**Rpackage: StreamNetworkTools**

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**Purpose:** an R package to derive covariates from NHDPlusV2 dataset and facilitate continental scale analyses of river networks and national scale monitoring efforts.

**Status:** V1.0

**Data Requirements**:

StreamNetworkTools works with NHDPlusV2. Users should become familiar with NHDPlusV2 documentation (<http://www.horizon-systems.com/NHDPlus/NHDPlusV2_documentation.php>)

**Installing StreamNetworkTools\***

1. install.packages(devtools)
2. library("devtools")
3. install\_git("https://github.com/dkopp3/StreamNetworkTools\_git.git", subdir = "StreamNetworkTools")
4. library(StreamNetworkTools)
5. help(package="StreamNetworkTools")

**OR\***

1. download StreamNetworkTools\_1.0.0.000.tar.gz from github
2. install.packages ("C:/Users/Darin/Dropbox/Dissertation/Chapter\_2\_StreamNetworkTools/StreamNetworkTools\_git/StreamNetworkTools\_1.0.0.000.tar.gz", repos = NULL, type="source")

\*if reinstalling after update, remember to:

1. remove.packages("StreamNetworkTools")
2. restart R
3. repeat above

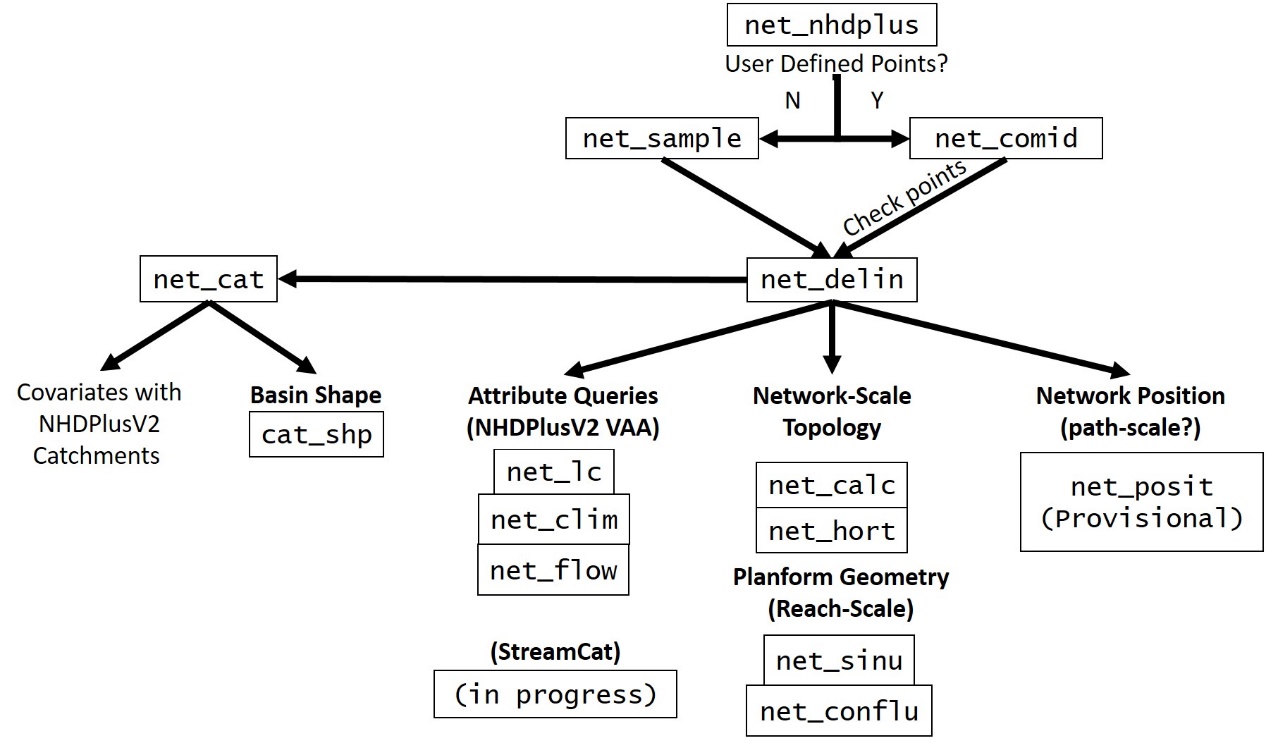


Figure 1: Workflow of StreamNetworkTools. Lines connecting boxes show relationships between functions. See StreamNetworkTools for descriptions.

Variable descriptions

|  |  |  |  |
| --- | --- | --- | --- |
| **Category** | **Variable** | **Definition** | **StreamNetworkTools**  **Function** |
| Basin Shape | basin\_len | longest distance between two catchment verticies | net\_cat |
| Basin Shape | basin\_area | area of catchments | net\_cat |
| Basin Shape | basin\_width | efffective basin width  (basin\_area/basin\_len) | net\_cat |
| Topology | WS.order | strahler order for root node | net\_calc |
| Topology | head.h2o | number of headwater reaches | net\_calc |
| Topology | trib.jun | number of tributary junctions | net\_calc |
| Topology | reach.cnt | number of reaches in network | net\_calc |
| Topology | diver.cnt | count of divergent flow paths | net\_calc |
| Topology | AREASQKM | drainage area (km^2) | net\_calc |
| Topology | LENGTHKM | total lenght of network flowlines (km) | net\_calc |
| Topology | drain.den | drainage density (LENGTHKM / AREASQKM) | net\_calc |
| Climate | TEMPVC | mean annual temperature  (deg C) | net\_clim |
| Climate | seasonality\_t | Coefficient of variation of mean monthly temperatures | net\_clim |
| Climate | warm\_mo | 2-digit warmest month | net\_clim |
| Climate | warm\_mo\_t | mean temperature of warmest month | net\_clim |
| Climate | cold\_mo | 2-digit coldest month | net\_clim |
| Climate | cold\_mo\_t | mean temperature of coldest month | net\_clim |
| Climate | diff\_t | difference between warm and cold monthly temperatures | net\_clim |
| Climate | warm\_q\_t | mean temperature of warmest quarter | net\_clim |
| Climate | warm\_q | 2-digit warmest quarter | net\_clim |
| Climate | cold\_q\_t | mean temperature of coldest quarter | net\_clim |
| Climate | cold\_q | 2-digit coldest quarter | net\_clim |
| Climate | PRECIPVC | cumulative mean annual precipiration (mm) | net\_clim |
| Climate | wet\_mo | 2-digit wettest month | net\_clim |
| Climate | wet\_mo\_p | cumulative mean precipitation of wettest month | net\_clim |
| Climate | dry\_mo | 2-digit driest month | net\_clim |
| Climate | dry\_mo\_p | cumulative mean precipitation of driest month | net\_clim |
| Climate | seasonality\_p | coefficient of vatiation of mean monthly precipitation | net\_clim |
| Climate | wet\_q\_p | cumulaltive mean precipitation of wettest quarter | net\_clim |
| Climate | wet\_q | 2-digit wettest quarter | net\_clim |
| Climate | dry\_q\_p | cumulative mean precipitation of driest quarter | net\_clim |
| Climate | dry\_q | 2-digit driest quarter | net\_clim |
| Climate | dry\_q\_t | mean temperature of driest quarter | net\_clim |
| Climate | wet\_q\_t | mean temperature of wettest quarter | net\_clim |
| Climate | warm\_q\_p | cumulaltive mean precipitation of warmest quarter | net\_clim |
| Climate | cold\_q\_p | cumulaltive mean precipitation of coldest quarter | net\_clim |
| Topology | trib\_order | order of COMID downstream of confluence | net\_conflu |
| Topology | area\_ratio | darinage areas ratios  (i.e. Triburaty Drainage Area / Mainstem Drainage Area) | net\_conflu |
| Topology | trib\_area | drainage area upstream of  confluence | net\_conflu |
| Topology | junction\_num | Concatenation of stream orders of confluence reaches | net\_conflu |
| Topology | alpha | angle (degrees) of tributary junction | net\_conflu |
| Topology | complex | indicates complex tributary junction | net\_conflu |
| Flow | RUNOFFVC | cumulative mean annual runoff (mm) | net\_flow |
| Flow | MAQ0001E | Mean Annual EROM discharge | net\_flow |
| Flow | minMMQ0001E | minimum mean monthly discharge | net\_flow |
| Flow | maxMMQ0001E | maximum mean monthly  discharge (cf) | net\_flow |
| Flow | covMMQ0001E | coefficient of variation of mean monthly discharge | net\_flow |
| Flow | V0001E | mean annual velocity (cfs) | net\_flow |
| Flow | minMMV0001E | minimum mean monthly velocity (cfs) | net\_flow |
| Flow | maxMMV0001E | maximum mean monthly velocity | net\_flow |
| Flow | covMMV0001E | coefficient of variation in mean monthly velocity | net\_flow |
| Topology | str\_ord | stream order | net\_hort |
| Topology | str\_num | count of stream reaches of specified order | net\_hort |
| Topology | str\_len | mean length of stream reaches of specified order | net\_hort |
| Topology | str\_area | mean drainage area of stream reaches of specified order | net\_hort |
| Topology | ohm | order of the network - 1 | net\_hort |
| Topology | Rb | bifurcation Ratio | net\_hort |
| Topology | Rl | length Ratio | net\_hort |
| Topology | Ra | area Ratio | net\_hort |
| Landcover |  | NLCD2011 landcover percentages | net\_lc |
| Planform | tot.len | length of reach | net\_sinu |
| Planform | str.len | straight line length of reach | net\_sinu |
| Planform | sinuosity | total length / straight line length | net\_sinu |
| Planform | MaxElevSM | maximum elevation of reach | net\_sinu |
| Planform | MinElevSM | minimum elevtion of reach | net\_sinu |
| Planform | SlopeNHDPlus | slope of reach | net\_sinu |

**Error Log:**

Upon loading StreamNetworkTools: “package or namespace load failed for 'dplyr' in loadNamespace…” because of missing package “bindr” resolved with restarting R and install.packages(“bindr”) before loading StreamNetworkTools

NHDPlus stream Order Error: Group id = 17153302, vpu = 18 is listed as 4th order but contains 5th order network upstream. Error at Tributaty junction of COMID’s 17153404 (STREAMORDE = 3) and 948030237 (STREAMORDE = 5) yields 3 order stream, should be 5th order. Needs to be reported