

Main Content of the WEB-DHM Model Training

This document aims to provide a brief overview of the main procedures for using the WEB-DHM model. It is divided into four parts, detailed as follows:

	Main content	Details
Part1	Model overview	model theory、 model application in the Third Pole region
	Software installation	CVF、 Workstation、 ArcGIS10.2, etc
	Acquisition and Correction of DEM	publicly available DEM and watershed-specific DEM correction
	Sub-basin division	sub-basin division in the Upper Salween River
	Prepare the watershed parameter file	parameter files for watershed topography and river channels
Part2	Land use data processing	USGS data、 Land use data of the TP
	Soil data processing	FAO-HWSD
	Preparation of glacier data	Extract glacier files based on land use data
Part3	Vegetation data processing	GLASS LAI and FPAR data processing
	TPMFD data processing	Extraction of 7 variables from TPMFD
	CMFD data processing	Extraction of 7 variables from CMFD
Part4	Model source code, initialization settings, and model operation	Run the WEB-DHM model (incorporating snow module) in the Upper Salween River

File Structure Description

The content for Parts 1–4 is located in the four subfolders (Part1–Part4) under the Data-Codes directory. The data and code used in each part are in the Data and Codes subfolders, respectively. The results obtained from the operations and runs for each part are stored in corresponding folders starting with Result+Part. As this document focuses on a brief overview of the workflow, the content is relatively concise. For more detailed information, please refer to the reference documents and study notes within the respective folders.

Furthermore, because a complete understanding of WEB-DHM operations requires significant time, which is limited during the training session, only part of the content will be covered in this training.

Resource Access:All training materials, including data, code, and software packages, are available at the following link:

Link: <https://pan.baidu.com/s/1KIUeSTfTgkh31AP0wkjIaQ>

Extraction Code: k9nn

Part 1

1) Model Overview

For a detailed model introduction, please refer to the reference documents in the folder: .\WEB_DHM_model_training\Resource Sharing\References for WEB-DHM model\.

2) Software Installation

ArcGIS 10.2, Workstation, and CVF need to be installed. The software installation packages can be found in the Software Installation Packages folder. Detailed installation steps can be found in: .\WEB_DHM_model_training\Software\Software Installation Method (in Chinese).docx.

3) Acquisition and Correction of DEM

See the document Acquisition and Correction of DEM (in Chinese) located in: .\WEB_DHM_model_training\Data-Codes\Part1\.

This application uses publicly released DEM data for the Third Pole (TP) region. Download links can be found in the Data List.docx document located in the .\WEB_DHM_model_training\Resource Sharing\ folder.

4) Sub-basin Division

This step requires operating within the ArcGIS 10.2 and Workstation environment. Please refer to the two documents located in .\WEB_DHM_model_training\Data-Codes\Part1\:

- WEB-DHM inputs data preparation.pdf
- Delineating target basin from DEM and its subdivision.pdf

These documents detail the steps for watershed delineation and the commands/code used. Some steps require Fortran programs. The relevant code and programs are located in: .\WEB_DHM_model_training\Data-Codes\Part1\Codes\.

5) Prepare the Watershed Parameter File

This step also requires the ArcGIS 10.2 and Workstation environment, along with Fortran programs. Please refer to the two documents mentioned above in the Part 1

folder. Some relevant code and programs are located
in: .\WEB_DHM_model_training\Data-Codes\Part2\.

The Part 1 will not be the main focus of the demonstration in the workshop.

Part 2

1) Land Use Data Processing

Includes USGS land use data and Qinghai-Tibet Plateau land use data downloaded from TPDC (located in .\WEB_DHM_model_training\Resource Sharing\; download links are in Data List.docx).

- **USGS Data**

Processing: See landuse_process.pdf in .\WEB_DHM_model_training\Data-Codes\Part2\. For data introduction, refer to WEBDHM Model Data Processing and Configuration (in Chinese).pptx.

- **Qinghai-Tibet Plateau Land Use Data Processing:** Requires UTM projection in ArcGIS (required for WEB-DHM model input) and clipping based on the study area extent, ultimately producing the Landuse.asc file needed for model input.

2) Soil Data Processing

Primarily uses the FAO soil dataset, available from the FAO website or TPDC (see Data List.docx). For specific processing steps, please refer to WEB-DHM inputs data preparation.pdf in .\WEB_DHM_model_training\Data-Codes\Part1\. Relevant data and code are in the Data and Codes folders under Part2.

This part is not the main focus of the demonstration.

3) Preparation of Glacier Data

This step requires the Landuse.asc file obtained from the previous step. Glacier areas are extracted from this file to create the glacier.asc file, which is used as model input to identify glacier regions.

The Anaconda software needs to be installed. Existing code is run in the Jupyter environment to generate the glacier.asc file. See the WEBDHM Model Data Processing and Configuration.pptx for Anaconda configuration and installation.

Part 3

1) Vegetation Data Processing

This step uses the global-scale GLASS data, located in: `.\WEB_DHM_model_training\Data-Codes\Part3\Data\`. From this data, LAI and FPAR, two vegetation dynamic variables, are extracted as input for the WEB-DHM model.

Processing Steps:

- First, run the Fortran programs `calculatexy.f` and `outputlonlat.f` to obtain the longitude and latitude coordinate grid files (`longrid.txt` and `latgrid.txt`) for the watershed extent. For specific steps, refer to the document: `readme-Generating Watershed LongitudeLatitude Files (in Chinese).docx` in `.\WEB_DHM_model_training\Data-Codes\Part3\`.
- After obtaining these two files, run the relevant code for vegetation data processing in Jupyter to generate the final format required for the WEB-DHM model.

2) TPMFD / CMFD Data Processing

Both datasets are highly downloaded from TPDC and are commonly used as forcing data for hydrological models. In this part, 7 meteorological variables (precipitation, temperature, air pressure, wind speed, downward longwave radiation, downward shortwave radiation, specific humidity) are extracted from both datasets as model inputs.

This part will be the main focus of this demonstration.

Processing Strategy: Convert the original netCDF (nc) format to the direct format recognizable by the model.

Run the corresponding sections of code for "Meteorological Input Data" in the Jupyter environment. This includes data conversion and bilinear interpolation.

Part 4: Model Source Code, Initialization Settings, and Model Operation

This part covers the model source code, initial settings, and model operation.

Model Source Code Location

- Root directory: `.\WEB_DHM_model_training\model_snow\`
- Alternate location: `.\WEB_DHM_model_training\Data-Codes\Part4\Codes\`

Model Folder Structure

Folder	Purpose
input	For storing input data
output	For storing output data
source	For storing the model source code

Data Organization Instructions

- **Vegetation and Meteorological Data:** Place the processed vegetation data and the 7-variable meteorological data into `input/data/`, naming the subfolders `laifpar` (for vegetation) and the forcing data name (e.g., `tpmfd`), respectively.
- **Parameter Files:** Place the processed watershed parameter files along with `landuse.asc`, `glacier.asc`, `cell_area.asc` (watershed extent), `soil_unit.asc` (soil type), and `soil_depth.asc` (soil depth) into the `input/parameter/` folder.
- **Output Folders:**
 - `other`: For other output variables (e.g., ET, soil temperature/moisture, land surface temperature (LST), snow depth, glacier/snow meltwater).
 - `river`: For user-specified river channel output (usually at the basin outlet).

- simulation: For automatically output basin-related parameters (usually not the focus).

Model Setup and Execution

- In the source folder, you need to set up and modify the input.txt file.
- For detailed model initialization settings, please refer to the document Model Setup - by Zhong Xiaoyang in the .\WEB_DHM_model_training\Data-Codes\Part4\ folder. This is currently the most detailed guide available for WEB-DHM model setup.

Example Model (Upper Salween River)

A pre-configured model is located in the folder: .\WEB_DHM_model_training\Data-Codes\Result_Part4_model_Salwen\.

This folder already contains all the processed data and can be run directly. The simulation period is **September 1983 – December 1984**.

Viewing Results

After the simulation completes, you can view the streamflow simulation results using the "Runoff Results Viewer" section in the Jupyter environment. The results show **a comparison between simulated and observed streamflow for 1984**.