

Metadata for the River Surface Reflectance Database (riverSR) v01.01

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Please cite the associated paper (in review in *Geophysical Research Letters*) and this zenodo database when publishing work using this data or code. Thank you.

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Table 1. Metadata associated with the River Surface Reflectance (river SR v01.01) database (rivers_usa_v1.0.feather). This database contains Landsat 5, 7, and 8 Level 1 Collection 1 surface reflectance from all rivers in the contiguous USA that are about 60 meters wide or greater. The surface reflectance values across bands (red, green, blue, nir, swir1, swir1) represent the median reflectance of pixels detected as water within each image that are within the boundaries of each reach in the NHDplusV2 flowlines database. Feather format is readable in R or python using feather package.

Column Name	Description	Units
LS_ID	Landsat product identifier (collection 1)	Na
Cloud_cover	% cloud cover of Landsat scene	percent
ID	Reach ID from modified NHDPlusV2	Na
azimuth	Solar azimuth angle from Landsat scene	degrees
cScore	Sum of pixel_qa cloud/cloud_shadow/snow/ice within the reach polygon	Na
date	Date of Landsat scene	YYYY-MM-DD
time	Time of Landsat scene (GMT)	HH:MM:SS
dswe	Median dynamic surface water extent category (1=open water) of reach water mask. Only 1 was collected.	Na
dswe_sd	Std. dev. dynamic surface water extent	Na
elevation	Elevation from MERIT. Minimum of reach water mask	meters
hillshade	Median Hillshade of reach. 0-255 (0=shadowed, 255 = illuminated)	Na
hillshadow	Median hillshadow of reach. Binary (0= shadowed, 1= not shadowed)	Na
hillshadow_sd	Std. dev of hillshadow over reach water mask	Na
path	WRS path of scene	Na
pixelCount	Number of pixels in reach water mask	count
qa	Median pixel_qa of reach water mask	Na
qa_sd	Std. dev. of pixel_qa of reach water mask	Na
Row	Row of WRS scene	Na
sat	Landsat mission 5, 7, or 8	Na
swir1_sd	Std. dev. of surface reflectance of shortwave infrared 1 band over the reach water mask	Na
Zenith	Solar zenith angle from Landsat scene	degrees
sate_time	Date and time of Landsat scene collection (GMT)	YYYY-MM-DD HH:MM:SS
month	Month of scene collection (1-12) (GMT)	m
year	Year of scene collection (GMT)	YYYY
hour	Hour of scene collection (1-24) (GMT)	h
season	Season of scene collection (Summer, Spring, Winter, Fall)	Na
decade	5 year interval for grouping (1984-1990, 1990-1995...)	YYYY
count	Number of observations for a given reach 1984-2018	count
max_year	The most recent year of observations for a given reach	YYYY

min_year	The first year of observations for a given reach	YYYY
n_years	The number of years between the min and max year	Na
rn	Row number	Na
red_raw	Uncorrected surface reflectance from the red band over reach water mask	Na
green_raw	Uncorrected surface reflectance from the green band over reach water mask	Na
blue_raw	Uncorrected surface reflectance from the blue band over reach water mask	Na
nir_raw	Uncorrected surface reflectance from the near infrared band over reach water mask	Na
swir1_raw	Uncorrected surface reflectance from the shortwave infrared 1 band over reach water mask	Na
swir2_raw	Uncorrected surface reflectance from the shortwave infrared 2 band over reach water mask	Na
red	Corrected surface reflectance (for Landat 5 and 8) from the red band over reach water mask (See Table 4 for correction coefficients)	Na
green	Corrected surface reflectance (for Landat 5 and 8) from the green band over reach water mask (See Table 4 for correction coefficients)	Na
blue	Corrected surface reflectance (for Landat 5 and 8) from the blue band over reach water mask (See Table 4 for correction coefficients)	Na
nir	Corrected surface reflectance (for Landat 5 and 8) from the nir band over reach water mask (See Table 4 for correction coefficients)	Na
swir1	Corrected surface reflectance (for Landat 5 and 8) from the swir1 band over reach water mask (See Table 4 for correction coefficients)	Na
swir2	Corrected surface reflectance (for Landat 5 and 8) from the swir2 band over reach water mask (See Table 4 for correction coefficients)	Na
ALL band ratios below were calculated with CORRECTED bands		
NR	nir/red	Na
BR	blue/red	Na
GR	green/red	Na
SR	swir1/red	Na
BG	blue/green	Na
RG	red/green	Na
NG	nir/green	Na
SG	swir1/green	Na
BN	blue/nir	Na
GN	green/nir	Na
RN	red/nir	Na
SN	swir1/nir	Na
BS	blue/swir1	Na

GS	green/swir1	Na
RS	red/swir1	Na
NS	nir/swir1	Na
R.GN	red/ (green +nir)	Na
R.GB	red/ (green + blue)	Na
R.GS	red / (green + swir1)	Na
R.BN	red / (blue + nir)	Na
R.BS	red / (blue + swir1)	Na
R.NS	red / (nir + swir1)	Na
G.BR	green / (blue + red)	Na
G.BN	green / (blue + nir)	Na
G.BS	green / (blue + swir1)	Na
G.RN	green / (red + nir)	Na
G.RB	green / (red + blue)	Na
G.NS	green / (nir + swir1)	Na
B.RG	blue / (red + green)	Na
B.RN	blue / (red + nir)	Na
B.RS	blue / (red + swir1)	Na
B.GN	blue / (green + nir)	Na
B.GS	blue / (green + swir1)	Na
B.NS	blue / (nir + swir1)	Na
N.RG	nir / (red + green)	Na
N.RB	nir / (red + blue)	Na
N.RS	nir / (red + swir1)	Na
N.GB	nir / (green + blue)	Na
N.GS	nir (green + swir1)	Na
N.BS	nir / (blue + swir1)	Na
GR2	(green + red) / 2	Na
GN2	(green + nir) / 2	Na
BR_G	(blue - red) / green	Na
NS_NR	(nir - swir1) / (red - swir1)	Na
fai	nir - (red + (swir1-red)*((830-660)/(1650-660)))	Na
N_S	nir - swir1	Na
N_R	nir - red	Na
ndvi	((nir - red)/(nir + red))	Na
ndwi	((green - swir1)/(green + swir1))	Na
ndssi	((blue - nir)/ (blue + nir))	Na
gn.gn	((green- nir)/ (green + nir))	Na
hue	Color, or hue, using rgb2hsv	Na
saturation	Saturation using rgb2hsv	Na
bright	Brightness using rgb2hsv	Na
bright_tot	Total brightness (red + green + blue + nir)	Na
dw	Dominant wavelength	nanometers
hexcolor	Hexadecimal color using rgb function	Na

Table 2. Metadata associated with the modified NHDplusV2 centerlines (nhdplusv2_modified_v1.0.shp). This file can be joined with the riverSR database by the “ID” column to assign geometries to the reflectance data. Centerlines were modified to achieve reaches that were ~2km on average by joining short reaches. More information on NHDplusV2 can be found at...

(https://nctc.fws.gov/courses/references/tutorials/geospatial/CSP7306/Readings/NHDPlusV2_User_Guide.pdf) (<https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus>).

nhdplusv2_polygons.shp has only the ID column and its geometry.

Column Name	Description	Units
ID	New reach ID from joining small reaches in NHDplusv2	Na
toID	ID of downstream reach	Na
LENGTHKM_	Length of new reach	kilometers
LvIPtID	levelPath (or mainstem) ID of new reaches	
Hydrsq_	Hydrosequence of new reaches	Na
COMID	Original reach ID from NHDplusV2. If reaches were joined, the most downstream COMID was joined to the new ID	Na
<p>ALL other columns are data from NHDplusV2 and attributes associated with the COMID (or most downstream point of the new reach). Column names have been truncated from their original names for shapefile reading and writing. More info on additional attributes can be found in the NHDplusV2 manual.</p> <p>https://nctc.fws.gov/courses/references/tutorials/geospatial/CSP7306/Readings/NHDPlusV2_User_Guide.pdf</p> <p>https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus</p>		

Table 3. COMID_ID is a table of the original NHDPlusV2 reach COMIDs that were joined to form new reach IDs.

Column Name	Description	Units
COMID	Original reach COMID	na
ID	New reach ID	na

Table 4. Polynomial coefficients for correcting Landsat 5 and 8 to 7 based on a 2nd order polynomial regression of ordered quantiles of all reflectance measurements from rivers in the contiguous USA. The equations is; $\rho_{corrected} = a\rho^2 + b\rho + c$, where ρ = surface reflectance measured by Landsat (5 or 8), abc are the polynomial coefficients shown below, and $\rho_{corrected}$ is the surface reflectance normalized to Landsat 7.

Band	<i>a</i>	<i>b</i>	<i>c</i>
<i>Correct Landsat 5 (to 7)</i>			
blue	7.28E-06	0.9781	3.0184
red	-1.20E-05	1.0438	-46.6908
green	-2.23E-05	0.9964	-24.8700
nir	-6.92E-05	1.1227	-55.6598
swir1	2.66E-04	0.7072	8.9740
swir2	2.65E-04	0.7265	6.1006
<i>Correct Landsat 8 (to 7)</i>			
blue	-9.21E-05	1.0259	59.7216
red	-3.04E-05	0.9971	46.2292
green	-4.25E-05	0.9949	49.2675
nir	-1.86E-04	1.2754	84.9931
swir1	-9.46E-05	1.0315	25.1120
swir2	-3.58E-05	0.9498	14.8144