



Web: <http://www.geosage.com/>

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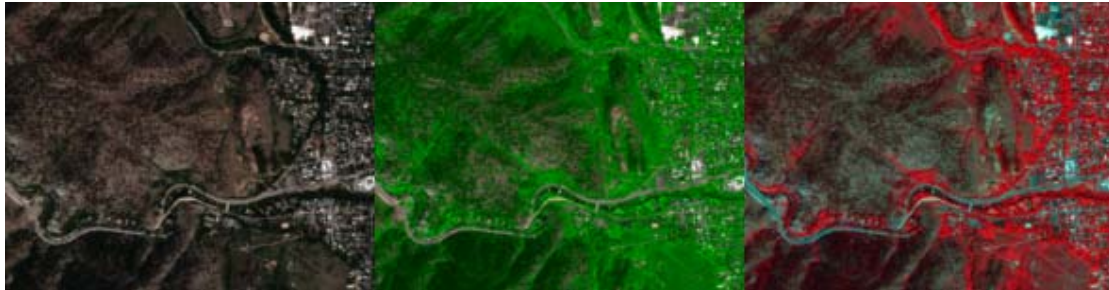


Image source: © DigitalGlobe, All Rights Reserved. Boulder - demo samples.

DOS-based *HighView* (Version 3.1, Released 2 Feb. 2010)

The **latest** version of *HighView* for rapidly processing the recent high-resolution satellite imagery – **WorldView-2, QuickBird, GeoEye-1 and IKONOS.**

A dedicated utility program in the form below

```
C:\Fuse.exe <optimization_method> <output_image_type> -e  
<enhanced_spatial_filter_option> <enhanced_green_color_option>  
<enhanced_pixel_offset_x_option> <enhanced_pixel_offset_y_option> -s  
<image_stretch_band1_left_cut> <image_stretch_band1_right_cut>  
<image_stretch_band2_left_cut> <image_stretch_band2_right_cut>  
<image_stretch_band3_left_cut> <image_stretch_band3_right_cut>  
<nonlinear_stretch_band1> <nonlinear_stretch_band2>  
<nonlinear_stretch_band3> <in_PAN.tif> <in_MS.tif>  
<out_PanSharpened.tif>
```

- Processing **WorldView-2, QuickBird, GeoEye-1 and IKONOS** imagery DIRECTLY from DigitalGlobe and GeoEye data vendors. Both 16-bit panchromatic and multispectral inputs in GeoTIFF format contain full 11-bit dynamic ranges. Pan-sharpened R/G/B output in GeoTIFF format can be directly used by GIS software (e.g., ArcGIS, MapInfo) and popular image manipulation software (e.g., PhotoShop). Maximum image size is about 36,500 x 36,500 pixels, and max file size for the output is 4Gb.
- Global and local optimization methods
- Natural- or false-color R/G/B composites
- Options for spatial and spectral enhancements
- Options for pixel offset adjustment in X/Y directions
- Options for both linear and non-linear image stretching
- Low memory usage, highly efficient in processing
- RGB Band Combination and Image Stretching tools included

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```
C:\Fuse.exe
<optimization_method> <output_image_type> -e
<enhanced_spatial_filter_option> <enhanced_green_color_option>
<enhanced_pixel_offset_x_option> <enhanced_pixel_offset_y_option> -s
<image_stretch_band1_left_cut> <image_stretch_band1_right_cut>
<image_stretch_band2_left_cut> <image_stretch_band2_right_cut>
<image_stretch_band3_left_cut> <image_stretch_band3_right_cut>
<nonlinear_stretch_band1> <nonlinear_stretch_band2> <nonlinear_stretch_band3>
<in_PAN.tif> <in_MS.tif> <out_PanSharpened.tif>
Version 3.1, Released 2 February 2010

Parameters - Specific to algorithms

<optimisation_method>
0 - local optimization; 1 - global optimization (recommended)

<output_image_type>
0 - true (natural) color composite, e.g., QuickBird MS Bands 3/2/1
Worldview-2 MS Bands 5/3/2
1 - color-infrared composite, e.g., QuickBird MS Bands 4/3/2
Worldview-2 MS Bands 7/5/3

<enhanced_spatial_filter_option>
0 - none; 1 - detail; 2 - sharper (recommended)

<enhanced_green_option>
Usually this value should be set to zero. If the user wishes to highlight
vegetation in TOTAL green based on NDVI thresholds, set this value within the
range (0.0-1.0) with a typical value of 0.2; i.e., vegetated areas with NDVI
greater than 0.2 will be shown in TOTAL green. If the user just wishes to
highlight vegetation GREENER, set this value within the range [1-10],
typical value 4.0. If the output image type is set to 1 (color-infrared),
this value should always be zero.

<enhanced_pixel_offset_x_option>
Usually this value should be set to zero. This option is to slightly adjust
horizontal pixel shifts between PAN and MS inputs, when necessary. Rare usage
recommended. For QuickBird and IKONOS inputs directly from data vendors, set
this value to zero. If slight pixel mismatches exist between PAN and MS inputs,
the user may set this value within the range [-0.25, 0.25]

<enhanced_pixel_offset_y_option>
Usually this value should be set to zero. This option is to slightly adjust
vertical pixel shifts between PAN and MS inputs, when necessary. Rare usage
recommended. For QuickBird and IKONOS inputs directly from data vendors, set
this value to zero. If slight pixel mismatches exist between PAN and MS inputs,
the user may set this value within the range [-0.25, 0.25]

Parameters - specific to adaptive image stretching

The following parameters are used for both linear and non-linear image
stretching, identical to those of the RGB Image Stretching Tool included
in this package. Type RGB_stretch.exe for more information.

<image_stretch_band1_left_cut>
Linear stretching, % of pixels to be excluded at left-end for band1
Value range [0.0-40.0], typical value 2.0
<image_stretch_band1_right_cut>
Linear stretching, % of pixels to be excluded at right-end for band1
Value range [0.0-40.0], typical value 2.0
<image_stretch_band2_left_cut>
Linear stretching, % of pixels to be excluded at left-end for band2
Value range [0.0-40.0], typical value 2.0
<image_stretch_band2_right_cut>
Linear stretching, % of pixels to be excluded at right-end for band2
Value range [0.0-40.0], typical value 2.0
<image_stretch_band3_left_cut>
Linear stretching, % of pixels to be excluded at left-end for band3
Value range [0.0-40.0], typical value 2.0
<image_stretch_band3_right_cut>
Linear stretching, % of pixels to be excluded at right-end for band3
Value range [0.0-40.0], typical value 2.0

<nonlinear_stretch_band1>
Nonlinear stretching coefficient/weight for band1
Value range [0.0-20.0], typical value 2.0
```

(Continued)

```
Fuse.exe Help Version 3.1.txt - Notepad
File Edit Format View Help
<nonlinear_stretch_band2>
Nonlinear stretching coefficient/weight for band2
Value range [0.0-20.0], typical value 2.0
<nonlinear_stretch_band3>
Nonlinear stretching coefficient/weight for band3
Value range [0.0-20.0], typical value 2.0

Parameters - Specific to input and output GeoTIFF files

All GeoTIFF files should be untiled, uncompressed.

<in_PAN.tif>
Panchromatic input must contain 16-bit, single-band data.
Pixel data range [0-2047] (or 11-bit) is expected.
<in_MS.tif>
Multispectral input must contain 16-bit, four-band data (e.g., QuickBird,
GeoEye-1 and IKONOS) or eight-band data (e.g., worldview-2).
Pixel data range [0-2047] (or 11-bit) is expected.
<out_PanSharpened.tif>
Pan-sharpened output file name. Output will be 8-bit, three-band GeoTIFF file.

Examples/Tips

1. This tool targets worldview-2, QuickBird, GeoEye-1 and IKONOS imagery
directly supplied by DigitalGlobe and GeoEye data vendors. Generally, both
panchromatic and multispectral inputs are 16-bit GeoTIFF files, and
meet the EXACT image size ratio of 4:1. Maximum image size for PAN
band is about 36500 x 36500 pixels, and max file size for output is 4GB.
2. Before pan-sharpening, users may wish to perform simple band combination
and produce R/G/B true-color composite using the multispectral input:
RGB_Stretch.exe 3 2 1 -s 2 1 2 1 2 1 2 2 2 in_QB_MS.tif QB_MS_RGB.tif
RGB_Stretch.exe 5 3 2 -s 2.5 2.5 2.5 2 2 2 in_WV_MS.tif WV_MS_RGB.tif
3. For worldview-2 and QuickBird imagery, use pan-sharpening commandlines:
Fuse.exe 1 0 -e 2 0 0 0 -s 2 1 2 1 2 1 0 0 0 in_PAN.tif in_MS.tif out.tif
Fuse.exe 1 0 -e 2 0 0 0 -s 2 1 2 1 2 1 2 2 2 in_PAN.tif in_MS.tif out.tif
4. For GeoEye-1 and IKONOS imagery, since multispectral data are provided with
four separate bands - blue, green, red and near-infrared, users need to
combine all multispectral bands together in order to make a new, four-band
multispectral input file first, using RGB Image Composition Tool included
in the package, i.e.,
RGB_Make.exe blue.tif green.tif red.tif nir.tif in_MS.tif
Then, use this tool for image pan-sharpening, e.g.,
Fuse.exe 1 0 -e 2 0 0 0 -s 2 1 2 1 2 1 2 2 2 in_PAN.tif in_MS.tif out.tif
5. To highlight vegetation in TOTAL green based on NDVI threshold, use
Fuse.exe 0 0 -e 0 0.2 0 0 -s 2 1 2 1 2 1 0 0 0 in_PAN.tif in_MS.tif out.tif
Just to highlight vegetation greener, use
Fuse.exe 0 0 -e 0 4 0 0 -s 2 1 2 1 2 1 0 0 0 in_PAN.tif in_MS.tif out.tif
6. To produce a color-infrared output, use
Fuse.exe 0 1 -e 2 0 0 0 -s 2 1 2 1 2 1 0 0 0 in_PAN.tif in_MS.tif out.tif
7. For more examples and tips, please refer to software features and tutorials
on the website.

Software Full Name:

Highview - An Advanced Image Fusion and Pan-Sharpening Tool
(RGB Band Combination and Image Stretching Tool included)

DOS-based command-line utility programs for rapidly pan-sharpening the recent
high-resolution satellite imagery such as worldview-2, QuickBird, GeoEye-1
and IKONOS.

Developer: http://www.GeoSage.com/
```

Example:

```
Fuse_Example.txt - Notepad
File Edit Format View Help
C:\fuse.exe 0 0 -e 2 0 0 0 -s 2 0.5 2 0.5 2 0.5 0 0 0 in_pan.TIF
in_ms.tif out_pansharpend.tif

Input - Multispectral bands
  Image width           = 800
  Image length          = 800
  Bits per sample       = 16
  Total number of bands = 4
  Image planar configuration = separate image planes
Input - Panchromatic band
  Image width           = 3200
  Image length          = 3200
  Bits per sample       = 16
  Total number of band  = 1
  Image planar configuration = single image plane
Output: Pan-sharpened image
  Image width           = 3200
  Image length          = 3200
  Bits per sample       = 8
  Total number of bands = 3
  Image planar configuration = single image plane
Calculating statistics for image stretching ...
Processing:
0...10...20...30...40...50...60...70...80...90...100
Start time -          Fri Jun 27 17:58:19 2008
End time   -          Fri Jun 27 17:58:21 2008
Used time (seconds) - 2
```



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Image source: USGS GloVIS, Landsat ETM+ bands 3/2/1. Washington, D.C.

RGB Band Combination and Image Stretching Tool:

Containing a hybrid of linear and nonlinear stretching methods

Highlights:

A powerful, easy-to-implement utility tool in the form below


C:\RGB_Stretch.exe

```
<band_selection_red> <band_selection_green> <band_selection_blue> -s  
<image_stretch_band1_left_cut> <image_stretch_band1_right_cut>  
<image_stretch_band2_left_cut> <image_stretch_band2_right_cut>  
<image_stretch_band3_left_cut> <image_stretch_band3_right_cut>  
<nonlinear_stretch_band1> <nonlinear_stretch_band2>  
<nonlinear_stretch_band3> <in.tif> <out.tif>
```

- 1. Directly processing multiple bands (≥ 3), 8- or 16-bit input imagery in untiled, uncompressed GeoTIFF format. R/G/B output is in GeoTIFF format as well, without losing any georeference information.**
- 2. Selection of any band combinations making true- or false-colour imagery**
- 3. Settings of linear stretching specific to each R/G/B band**
- 4. Nonlinear image stretching option designed to improve overall brightness of the output and rendering effect**
- 5. Applicable to all types of remotely sensed imagery**
- 6. Processing input files up to 4Gb in size**
- 7. Super fast in running (e.g., processing 8,500+ Landsat ETM+ scenes with a global coverage takes less than 24 hours on a typical office PC)**
- 8. Support of batch processing, without limit on the # of images to be processed.**
- 9. Great tips and generous technical support.**

RGB Band Combination and Image Stretching Tool:

Containing a hybrid of linear and nonlinear stretching methods



```
C:\RGB_Stretch.exe
<band_selection_red> <band_selection_green> <band_selection_blue> -s
<image_stretch_band1_left_cut> <image_stretch_band1_right_cut>
<image_stretch_band2_left_cut> <image_stretch_band2_right_cut>
<image_stretch_band3_left_cut> <image_stretch_band3_right_cut>
<nonlinear_stretch_band1> <nonlinear_stretch_band2> <nonlinear_stretch_band3>
<in.tif> <out.tif>
Version 3.1, Released 2 February 2010

Parameters

<band_selection_red>:
Band selection number for the Red band from input, range [1-256]
<band_selection_green>:
Band selection number for the Green band from input, range [1-256]
<band_selection_blue>:
Band selection number for the Blue band from input, range [1-256]

<image_stretch_band1_left_cut>:
Linear stretching, % of pixels to be excluded at left-end for band1
Value range [0.0-40.0], typical value 2.0
<image_stretch_band1_right_cut>:
Linear stretching, % of pixels to be excluded at right-end for band1
Value range [0.0-40.0], typical value 2.0
<image_stretch_band2_left_cut>:
Linear stretching, % of pixels to be excluded at left-end for band2
Value range [0.0-40.0], typical value 2.0
<image_stretch_band2_right_cut>:
Linear stretching, % of pixels to be excluded at right-end for band2
Value range [0.0-40.0], typical value 2.0
<image_stretch_band3_left_cut>:
Linear stretching, % of pixels to be excluded at left-end for band3
Value range [0.0-40.0], typical value 2.0
<image_stretch_band3_right_cut>:
Linear stretching, % of pixels to be excluded at right-end for band3
Value range [0.0-40.0], typical value 2.0

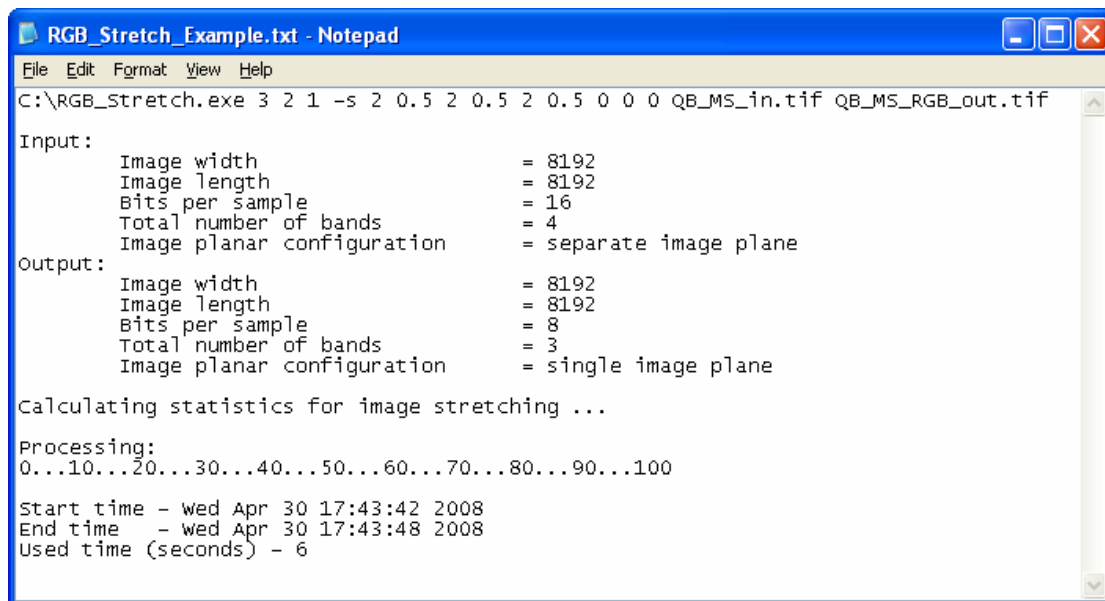
<nonlinear_stretch_band1>:
Nonlinear stretching coefficient/weight for band1
Value range [0.0-20.0], typical value 2.0
<nonlinear_stretch_band2>:
Nonlinear stretching coefficient/weight for band2
Value range [0.0-20.0], typical value 2.0
<nonlinear_stretch_band3>:
Nonlinear stretching coefficient/weight for band3
Value range [0.0-20.0], typical value 2.0

Examples/Tips

1. If a scene contains a small percentage of information-rich white pixels
(e.g. those showing built-up areas), try to use smaller right-end cut-off
values. Such data are popular, including Landsat ETM+ imagery in NASA
GeoCover series and 16-bit worldview-2, QuickBird, GeoEye-1, IKONOS
imagery with populated areas.
IMPORTANT: This option will probably work best for the majority of scenes.
RGB_stretch.exe 3 2 1 -s 2 0.2 2 0.2 2 0.2 0 0 0 in.tif out.tif
RGB_stretch.exe 5 3 2 -s 2 0.2 2 0.2 2 0.2 2 2 2 in.tif out.tif
RGB_stretch.exe 7 5 2 -s 2 0.5 2 0.5 2 0.5 2 2 2 in.tif out.tif
2. If a full scene or its large part is about desert land cover, try to
use smaller right-end cut-off values, e.g.
RGB_stretch.exe 3 2 1 -s 2 0.2 2 0.2 2 0.2 0 0 0 in.tif out.tif
RGB_stretch.exe 5 3 2 -s 2 0.1 2 0.1 2 0.1 2 2 2 in.tif out.tif
3. If a scene contains a large proportion of white areas (e.g. clouds, snows),
try to increase the right-end cut-off values for their exclusion, e.g.
RGB_stretch.exe 1 2 3 -s 2 4 2 4 2 4 0 0 0 in.tif out.tif
RGB_stretch.exe 1 2 3 -s 2 6 2 6 2 6 0 0 0 in.tif out.tif
4. If an initial image stretching result appears bluish, try to increase
the left-end cut-off values for the BLUE band only, e.g.
RGB_stretch.exe 1 2 3 -s 2 2 2 2 5 2 0 0 0 in.tif out.tif
5. Input GeotIFF file should be untiled, uncompressed, 8-/16-bit.
6. Planar configuration for the output: single image plane.

Full Name: RGB Band Combination and Image Stretching Tool
Containing a hybrid of linear and nonlinear stretching methods
Developer: http://www.Geosage.com/
```

Example



```
RGB_Stretch_Example.txt - Notepad
File Edit Format View Help
C:\RGB_Stretch.exe 3 2 1 -s 2 0.5 2 0.5 2 0.5 0 0 0 QB_MS_in.tif QB_MS_RGB_out.tif

Input:
  Image width           = 8192
  Image length          = 8192
  Bits per sample       = 16
  Total number of bands = 4
  Image planar configuration = separate image plane

Output:
  Image width           = 8192
  Image length          = 8192
  Bits per sample       = 8
  Total number of bands = 3
  Image planar configuration = single image plane

Calculating statistics for image stretching ...

Processing:
0...10...20...30...40...50...60...70...80...90...100

Start time - wed Apr 30 17:43:42 2008
End time   - wed Apr 30 17:43:48 2008
Used time (seconds) - 6
```

Tutorial

Step 1 (optional): Download GeoTIFF files and combine all separate bands into a single file (common for **Landsat ETM+**, **GeoEye-1** and **IKONOS** imagery sources).

Many tools are available in the public domain for this task, e.g.,

- Use RGB_Make.exe (next page)

RGB_Make.exe tm_band3.tif tm_band2.tif tm_band1.tif out.tif

- Or, use versatile GDAL_merge.py (http://www.gdal.org/gdal_merge.html)

GDAL_merge -o out.tif -separate tm_band3.tif tm_band2.tif tm_band1.tif

Step 2: Perform band combination and image stretching, e.g.,

Landsat ETM+ multi-band, multispectral imagery in NASA GeoCover series

C:\RGB_Stretch.exe 3 2 1 -s 2 0.5 2 0.5 2 0.5 0 0 0 in.tif rgb_out.tif

QuickBird multispectral imagery (Data directly from data vendors usually have four MS bands in a single file and use 16-bit data type for 11-bit pixel values ranging from 0 to 2047)

- Natural color composite -

C:\RGB_Stretch.exe 3 2 1 -s 2 0.5 2 0.5 2 0.5 2 2 2 in.tif rgb_out.tif

- False color composite -

C:\RGB_Stretch.exe 4 3 2 -s 2 0.5 2 0.5 2 0.5 2 2 2 in.tif rgb_out.tif

WorldView-2 multispectral imagery (Data directly from data vendors usually

have eight MS bands in a single file and use 16-bit data type for 11-bit pixel values ranging from 0 to 2047)

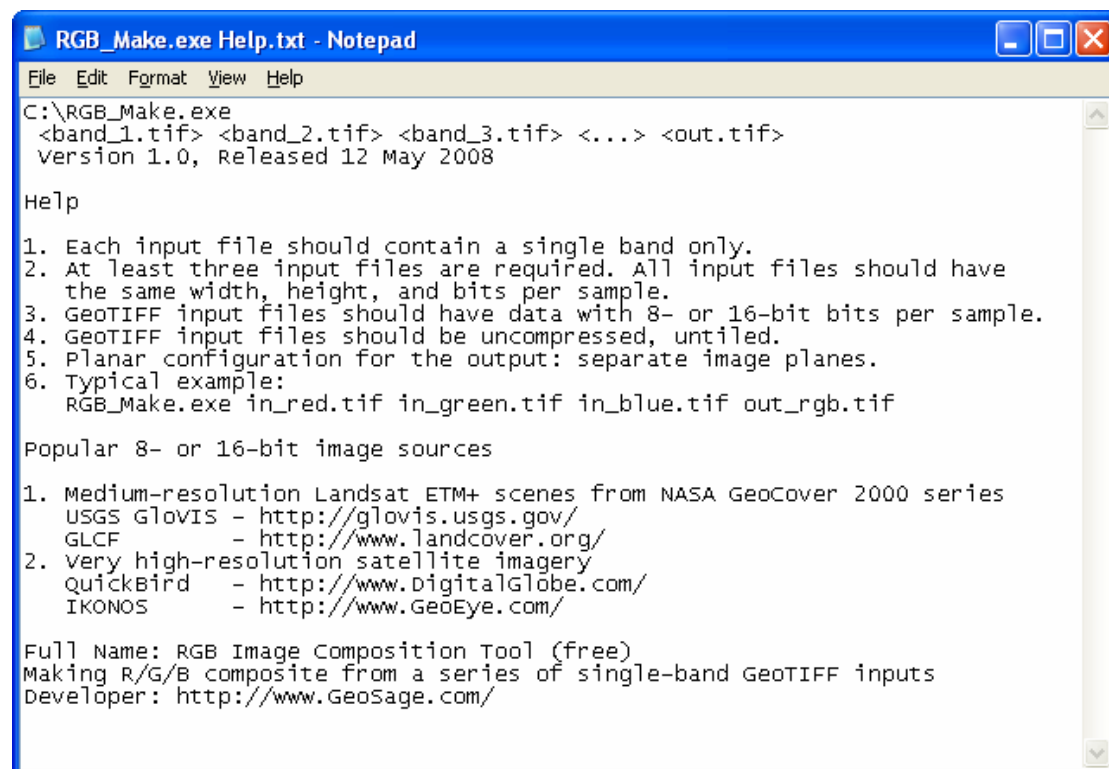
Natural color composite -

C:\RGB_Stretch.exe 5 3 2 -s 2 0.5 2 0.5 2 0.5 2 2 2 in.tif rgb_out.tif

False color composite -

C:\RGB_Stretch.exe 7 5 3 -s 2 0.5 2 0.5 2 0.5 2 2 2 in.tif rgb_out.tif

RGB Image Composition Tool (free)



```
RGB_Make.exe Help.txt - Notepad
File Edit Format View Help
C:\RGB_Make.exe
<band_1.tif> <band_2.tif> <band_3.tif> <...> <out.tif>
Version 1.0, Released 12 May 2008

Help

1. Each input file should contain a single band only.
2. At least three input files are required. All input files should have
   the same width, height, and bits per sample.
3. GeoTIFF input files should have data with 8- or 16-bit bits per sample.
4. GeoTIFF input files should be uncompressed, untiled.
5. Planar configuration for the output: separate image planes.
6. Typical example:
   RGB_Make.exe in_red.tif in_green.tif in_blue.tif out_rgb.tif

Popular 8- or 16-bit image sources

1. Medium-resolution Landsat ETM+ scenes from NASA GeoCover 2000 series
   USGS GloVIS - http://glovis.usgs.gov/
   GLCF       - http://www.landcover.org/
2. Very high-resolution satellite imagery
   QuickBird  - http://www.DigitalGlobe.com/
   IKONOS     - http://www.GeoEye.com/

Full Name: RGB Image Composition Tool (free)
Making R/G/B composite from a series of single-band GeoTIFF inputs
Developer: http://www.GeoSage.com/
```