Documentation: run_grass_commands.sh

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1 Introduction

This document describes the usage and functionality of the Bash script `run_grass_commands.sh`, which is designed to automate tasks in a GRASS GIS environment. The script imports several raster datasets, runs a hydrological simulation using the `r.sim.water` module, and outputs the results. It is specifically configured to run on the **Terrabyte**[1] computer, ensuring efficient handling of large datasets and computationally intensive operations.

2 Prerequisites

Before running the script for the first time, the following prerequisites must be met:

1. The **Charliecloud** image, which contains the **GRASS GIS Docker image**, must be available in the home directory on Terrabyte. For more information on generating a Charliecloud image from an existing Docker image, refer to the official documentation: `https://docs.terrabyte.lrz.de/software/containers/charliecloud/#generate-a-charliecloud-image-from-an-existing-docker-image`

2. Make sure that the input directories and the container path (where the Charliecloud image should be located) match your folder structure.

```
# Input directories and container path
DIR="/dss/dsshome1/0A/user/Simulation_Folder"
INPUT_DIR="$DIR/input"
OUTPUT_DIR="$DIR/output"
CHARLIECLOUD_IMAGE="$DIR/charliecloud_image.sqfs"
```

The following prerequisites must be checked before each run of the simulation:

1. The necessary raster input maps must be available in the `input` directory. These must be **GeoTIFF** files. Depending on the names of the input rasters, either the raster filenames in the script need to be modified, or the input raster files must be renamed to match the script's expected names. Only the file name within the square brackets may be changed. The input raster file names can be changed here:

```
# List of raster files to import
declare -A RASTERS_TO_IMPORT=(
    ["dgm.tif"]="dgm"
    ["dx.tif"]="dx"
    ["dy.tif"]="dy"
```

[1] `https://www.dlr.de/de/eoc/forschung-transfer/projekte-und-missionen/terrabyte`

```
    ["rainfall_excess.tif"]="rain"
    ["manningsn.tif"]="manningsn"
)
```

2. The names of the output grids depth, error and discharge can be specified here.

```
# Output file names
OUTPUT_DEPTH_NAME="depth_name.tif"
OUTPUT_ERROR_NAME="error_name.tif"
OUTPUT_DISCHARGE_NAME="discharge_name.tif"
```

3. It is **very important** that the name of the DGM is changed at the bottom of the script, where the container is started with `ch-run` at `grass -c` after `INPUT_DIR/`, so that the correct coordinate system can be used to create the location.

3 Script Overview

3.1 Setup

The script begins by setting the working environment for GRASS GIS. It defines the location name as `testlocation` and specifies the path to the `PERMANENT` mapset. The location name can be changed.

- `LOCATION_NAME="testlocation"`
- `LOCATION_PATH="/app/location/${LOCATION_NAME}/PERMANENT"`

3.2 Input Structure

The input raster files are located in the `/app/input/` directory. These files are required to be in **GeoTIFF** format.

3.3 Input Raster Files

The following raster files are imported:

- `dgm.tif`: Digital elevation model, imported as `dgm.tif`.
- `dx.tif`: x-derivatives raster map [m/m], imported as `dx.tif`.
- `dy.tif`: y-derivatives raster map [m/m], imported as `dy.tif`.
- `rain.tif`: rainfall excess rate raster map [mm/hr], imported as `rain.tif`.
- `manningsn.tif`: Manning's n roughness coefficient (surface roughness), imported as `manningsn.tif`.

3.4 Dynamic script

The script generates an additional shell script named `grass_commands.sh`, which contains the GRASS GIS commands to be executed. This script is dynamically created based on the `rungrass_tb` script.

4 Simulation Parameters

The simulation is configured using the `r.sim.water` module, with several key parameters that can be customized to adjust the behavior of the water flow simulation. Among these parameters are `NITERATIONS`, as well as `OUTPUT_STEP`, `DIFFUSION_COEFF`, `HMAX`, `HALPHA`, and `HBETA`. The default values for these parameters are as follows:

```
# Parameter for r.sim.water
NITERATIONS=10
OUTPUT_STEP=2
DIFFUSION_COEFF=0.8
HMAX=0.3
HALPHA=4
HBETA=0.5
```

Detailed explanations of these parameters are available in the r.sim.water manual at `https://grass.osgeo.org/grass84/manuals/r.sim.water.html`. Once defined, these parameters are passed to the `r.sim.water` module for the water flow simulation.

5 Output Raster Files

The simulation generates several output raster maps:

- `depth.tif`: Water depth map after the simulation.
- `discharge.tif`: Discharge map showing water flow rates.
- `error.tif`: Error map indicating simulation inaccuracies.

These raster files represent the final results of the hydrological simulation.

6 Additional information

- r.sim.water manual: `https://grass.osgeo.org/grass84/manuals/r.sim.water.html`
- terrabyte: `https://www.dlr.de/de/eoc/forschung-transfer/projekte-und-missionen/terrabyte`