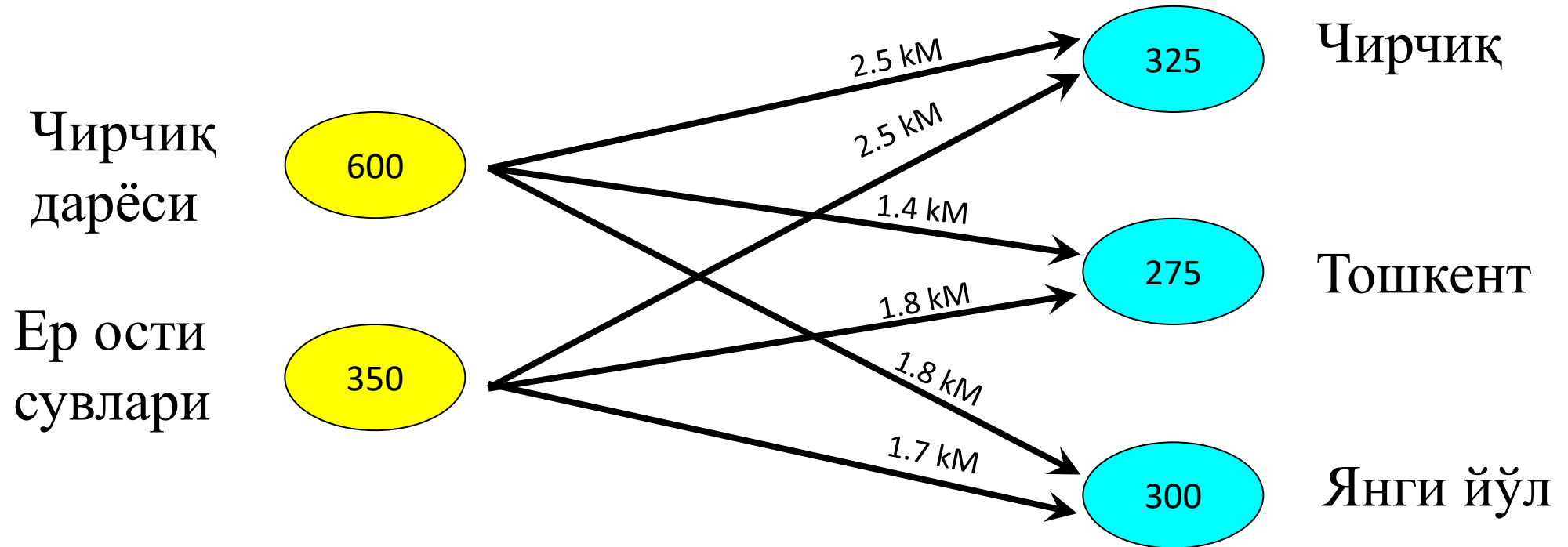
A GAMS Example = TRANSPORTATION EXAMPLE

**GAMS модели Мисоли = Ресурс тақсимлаш етқазиб бериш**

- Сув муамоси!...
- 2 манба, 3 шаҳар, сув сифати кўрилмайди.
- Берилган: сувни етқазиб бериш нархи берилган.
- Сувни етқазиб бериш харажатларини минималаштириш?

# A GAMS Example = TRANSPORTATION EXAMPLE

## GAMS модели Мисоли = Ресурс тақсимлаш етқазиб бериш



**Minimize:** (Сув етқазиб бериш харажатларини) Transportation cost

**Subject to:** Талаб максимал қондирилиши керак, сув ресурсларини чекланганлигини ҳисобга олинг

# A GAMS Example = TRANSPORTATION EXAMPLE

## GAMS модели Мисоли = Ресурс тақсимлаш етқазиб бериш

Масофа				
	Шахарлар			
Манбалар	Чирчиқ	Тошкент	Янгийул	Сув миқдори
Чирчиқ дарёси	2.5	1.7	1.8	350
Ер ости сув.	2.5	1.8	1.4	600
Талаб	325	300	275	

1 м<sup>3</sup> сувни 1 км етқазиб бериш харажатлари \$90 тенг

A GAMS Example = TRANSPORTATION EXAMPLE

**GAMS модели Мисоли = Ресурс тақсимлаш етқазиб  
бериш**

*Indices (or sets):*

$i$  = манба (2)

$j$  = талабгорлар (3)

*Given Data (or parameters):*

$a_i$  = манбалар,  $i$  (in cases)

$b_j$  = талабгорлар,  $j$  (cases)

$c_{ij}$  = харажатлар  $i$  манбадан  $j$  шаҳарга  
(\$/case)

A GAMS Example = TRANSPORTATION EXAMPLE

**GAMS модели Мисоли = Ресурс тақсимлаш етқазиб бериш**

***Ўзгарувчилар:***

$x_{ij}$  =  $i$  манбадан  $j$  шаҳарга етқазиладиган сув миқдори (cases),  
қаерда  $x_{ij} \geq 0$ , for all  $i, j$

***Чегаравий шароитлар:***

$i$  манбадан  $j$  шаҳарларга сув етқазиб бериш чегараси:

$$\sum_j x_{ij} \leq a_i, \text{ for all } i \text{ (cases)}$$

Хар бир шаҳар талаби қондирилиш керак:

$$\sum_i x_{ij} \geq b_j, \text{ for all } j \text{ (cases)}$$

***Оптимальлаштириш функцияси:***

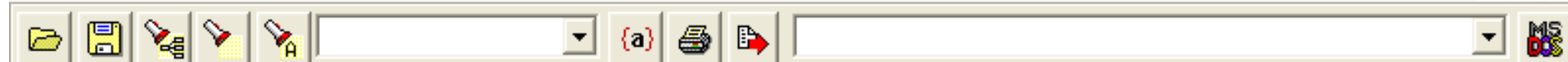
$$\text{Minimize } \sum_i \sum_j c_{ij} x_{ij} \text{ (\$K)}$$

Transportation Example:

## ALGEBRAIC REPRESENTATION

- All the entities of the model are identified (and grouped) by type.
- the ordering of entities is chosen so that no symbol is referred to before it is defined.





transport.gms | transport.lst

**Sets**

```
i  canning plants  / seattle, san-diego /  
j  markets          / new-york, chicago, topeka / ;
```

**Parameters**

```
a(i)  capacity of plant i in cases  
/      seattle      350  
      san-diego    600 /
```

```
b(j)  demand at market j in cases  
/      new-york     325  
      chicago       300  
      topeka        275 / ;
```

**Table** d(i,j) distance in thousands of miles

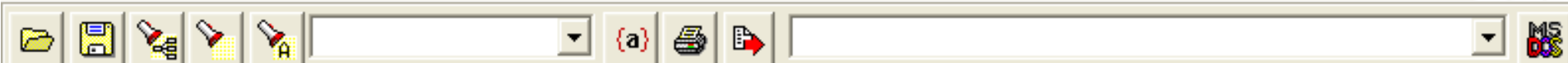
	new-york	chicago	topeka
seattle	2.5	1.7	1.8
san-diego	2.5	1.8	1.4

 ;

```
Scalar f  freight in dollars per case per thousand miles /90/ ;
```

```
Parameter c(i,j)  transport cost in thousands of dollars per case ;
```

```
      c(i,j) = f * d(i,j) / 1000 ;
```



trnsport.gms | trnsport.lst

**Variables**

```
x(i,j)  shipment quantities in cases
z        total transportation costs in thousands of dollars ;
```

**Positive Variable** x ;**Equations**

```
cost      define objective function
supply(i) observe supply limit at plant i
demand(j) satisfy demand at market j ;
```

```
cost ..   z  =e=  sum((i,j), c(i,j)*x(i,j)) ;
```

```
supply(i) ..  sum(j, x(i,j))  =l=  a(i) ;
```

```
demand(j) ..  sum(i, x(i,j))  =g=  b(j) ;
```

**Model** transport /all/ ;**Solve** transport using lp minimizing z ;**Display** x.l, x.m ;

**Этиборингиз учун рахмат**