

1. App Tutorial: Prepare TOPKAPI Model

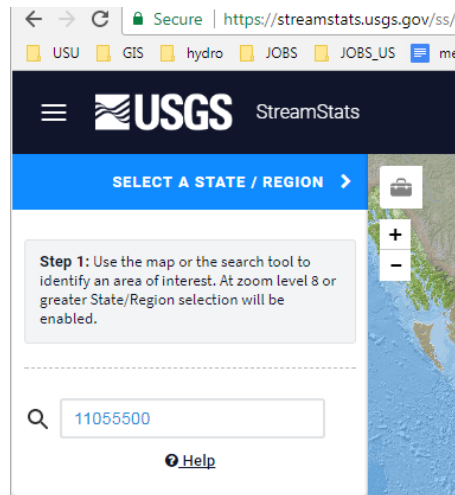
This tutorial provides step by step guidance for using the HydroTop app to prepare input-files for TOPNET. The steps given correspond to the Plunge River, the alternative use case mentioned in the text to demonstrate app's TOPKAPI modeling functionality.

Log on to the app's home page (<http://appsdev.hydroshare.org/apps/hydrotop>). If you are prompted to enter your HydroShare account, and to authorize the app to access your HydroShare account, please do so. As of this writing, the app is hosted by the HydroShare's development app portal, but this could change in the future.

We are interested in modeling a watershed called Plunge that drains to the USGS gage 11055500 in south west California. We will need to know the position of the outlet, and the domain containing the watershed. Assuming we have the required information, lets proceed. The next section shows the procedure to get the model domain accurately using streamstats, which is the recommended method to define the model domain. You can skip the following section (*Get bounding box GeoJSON from Streamstat*) and go to *App Input* section if you already have a file describing the bounding box, or if you only want the App tutorial.

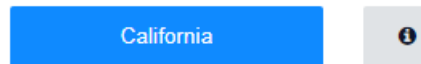
Get bounding box GeoJSON from Streamstat

There are three ways to enter the domain, drawing on the map, explicitly typing them, or uploading supported file. In this tutorial, we will use a combination of the two. First, we will get a GeoJSON file for our watershed to accurately describe our model domain. For this, go to <https://streamstats.usgs.gov/ss/>, and enter the USGS gage id 11055500 in the search box field to the left of the screen.



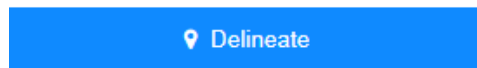
A button to confirm the location is California pops up. Click on it to confirm.

Click to select a State or Regional Study Area



We want to delineate watershed for our USGS gage, so click on Delineate button to do so.

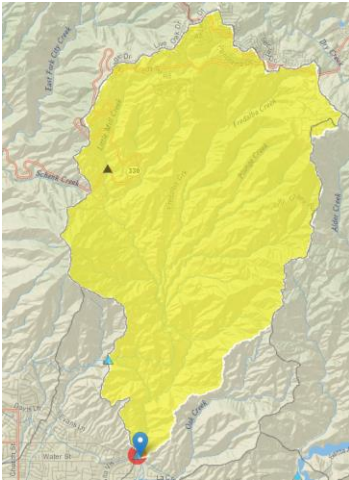
Step 2: Click the 'Delineate' button to activate the delineation tool



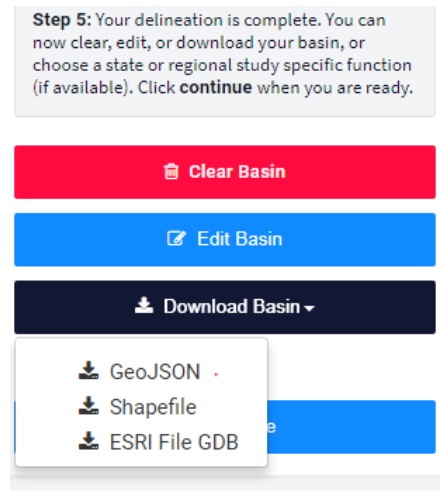
Now click on the stream location on the map, very close to the USGS gage location.



After waiting a few second, you should see the watershed getting delineated.



Now, head back to the left of the screen, and choose **Download Basin → GeoJSON**

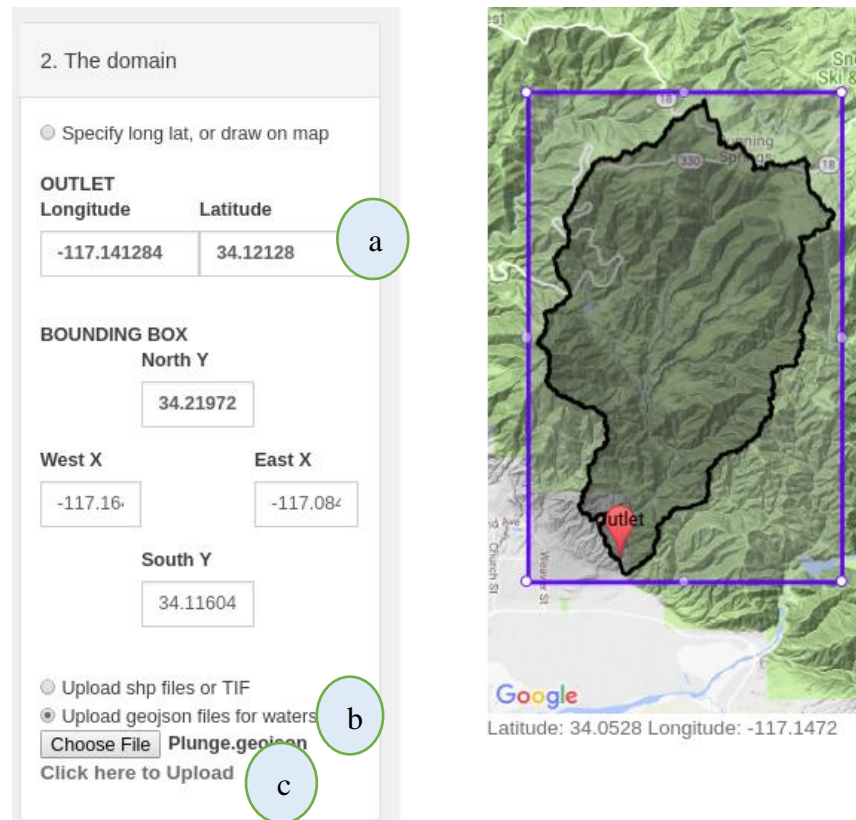


App Inputs

Switch back to the app's homepage. In the app navigation section to the top left of screen, click and expand the tab '**1. General Inputs**', and type in the simulation name, and start and end date of the simulation. In this example, we will do 2010 water year.

Expand '**The Domain**' section, and type in the latitude and longitude of the outlet, which is the location of USGS gage, as 34.12128 and -117.141284 respectively (Figure ...,

a). This should bring the outlet marker on the map to our point of interest. On the same section, check the “**Upload GeoJSON file for watershed**” button → **upload the GeoJSON file** you just downloaded → Click ‘**upload file**’ button.



The image shows two parts of the TOPKAPI model setup interface. On the left is a form titled '2. The domain'. It has a radio button for 'Specify long lat, or draw on map'. Below this is an 'OUTLET' section with a table for 'Longitude' and 'Latitude'. The 'Longitude' field contains '-117.141284' and the 'Latitude' field contains '34.12128'. A green circle labeled 'a' is next to the 'Latitude' field. Below the outlet section is a 'BOUNDING BOX' section with fields for 'North Y' (34.21972), 'West X' (-117.16), 'East X' (-117.084), and 'South Y' (34.11604). At the bottom of the form are three radio buttons: 'Upload shp files or TIF', 'Upload geojson files for waters' (which is selected), and 'Click here to Upload'. A green circle labeled 'b' is next to the selected radio button, and a green circle labeled 'c' is next to the 'Click here to Upload' text. On the right is a map view showing a watershed area outlined in black on a green terrain map. A red dot labeled 'outlet' is located at the bottom of the watershed. A purple bounding box surrounds the watershed. The map includes labels for 'Spring', 'Sno', 'Skil', 'Church St', and 'Wash St'. The Google logo is visible at the bottom left of the map, and the coordinates 'Latitude: 34.0528 Longitude: -117.1472' are shown at the bottom right.

The map section should be updated with the watershed map and the bounding box surrounding the watershed. Also, the coordinates for the bounding box at the values at the navigation pane also should update accordingly.

Now, head over to the navigation pane, click and expand the tab the third tab-‘**3. Additional Inputs**’, complete the form as shown in the figure below.

3. Additional Inputs

Cell size in meters

100

Stream threshold in square km

5

Choose an action

Prepare TOPKAPI model

Initial saturation in soil cells (in %)

30

Initial volume of water in overland cells (in m3)

3

Initial flow of water in channel cells (in m3/s)

0.1

Send Request

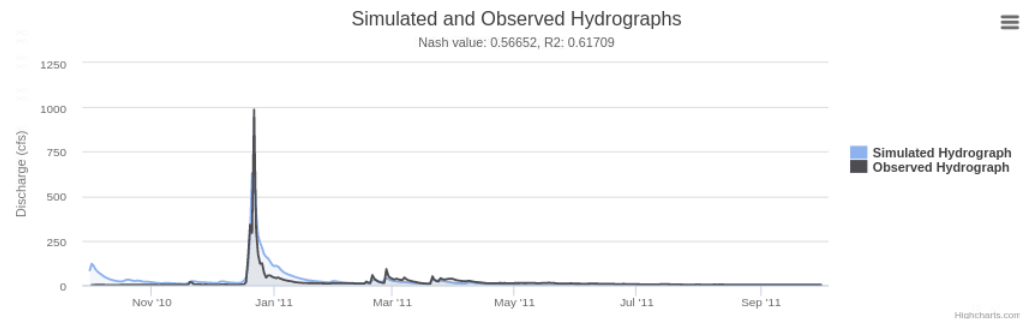
This is all the inputs required to create a TOPKAPI model. With the inputs completed, go ahead and click ‘**Send Request**’ button. It will be few minutes for the app to do its work and return result. So make sure you don’t close the page. If you accidentally closed it, that will be fine too. The model-instance will be saved in your HydroShare account so you will not lose the progress.

Results

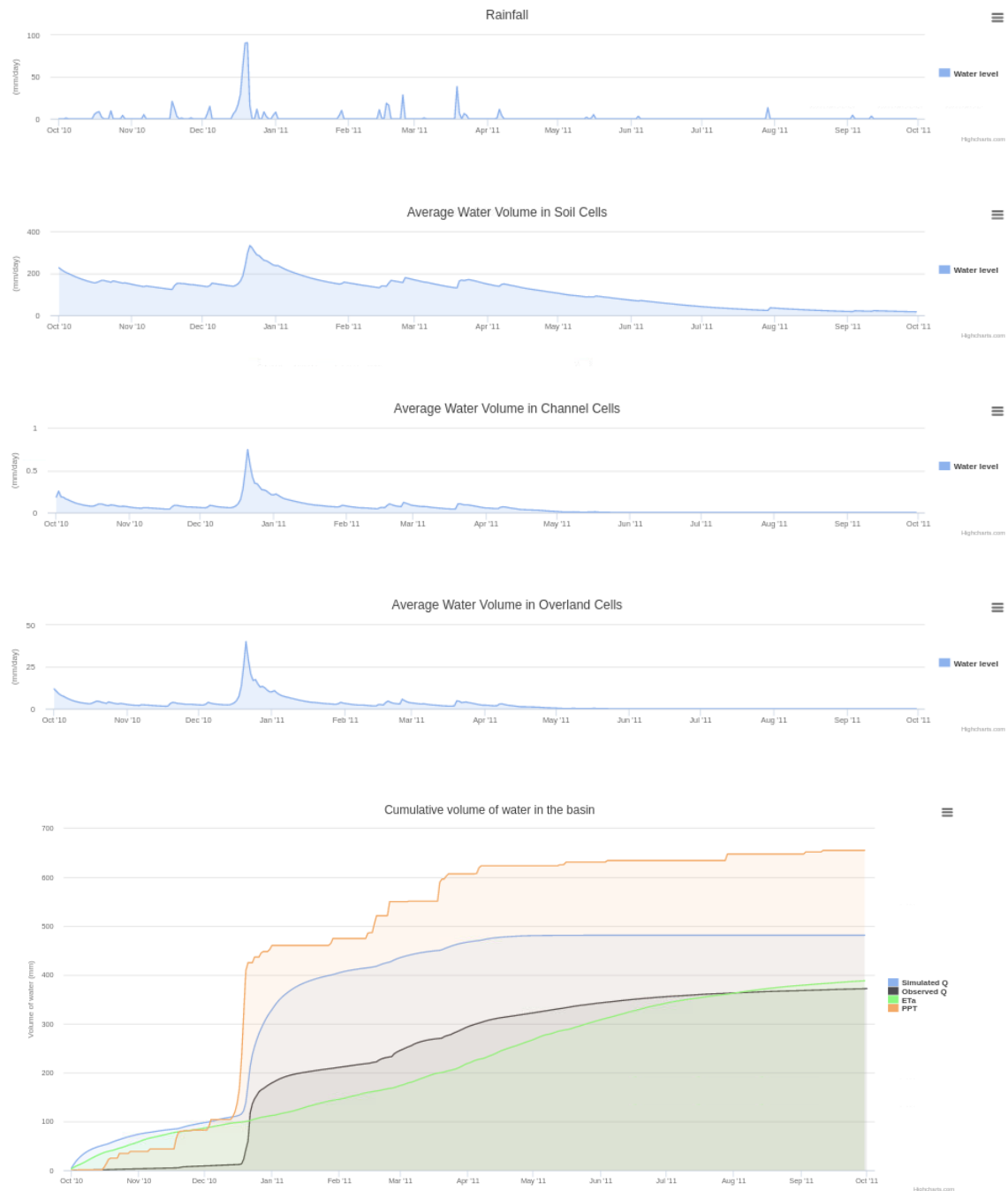
After a few minutes, you should get results (as shown in the figure below), which are the time series plots of the simulated and observed hydrograph. The plot also mentions a NSE value of 0.57, and an R^2 value of 0.62 for the two hydrographs.

PyTOPKAPI simulation- Plunge_demo ran successfully!

Results saved in HydroShare with resource ID: [0c6519de865c4ce78c28c9fae54b82c8](#) Here is the simulated discharge for the outlet chosen



There are also other time series plots displayed as shown in the figure below, like rainfall (Fig (a)), volume of water in soil (Fig (b)), channel (Fig (c)) and overland (Fig (d)) cells and actual ET(Fig (e)),. Additionally, a cumulative graphs of volume of water in the basin (Fig (f)).



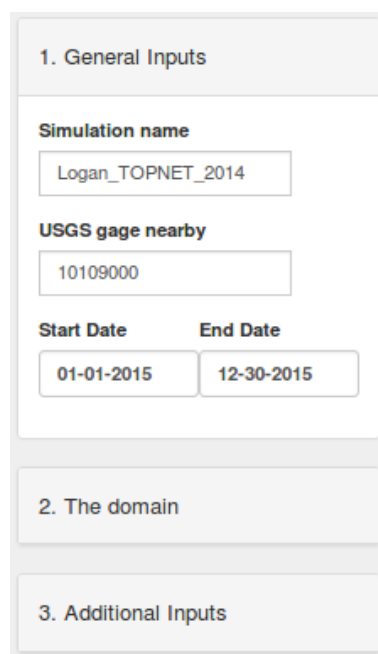
The initial values used for the model are displayed in the left section of the app, which is shown in the figure below:

<u>Multiplicative factors</u>	
Soil depth across all model cells	Saturated hydraulic conductivity
<input type="text" value="1.0"/>	<input type="text" value="1.0"/>
Manning's n for overland	Manning's n for channel
<input type="text" value="1.0"/>	<input type="text" value="1.0"/>
Soil saturation	
<input type="text" value="1.0"/>	
<u>Initial Parameters</u>	
Soil cell's saturation %	Water volume in Overland cells (m3)
<input type="text" value="30.0"/>	<input type="text" value="3.0"/>
Flow in channel cells (m3/s)	Crop coefficient across all model cells
<input type="text" value="0.1"/>	<input type="text" value="1.0"/>
<input type="button" value="Submit"/>	

2. App Tutorial: Prepare TOPNET Input Files

This tutorial provides step by step guidance for using the HydroTop app to prepare input-files for TOPNET. The steps given correspond to the Logan River use case for TOPNET input files creation described in the text.

To start, log on to <http://appsdev.hydroshare.org/apps/hydrotop>, the app's home page. In the *app navigation* section to the top left of screen, click and expand the tab '**1. General Inputs**', and type in the simulation name, and start and end date of the simulation. In this example, we will do 2015 calendar year.



The screenshot shows the '1. General Inputs' section of the HydroTop app. It contains three main input fields: 'Simulation name' with the value 'Logan_TOPNET_2014', 'USGS gage nearby' with the value '10109000', and two date pickers for 'Start Date' (01-01-2015) and 'End Date' (12-30-2015). Below this section are two more sections: '2. The domain' and '3. Additional Inputs', which are currently collapsed.

Expand '**The Domain**' section and click '**Specify long lat**' radio button. Type in the latitude and longitude of the outlet, which is the location of USGS gage 10109000, as 41.7436 and -111.7836 respectively. This should bring the outlet marker on the map to our point of interest. On the same section, enter the bounding box coordinates for North Y, East X, South Y and West X as 42.12, -111.44, 41.68, and -111.83 respectively.

2. The domain

Specify long lat, or draw on map

OUTLET

Longitude

Latitude

-111.7836

41.7436

BOUNDING BOX

North Y

42.12

West X

-111.83

East X


-111.44

South Y

41.68

☐ Upload shp files or TIF

☐ Upload geojson files for watershed



Latitude: 41.6780 Longitude: -111.7886

The map section should be updated with the watershed map and the bounding box surrounding the watershed. Now, head over to the navigation pane, click and expand the tab the third tab-**‘3. Additional Inputs’** → **‘Prepare TOPNET input-files’**, and complete the expanded form for TOPNET inputs as shown in the figure below.

3. Additional Inputs

Cell size in meters

30

Stream threshold in square km

25

Choose an action

Prepare TOPNET input-files

Stream threshold

100

pk_min_threshold

500

pk_max_threshold

50000

pk_num_threshold

12

Send Request

This is all the inputs required to create input files for TOPNET model. With the inputs completed, go ahead and click ‘**Send Request**’ button. It will be few minutes for the app to do its work and return result.

Results

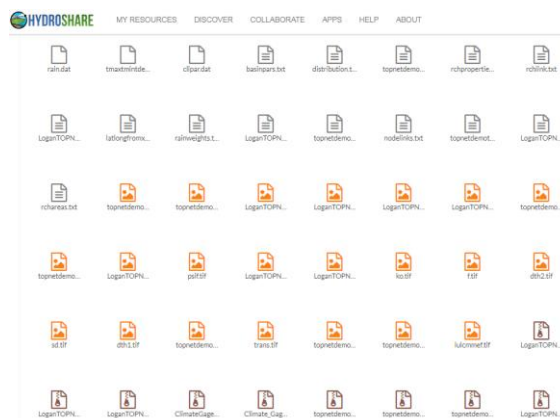
After a few minutes, you should get the prompt (as shown in the figure below), saying the files were created successfully. This page will have a temporary link to the zipped file that contains all the files for you to download immediately. Also, you will have a link to HydroShare where the file is permanently stored. The results of this analysis can be found in HydroShare, and has been made public and available at <https://www.hydroshare.org/resource/955d72a9b00141548aca582c493ee140/>

Congratulations! Files were created successfully!

The created geospatial and forcing files can be accessed temporarily by using this link: [Download zip here](#)

The files is also saved permanently in HydroShare, with the ID [955d72a9b00141548aca582c493ee140](#)

Snippet of files shaved in HydroShare is a shown in the figure below.

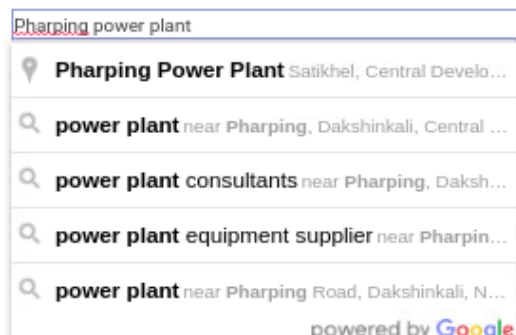



3. App Tutorial: Perform Terrain Analysis

This tutorial provides step by step guidance for using the HydroTop app to perform terrain analysis. The steps given correspond to the terrain analysis for the Bagmati River in Kathmandu, Nepal use case.

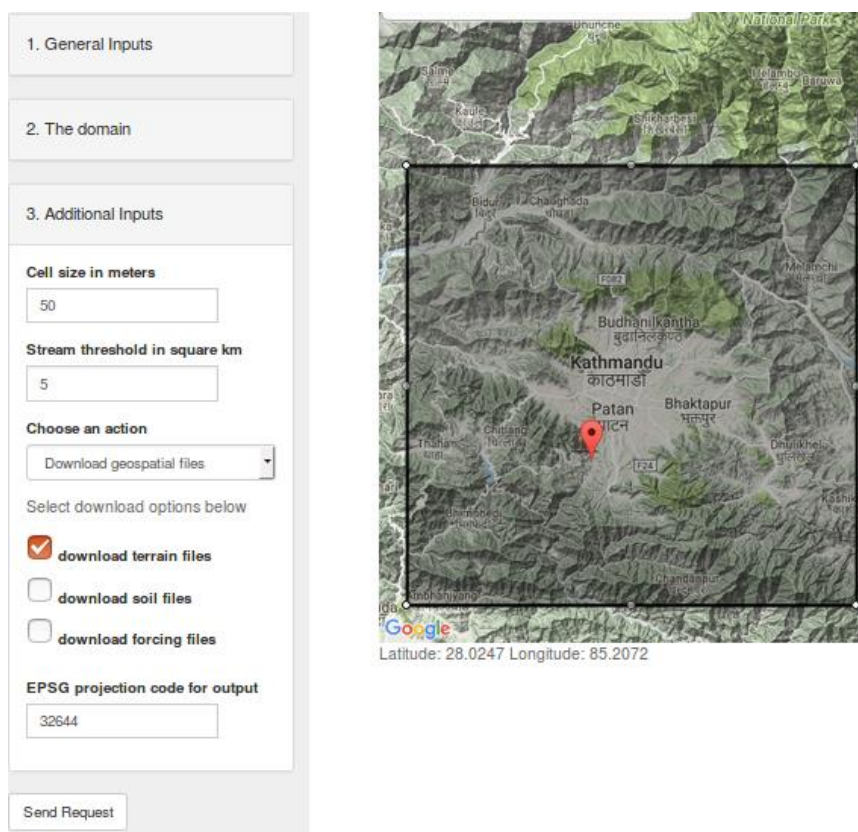
To start, log on to the app's home page (<http://appsdev.hydroshare.org/apps/hydrotop>). The outlet location, and the extent of the area that includes the watershed are required as inputs. Assuming we have the required information, lets proceed.

To quickly go to our desired location, type in 'Pharping Power Plant' in the search box located at the top-left of the map element.



Now, click on this icon at the top-center of the map element,  and draw the outlet point on the Bagmati River.





The image shows a web form for terrain analysis on the left and a map of Kathmandu on the right. The form has three sections: '1. General Inputs', '2. The domain', and '3. Additional Inputs'. Under '3. Additional Inputs', there are input fields for 'Cell size in meters' (50), 'Stream threshold in square km' (5), and 'EPSG projection code for output' (32644). There is a dropdown menu for 'Choose an action' set to 'Download geospatial files'. Below this, there are three checkboxes: 'download terrain files' (checked), 'download soil files' (unchecked), and 'download forcing files' (unchecked). A 'Send Request' button is at the bottom. The map on the right shows a topographic view of Kathmandu with a black rectangular box indicating the analysis domain. The map includes labels for 'Kathmandu', 'Patan', 'Bhaktapur', and 'National Park'. The Google logo and coordinates 'Latitude: 28.0247 Longitude: 85.2072' are visible at the bottom of the map.

This is all the inputs required to create perform terrain analysis. With the inputs completed, go ahead and click ‘Send Request’ button. It will be few minutes for the app to do its work and return result. So make sure you don’t close the page. Again, if you accidentally closed it, that will be fine too. The files will be saved in your HydroShare account so you will not lose the progress.

Results

After a few minutes, you should get results page displayed, which will have a temporary link to the zipped file that contains all the files for you to download immediately. Also, you will have a link to HydroShare where the file is permanently stored. The results of this analysis can be found in HydroShare, and has been made public. If you want to

check it out, here is the link: <https://www.hydroshare.org/resource/ebda23b9e6054f5d8e6dc1ddb1594d26>

Congratulations! Files were created successfully!

The created geospatial and forcing files can be accessed temporarily by using this link: [Download zip here](#)

The files is also saved permanantly in HydroShare, with the ID [ebda23b9e6054f5d8e6dc1ddb1594d26](#)

