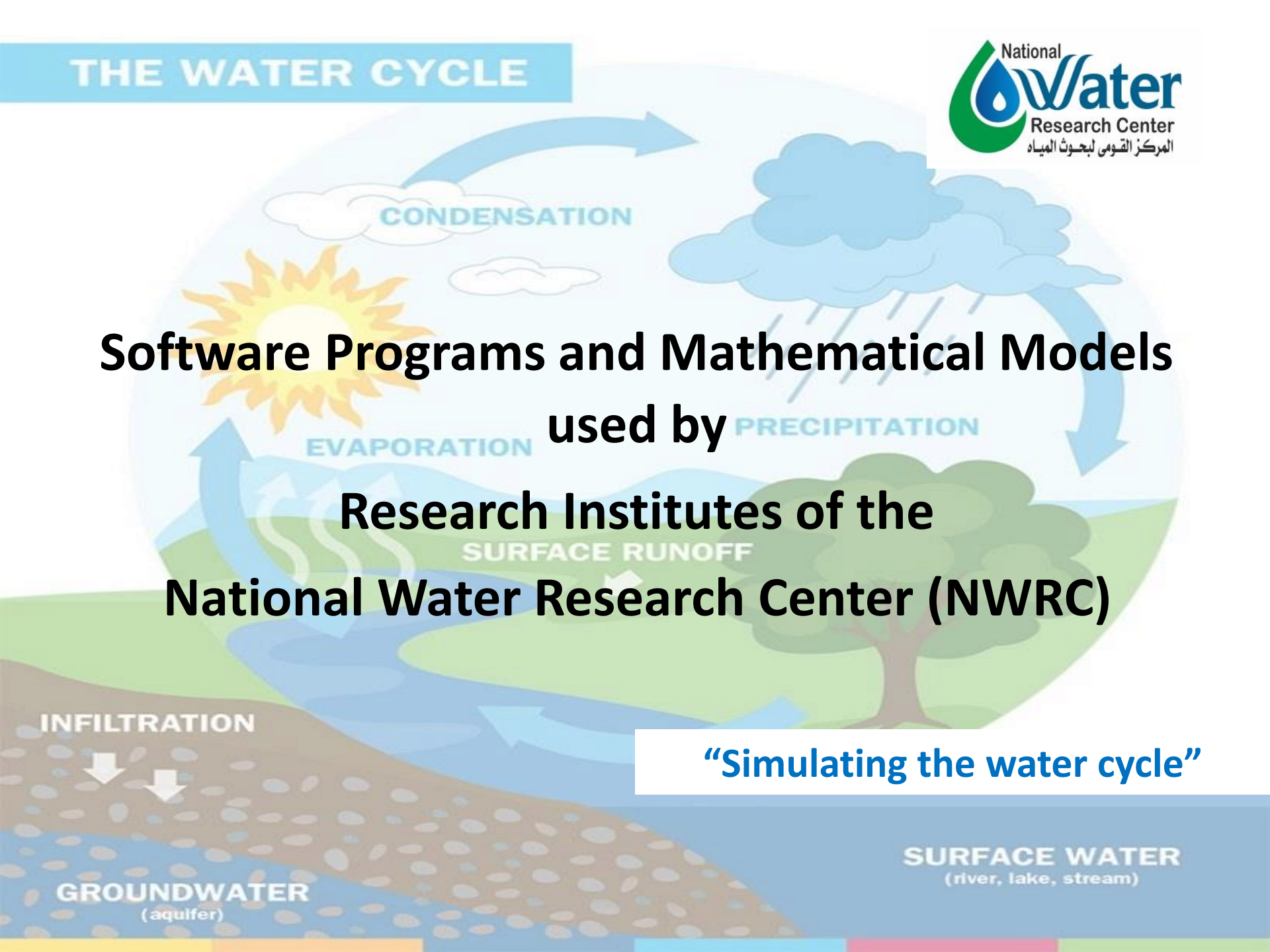


THE WATER CYCLE

**Software Programs and Mathematical Models
used by
Research Institutes of the
National Water Research Center (NWRC)**

“Simulating the water cycle”



A stylized water cycle diagram serves as the background. It features a sun in the upper left, a cloud in the upper right with rain falling, a tree in the lower right, and a body of water at the bottom. Arrows indicate the cycle: a large blue arrow on the right points down from the cloud to the water, labeled 'PRECIPITATION'; a blue arrow on the left points up from the water to the cloud, labeled 'EVAPORATION'; a blue arrow at the bottom points from the water towards the left, labeled 'SURFACE RUNOFF'; and two white arrows at the bottom left point down into the ground, labeled 'INFILTRATION'.

Climatic and Environmental Models

- SimCLIM for ArcGIS/ Climate
- PREEZE AERMOD/ISC (Pro Plus)
- AQUARIUS Time-Series

Hydraulic Mathematical Models

- HEC-RAS
- Hypack
- TUFLOW
- Delft3D
- UNIBEST-CL+
- SOBEK
- Ky pipe2000 Package
- MIKE 21

Water Resources Models

Hydrologic Models

- (WMS) version 10.1
- FREQ-HYFRAN
- SPSS 13

Groundwater Simulation Models

- Geosoft Oasis Montaj
- Zonge TEM
- VISUAL MODFLOW
- Visual Modflow Flex
- IPI2win (lite)
- GMS Groundwater Modeling System
- AQUIFER TEST

Water Quality Simulation Models

- QUAL2K
- CORMIX
- AQUACHEM
- Laboratory Information Management System(LIMS))

Construction Models

- Plaxis 3D Software
- Diana software
- ARTeMIS software

Water Resources Management Models

- Simulation of Water management in the Arab Republic of Egypt (SIWARE)
- RIBASIM
- A General River and Reservoir Modeling Tool (RiverWare)

GIS Models

- ArcGIS 10.8
- SURFER
- ERDAS Imagine
- Terrset
- Autocad Civil 3d
- ENVI 5.5



Climatic and Environmental Models

Climatic and Environmental Models

SimCLIM for ArcGIS/ Climate

Enables ArcGIS users to produce spatial images of climate change through a quick, easy and straightforward process. The add-in is based on 20 years of development of the standalone SimCLIM tool and uses outputs from global climate models, produced for the Intergovernmental Panel on Climate Change (IPCC).



BREEZE AERMOD/ISC (Pro Plus)

Conducts complete air dispersion modeling analyses and reporting. The Pro Plus edition offers additional features and functionality to increase efficiency as well as advanced post-processing and results tools.

AQUARIUS Time-Series

The most powerful platform for managing water resources. Environmental data from multiple sources are securely stored for fast, central access.





Water Resources Models

Water Resources Models

Hydraulic Mathematical Models

HEC-RAS

Designed to perform one and two-dimensional hydraulic calculations for a full network of natural and artificial channels.



HYPACK
a xylem brand

HYPACK

Provides the Surveyor with all the tools needed to design their survey, collect data, process it, reduce it, and generate final products.

TUFLOW

A powerful computational engine that provides one-dimensional (1D) and two-dimensional (2D) solutions of the free-surface flow equations to simulate flood and tidal wave propagation.



Hydraulic Mathematical Models ... cont.



Delft3D

A world leading 3D modeling suite to investigate hydrodynamics, sediment transport and morphology and water quality and ecology in rivers and coastal environments.

UNIBEST-CL+

A powerful tool to **model** longshore sediment transports and morphodynamics of coastlines. Shoreline migration is computed on the basis of computed longshore transports at specific locations along the coast. It is used to select the optimum mitigation measures for shoreline stability.

SOBEK

A powerful modelling suite for flood forecasting, optimization of drainage systems, control of irrigation systems, sewer overflow design, salt intrusion and surface water quality.



Ky pipe2000 Package

Models water, refined products, chemicals, refrigerants, low pressure sewer systems and more. It can be used for selecting and sizing pipes, pumps, valves, tanks and other devices.



MIKE 21

A leading software package for 2D modelling of hydrodynamics, waves, sediment dynamics, water quality and ecology. It is professional software of high reliability, quality and versatility. MIKE 21 includes simulation engines that are aimed at a very wide range of applications, such as modelling of tidal flows, storm surge, advection-dispersion, oil spills, water quality, mud transport, sand transport, harbour disturbance and wave propagation.

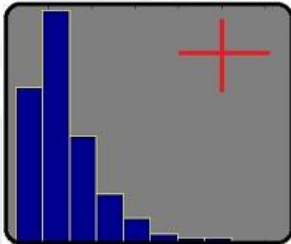


Water Resources Models ... cont.

Hydrologic Models

Watershed Modeling System (WMS)

WMS is a complete watershed solution used for automated delineation, hydrologic & hydraulic modeling, floodplain mapping, and storm drain modeling.



FREQ-HYFRAN

Analysis of rainfall data for different repetitive times to calculate the design rainfall amount for different return periods.

SPSS 13

A widely used program for statistical analysis, , data management, and data documentation.



Water Resources Models ... cont.

Groundwater Simulation Models

Geosoft Oasis Montaj

Provides a suite of modelling and analysis tools for advanced understanding of the Earth's subsurface and subsea environments. Process, map, QA and interpret all data, including ground and airborne survey geophysics, geochemistry and geology, within one dynamic, 3D environment.



Zonge TEM

A robust method for converting transient electromagnetic (TEM) measurements to profiles of resistivity versus depth. Observed TEM time for each station are used to determine the parameters of a layered-earth model.

Visual Modflow Flex

Groundwater Flow & Contaminant Transport Modeling software that brings together industry-standard codes for groundwater flow and contaminant transport, essential analysis and calibration tools, and stunning 3D visualization capabilities in a single, easy-to-use software environment.



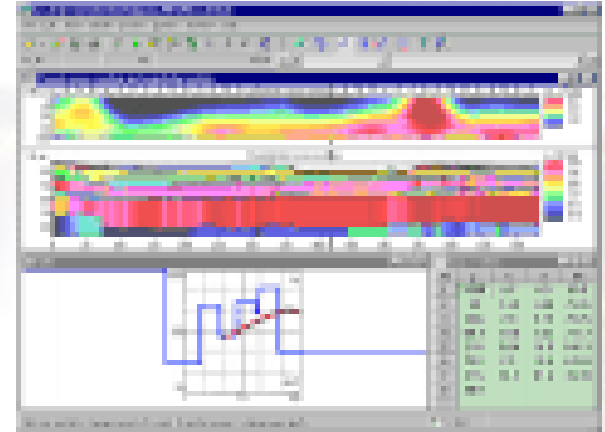
VISUAL MODFLOW

A software developed for groundwater simulation modeling and contaminant transport.

Groundwater Simulation Models ... Cont.

IPI2win (lite)

A program for 1D automatic and manual interpretation of VES curves.



AQUIFER TEST

An easy-to-use software package for analyzing, interpreting and visualizing pumping and slug test data. It delivers all the tools needed to accurately interpret data from all types of aquifers in all types of test conditions.

GMS Groundwater Modeling System

An advanced 3D simulation *software* for groundwater flow & transport modeling. It features 2D and 3D geostatistics, stratigraphic modeling and a unique conceptual model approach. . USGS MODFLOW and other numerical models supported.



A conceptual image showing a hand holding a small globe of the Earth. In the background, a faucet is shown with a single drop of water falling from it. The drop also contains a small globe of the Earth. The entire scene is set against a light blue, watery background.

Water Quality Simulation Models

Water Quality Simulation Models

QUAL2K

One-dimensional river and stream water quality model intended to represent a well-mixed channel both vertically and laterally with steady state hydraulics, non-uniform steady flow, and diel heat budget and water-quality kinetics.



CORMIX

Contains systems to model single-port, multiport diffuser discharges and surface discharge sources. Effluents considered may be conservative, non-conservative, heated, brine discharges or contain suspended sediments.

AQUACHEM

Analysis tools cover a range of functions and calculations including unit transformations, charge balances, and statistics. These powerful analytical capabilities are complemented by an extensive selection of commonly used geochemical plots to represent the chemical characteristics of water quality data.



Laboratory Information Management System (LIMS)

A software-based solution with features that support a modern laboratory's operations. Key features include workflow and data tracking support, flexible architecture, and data exchange interfaces.

An aerial photograph of Niagara Falls, showing the massive volume of water cascading over the edge. The surrounding area includes a road with a railing, a bridge, and lush green trees. A semi-transparent white box with a green border is centered over the falls, containing the title text.

Water Resources Management Models

Water Resources Management Models

SIWARE (Simulation of Water management in the Arab Republic of Egypt)

A mathematical model developed to simulate very large areas of land such as the delta region where the quantities and salinity of agricultural wastewater are predicted by the use of data such as the irrigation system used, soil characteristics and the quality of cultivated plants.



RIBASIM (River Basin Simulation Model)

A generic model package for analyzing the behaviour of river basins under various hydrological conditions. The model package is a comprehensive and flexible tool which links the hydrological water inputs at various locations with the specific water-users in the basin.

RiverWare (General River and Reservoir Modeling Tool)

RiverWare is an extensible, maintainable software framework which provides a modeling environment to meet all the modeling needs of managers and operators of river and reservoir systems.



The background of the slide is a grayscale aerial photograph of a city. A green rounded rectangle is centered on the slide, containing the title text. The text is in a blue, sans-serif font. The title is split into two lines: 'GIS and Remote Sensing' on the top line and 'tools' on the bottom line.

GIS and Remote Sensing tools

GIS and Remote Sensing Models



SURFER

A 2D & 3D mapping, modeling, and analysis software for scientists and engineers

TerrSet (Geospatial Monitoring and Modeling Software)

An integrated geospatial software system for monitoring and modeling the earth system for sustainable development. The TerrSet system incorporates the IDRISI GIS Analysis and IDRISI Image Processing tools along with a constellation of vertical applications.



GIS and Remote Sensing Models

ArcGIS 10.8

ArcGIS is a geographical information system (GIS) software that allows handling and analyzing geographic information by visualizing geographical statistics through layer building maps like climate data or trade flows.



ERDAS Imagine

An image processing *software* package that allows users to process both geospatial and other imagery as well as vector data. *Erdas* can also handle hyperspectral imagery and LiDAR from various sensors. *Erdas* also offers a 3D viewing module (VirtualGIS) and a vector module for modeling.

ENVI 5.5

ENVI is a software for processing and analyzing geospatial imagery. It handles hyperspectral, LiDAR, and other remotely sensed data sets easily with both wizard based approaches and allowing users to program operations. ENVI 5.5 brings software integration for ENVI and ArcGIS Pro, where Esri users can work in either environment to take advantage of the advanced remote sensing capabilities in ENVI.



An aerial photograph of a large-scale hydroelectric construction project. A long, multi-bay dam structure is visible, spanning a wide river. The dam features a series of vertical concrete piers. Behind the dam, a large industrial complex, likely a power station, is visible with various structures and equipment. The water in the foreground is a deep blue-green color. The text "Construction Models" is overlaid in the center of the image, enclosed in a rounded rectangular box with a thin green border.

Construction Models

Construction Models

Plaxis 3D Software

A computer programme that performs finite element analyses within the realm of geotechnical engineering, including deformation, stability and water flow. The input procedures enable the enhanced output facilities provide a detailed presentation of computational results.



Diana software

(Displacement Analyzer) is an extensive multi-purpose finite element software package that is dedicated, but not exclusive, to a wide range of problems arising in Civil engineering including structural, geotechnical, tunnelling, earthquake disciplines and oil & gas engineering.



ARTEMIS Software

A set of software tools for genome browsing and annotation that allows visualization of sequence features, next generation data and the results of analyses within the context of the sequence, and also its six-frame translation.