This tool provides scripts generating Landlab input files from WRF output, and WRF input file from Landlab output files.

Consider the example as in the manuscript:

Hong Shen, Brigid Lynch, Chris Poulsen, Brian Yanites. Modelling climate-erosion-landscape interaction and co-evolution with asynchronously coupled WRF-LandLab system. In preparation.

Manuscript link not available since it has not been published yet.

Terms used:

WRF: Weather Research and Forecasting Model, developed by NCAR. See the link:

<https://www.mmm.ucar.edu/weather-research-and-forecasting-model>

WPS: WRF Pre-processing System, for preparing boundary and initial condition files for WRF.

WRF-Hydro: A hydrological component to be coupled to WRF. See the link:

<https://ral.ucar.edu/projects/wrf_hydro/overview>

Landlab: A python toolkit for modeling earth surface processes. See the link:

<https://landlab.github.io/#/>

**Workflow to create WRF & WRF-Hydro lower-boundary files from Landlab input:**

*Pre-requisites:*

1. a high-resolution (250m here) large-scale (~10000\*10000km here) topography file created by WPS with your desired projection. The topography can be anything (modern topo recommended) since it will be changed later. Let us call this file large-scale file.
2. A high resolution (250m here) topography domain output from Landlab. Let us call this file the Landlab topography. Find example script in LandlabCreate (driver\_create\_topo.py & create\_topo.txt)
3. Lower boundary files for WRF nested domains of your desired location, size and resolution. Note that these files should have exactly the same projection with the large-scale file. The topography can be anything (modern topo recommended) since it will be changed later. Let us call these files WRF nested domain files.
4. For the innermost WRF domain, create a high resolution (250m here) topography file. Again, topography can be anything (modern topo recommended) since it will be changed later. Let us call this file geo\_04 file.

*Instructions:*

multiple small domain (~200km \* 200km) Landlab output of high resolution (250m here)

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| step 1: rotate and copy these small domains to the large-scale file & interpolate to

| create a mountain range

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Large-scale file containing the entire mountain range

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| step 2: re-write the topography of WRF nested files and geo\_04 using the large-scale | file

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WRF lower boundary files with resolutions of 93.75, 18.75 and 3.75km (innermost domain).

& innermost domain of high (250m) resolutions, to be used in step 3 to create WRF-hydro files.

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| step 3: use the ArcGIS tool to create WRF-Hydro lower boundary files

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WRF-Hydro lower boundary files

*What are the scripts to be used in each step?*

step 1: matlab script in “step1” folder. Build\_large\_scale\_topo\_file.m rotates Landlab topography files, inserts them into the large-scale topography file and interpolates between them to create mountain range. NOTE: This script is an example for inserting and interpolating between two Landlab topographies. In this project we do this between 5 domains, the steps in the example script can be repeated for the desired number of high-resolution Landlab domains.

step 2: matlab scripts in “step2” folder. subset\_grid01.m, subset\_grid02.m, subset\_grid03.m, are for the three WRF nested domains here. And subset\_grid04.m is for processing geo\_04 file.

step 3: See in the folder Standalone\_Tool\_v2\_2. This is our modified tool with its original tutorial in it. The usage is same as the original package, but the input GEGRID file will be your innermost WRF file, and the high-resolution raster file will be processed from the geo\_04 file using their utility “ExportGrid”.

*Finally, to run WRF-Hydro, you will need:*

1. lower boundary files with resolutions of 93.75, 18.75 and 3.75km
2. WRF-Hydro lower boundary files

**Workflow to create Landlab input files from WRF-Hydro output:**

*Prerequisites:*

1. *Multiple WRF-Hydro 6-hourly discharge output files*

*Instructions:*

WRF-hydro 6-hourly discharge output files

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| rotate and cut each of the discharge map files

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~200km \* 200km discharge maps to be read by Landlab

*What are the scripts to be used in this step?*

We use the matlab script “rotate\_WRFHydro.m”. See the file for an example to process an example file called “201105241200.CHRTOUT\_GRID3”, and the output file “201105241200.CHRTOUT\_GRID3\_rot.nc”

**Workflow to run Landlab using WRF-Hydro discharge output:**

*Prerequisites:*

1. Rotated and cut discharge maps – unzip files from wrf\_hydro\_discharge.zip

*Instructions:*

Use example Landlab driver and input file provided to run Landlab using WRF-Hydro discharge output to erode topography. This example uses data from Domain 1 of this study.

*What are the scripts to be used in this step?*

We use the Landlab driver “LL\_driver\_domain1.py” and input file “LL\_driver\_params.txt” located in LandlabDriver folder.