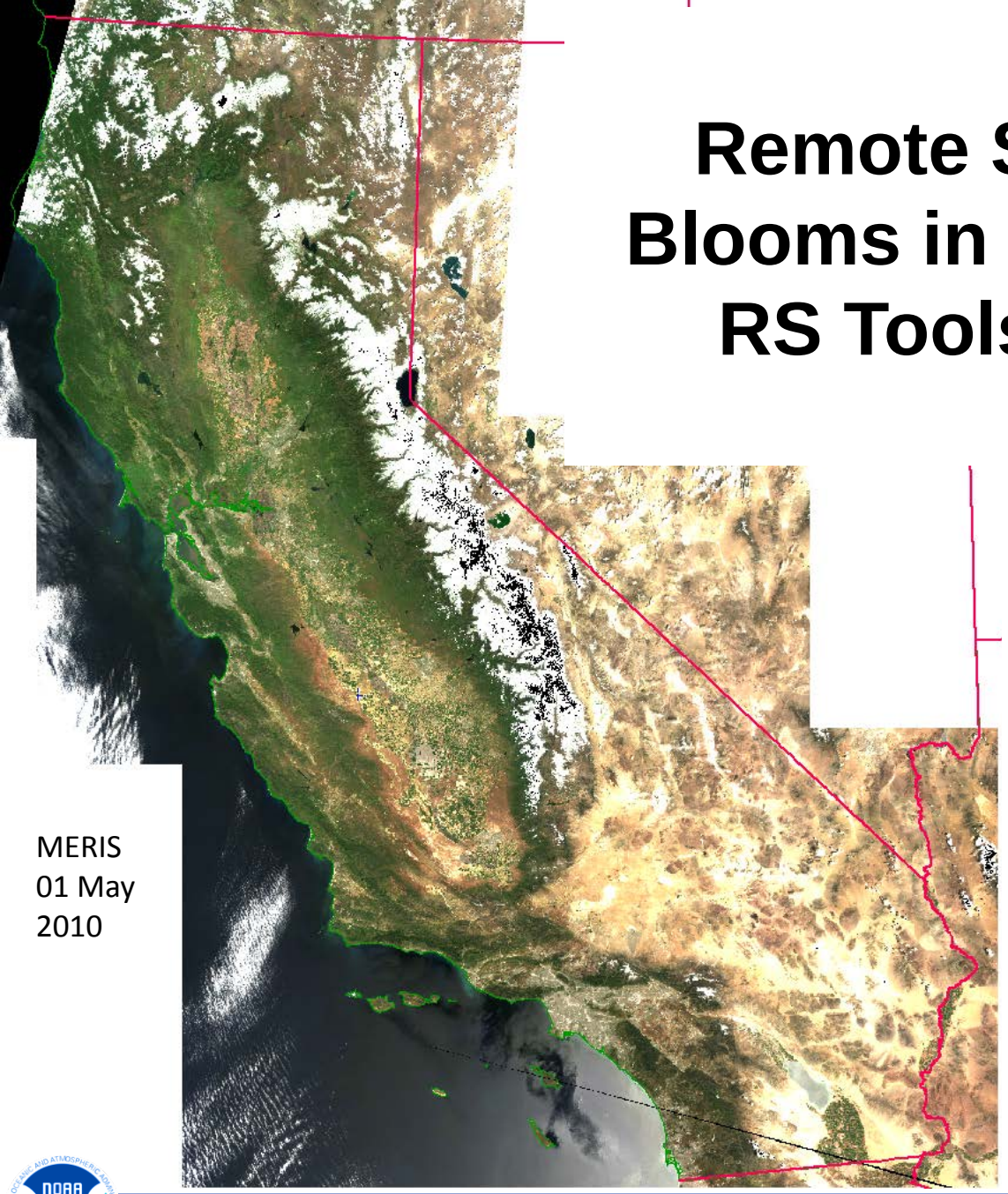
Remote Sensing for Algal Blooms in California Lakes RS Tools Introduction



MERIS
01 May
2010

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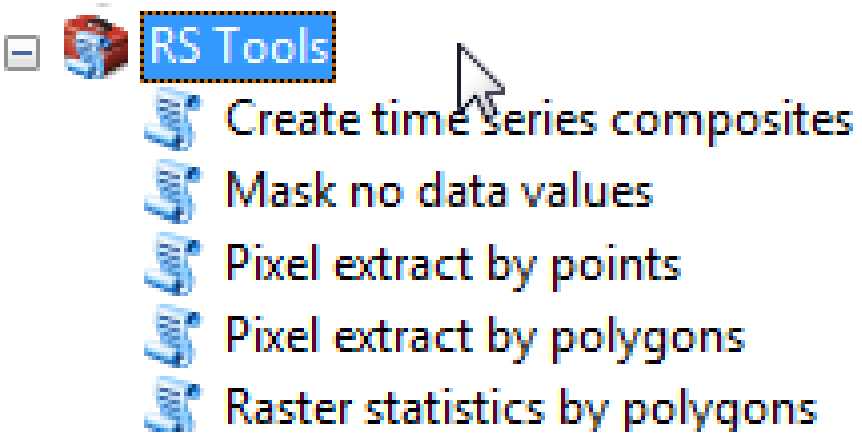
NOAA
National Centers for
Coastal Ocean Science

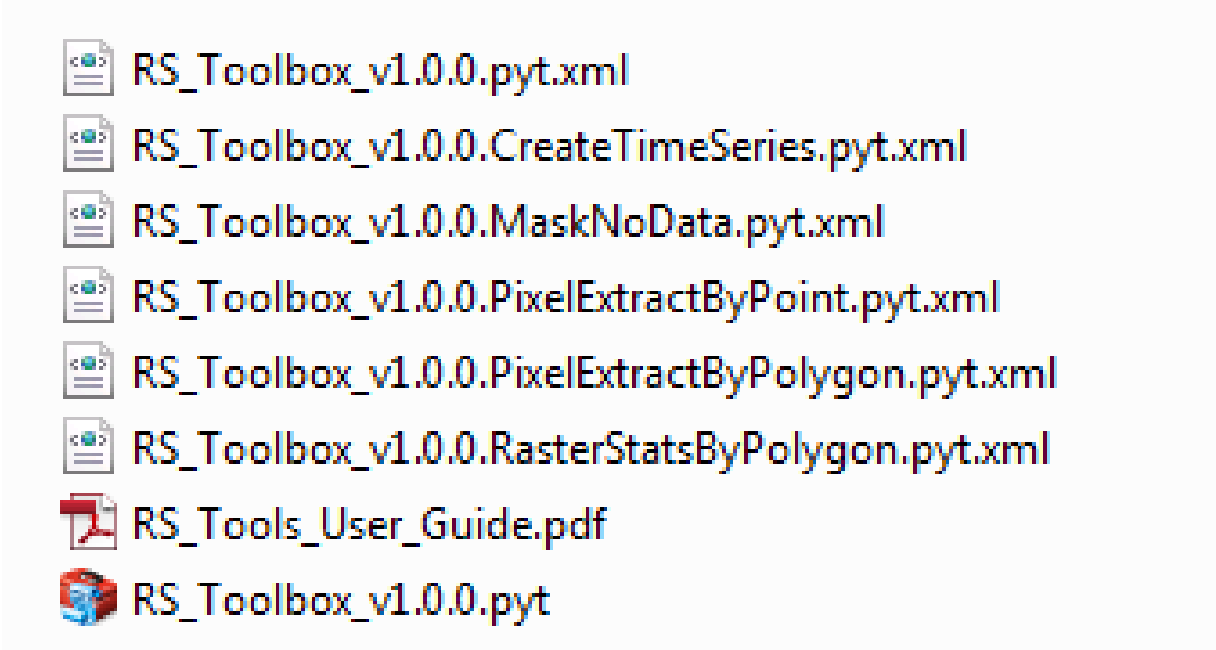
RS Tools - What is it?

- ArcGIS Toolbox
  - Version 10.2+
  - Python
- 5 tools to facilitate manipulating and analyzing NOAA/NCCOS satellite data products



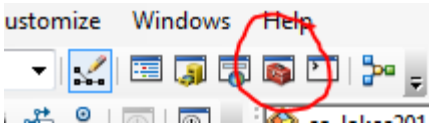
Installation

- Copy rs_toolbox_v1.0.0.zip to C:\Users\<username>\Documents\ArcGIS
- Unzip/Extract all files into C:\Users\<username>\Documents\ArcGIS\RS_Toolbox_v1.0.0

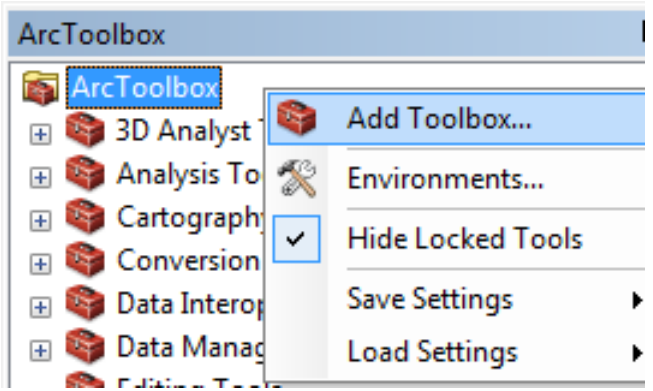


Access *RS Tools* in ArcMap

- Open an ArcMap project
- Open ArcToolbox
  - Click toolbar icon

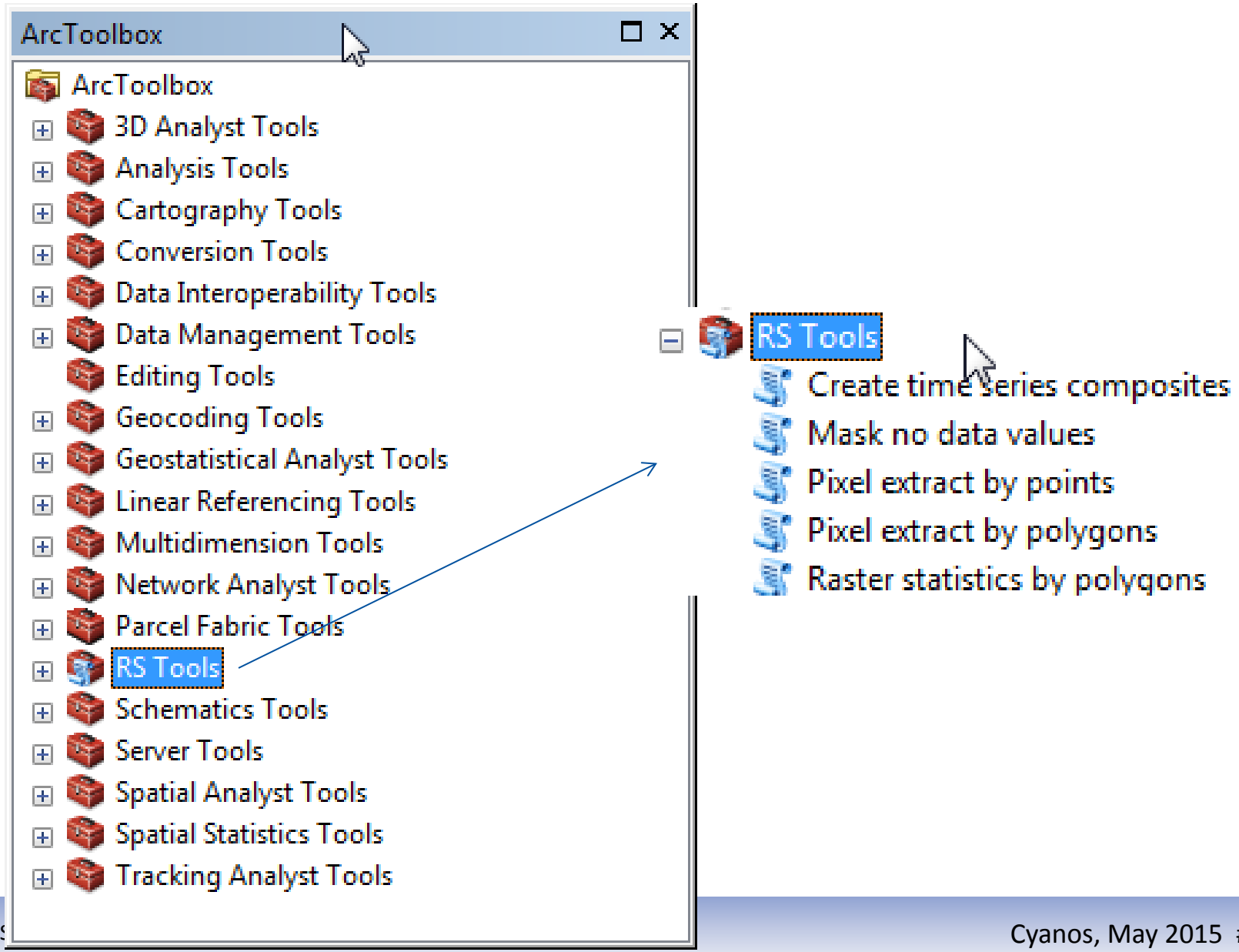


- Add the RS Toolbox
  - Right-click the ArcToolbox item in the ArcToolbox window

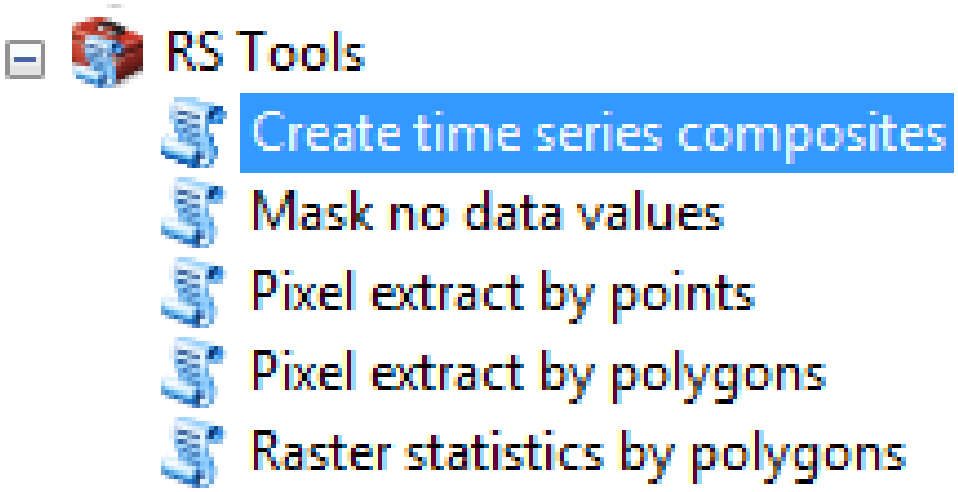


- Select the Add Toolbox… option and navigate to the directory containing the RS Toolbox
- Select the file RS_Toolbox_v1.0.0.pyt and click open

Access *RS Tools* in ArcMap



Tool use: Create time series composites

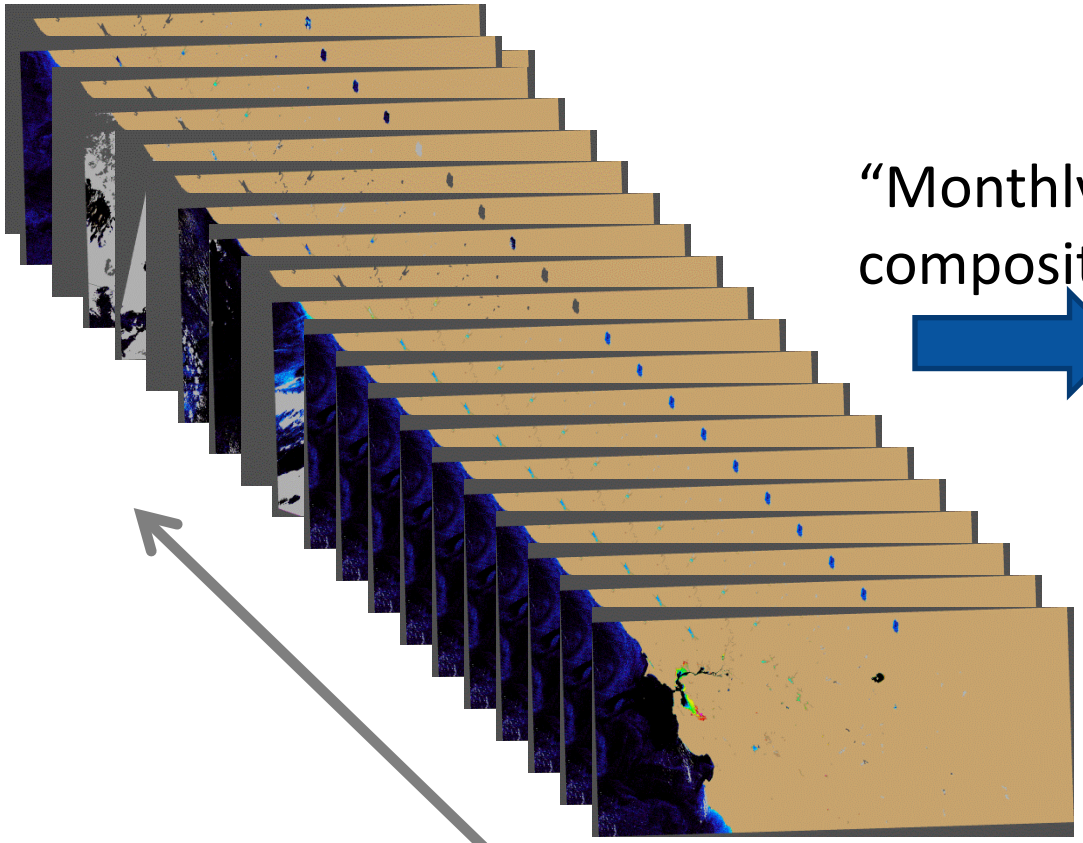


Tool: Create time series composites

- Purpose
  - Summarize **valid** raster data from user defined time ranges into a single raster
- Application
  - Generate climatologies or indices
  - Simplify analysis and interpretation by removing noise (i.e. clouds, anomalous & invalid data)

Tool: Create time series composites

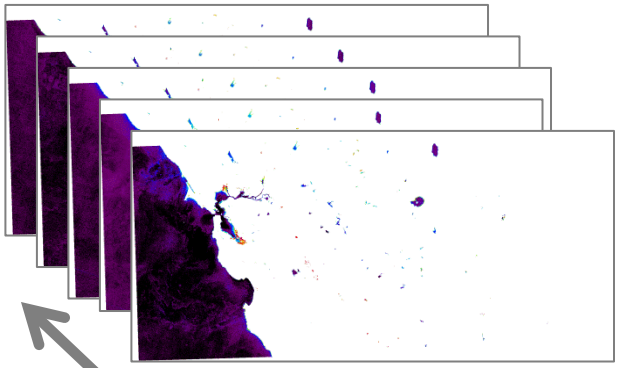
daily CI images for a year



300+ images

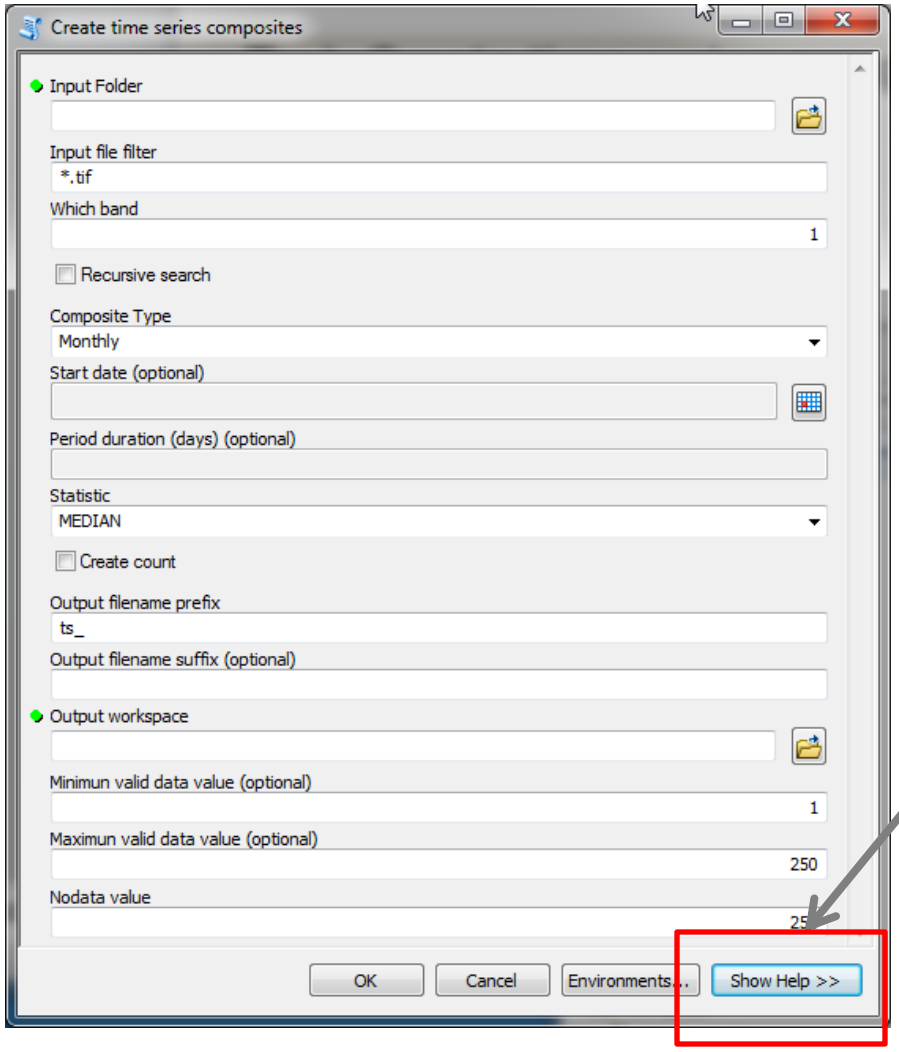
"Monthly" composite

monthly CI means



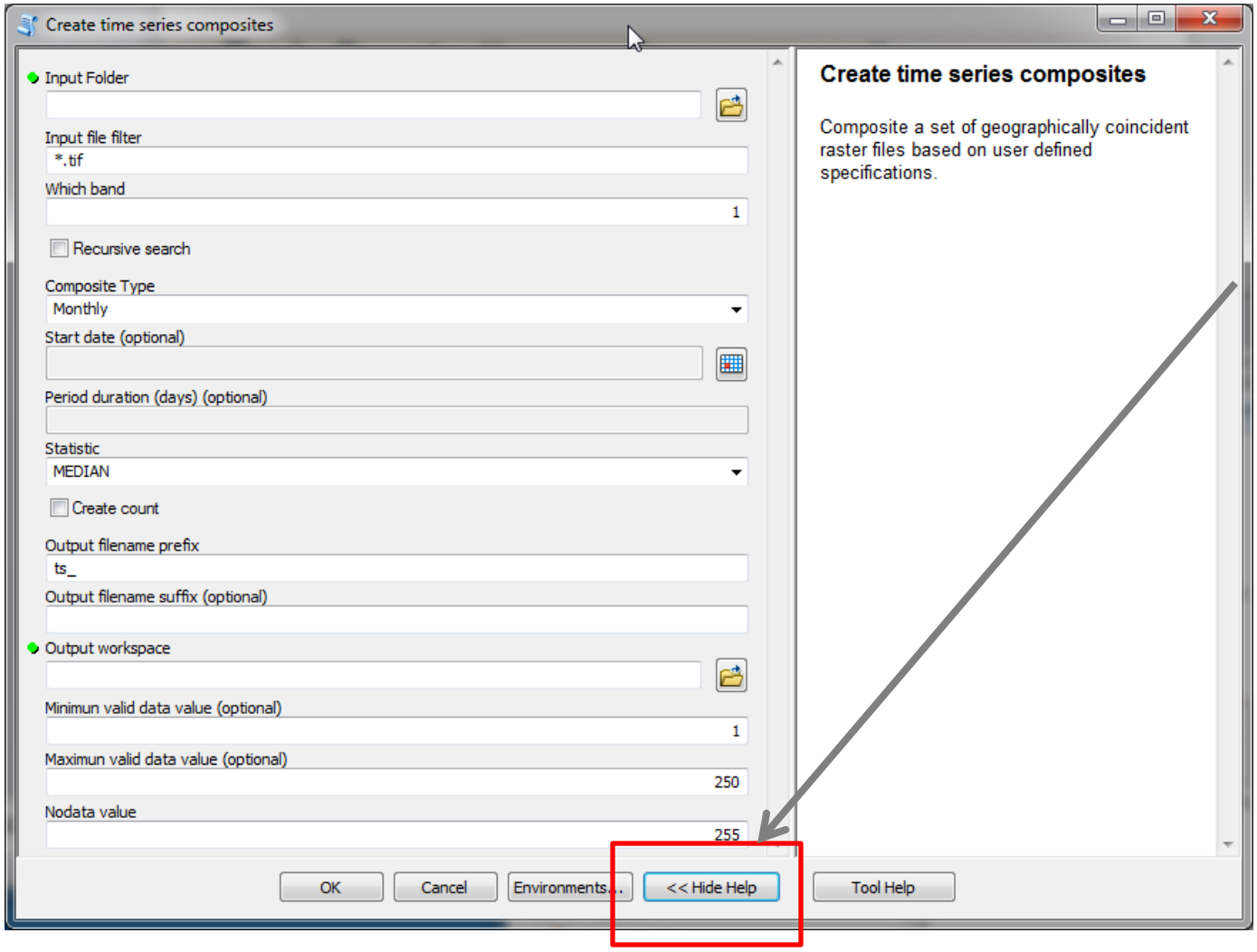
12 images

Tool: Create time series composites



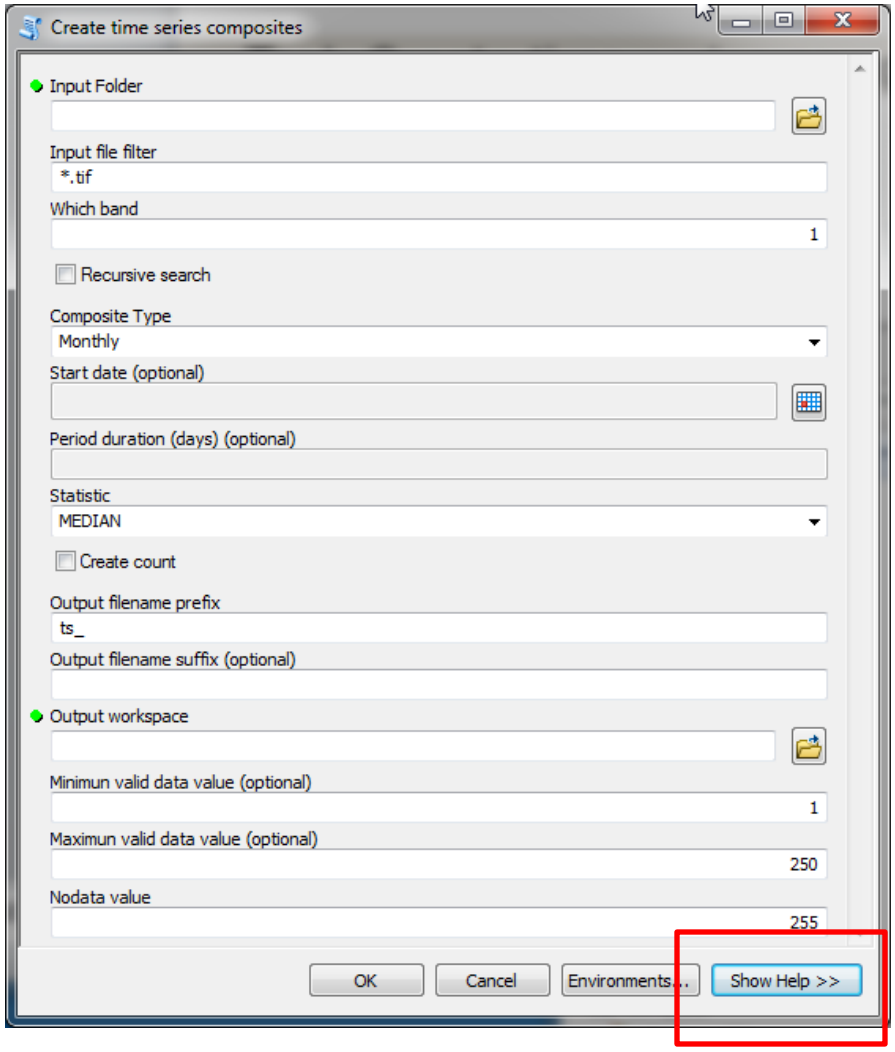
Click the *Show Help* button to open a window with information about the tool and it's input parameters

Tool: Create time series composites

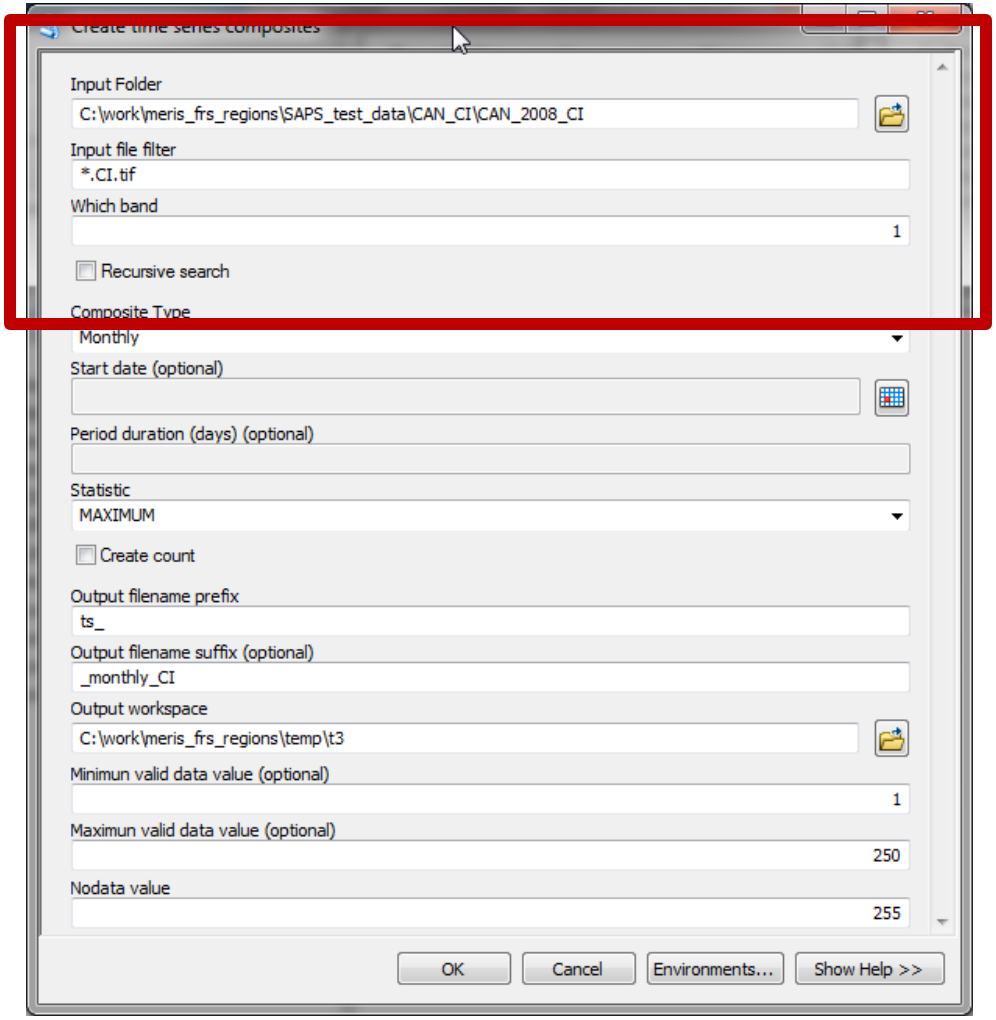


Click the Hide Help button to close

Tool: Create time series composites



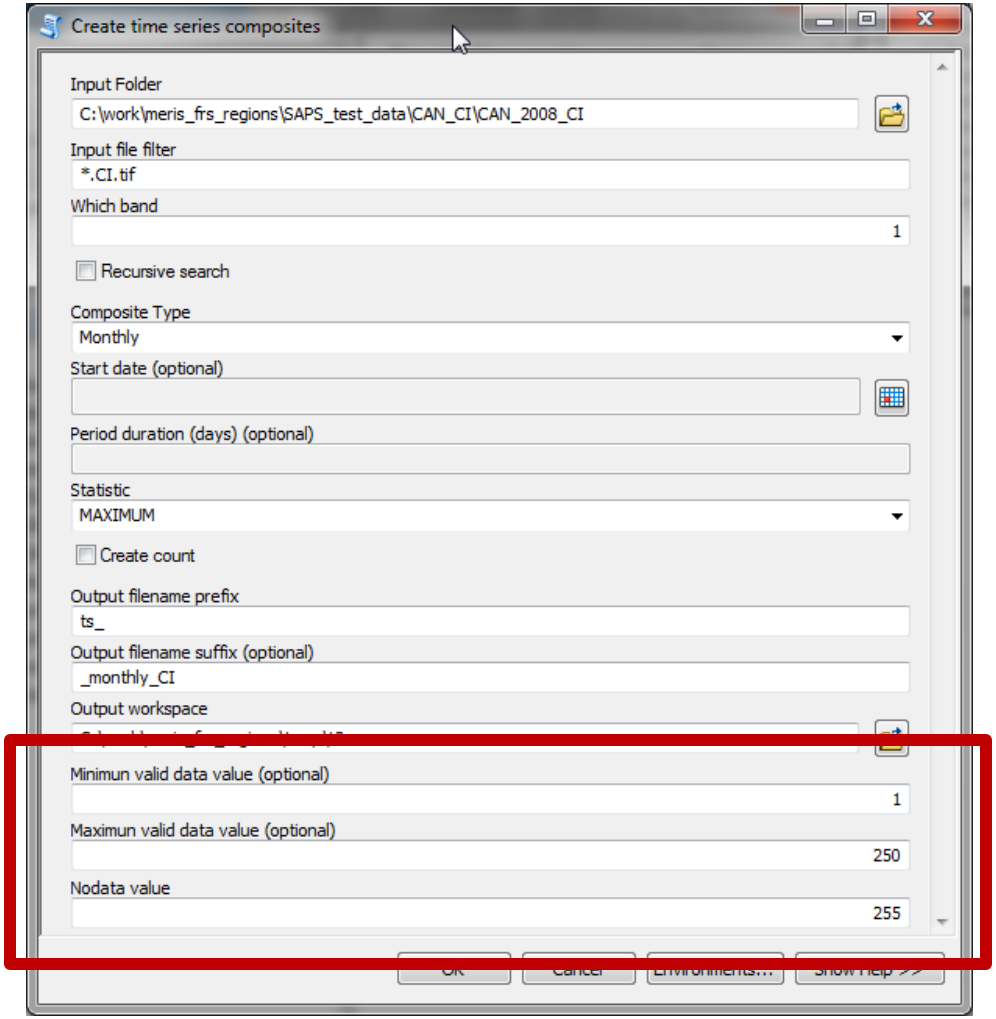
Tool: Create time series composites



Standard input file selection

1. Identify folder containing files to process
2. Specify a filter
   - Tiff files only “*.tif”
   - Only CI products “*.CI.tif”
3. Click *Recursive* option if the input files span multiple subdirectories under the *Input folder*

Tool: Create time series composites



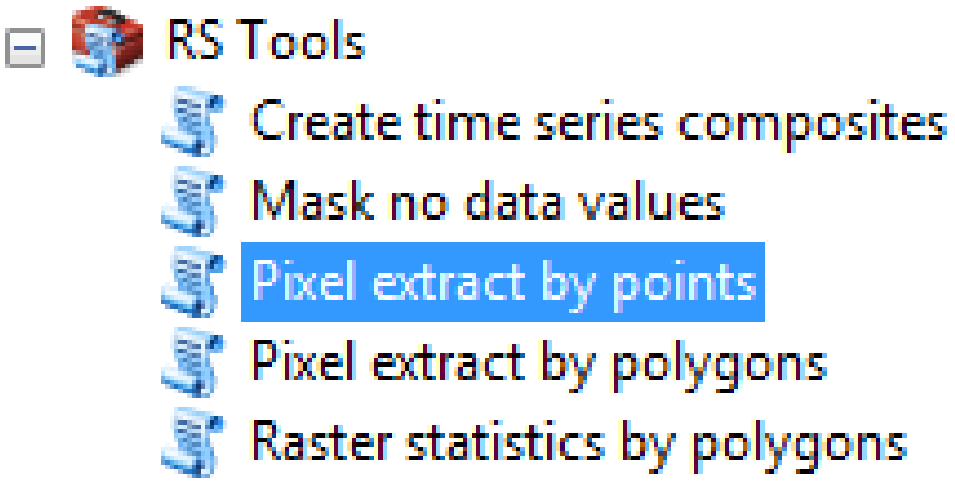
Filtering valid data

- Set the *Minimum valid data value*
- Set the *Maximum valid data value*
- Use defaults for our data products

Key to our products

- Valid data 1-250
- No value = 0
- Land = 252
- Clouds = 253
- Invalid = 254

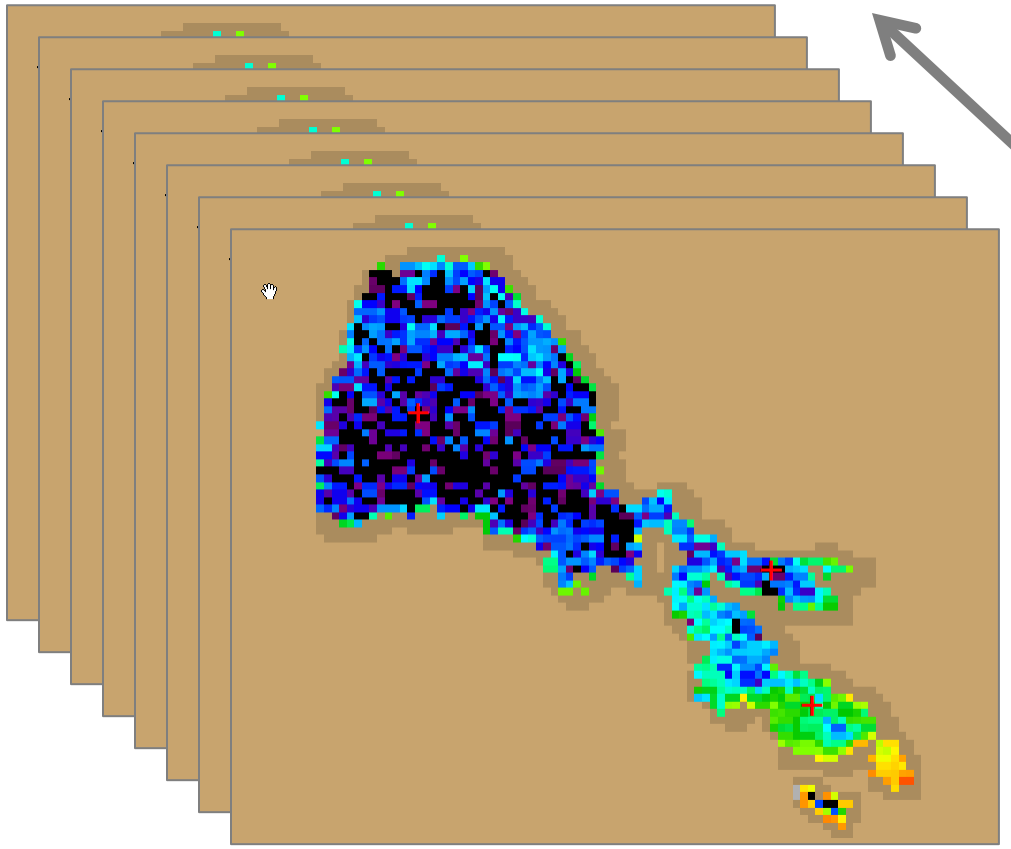
Tool use: Pixel extract by points



Tool: Pixel extract by points

- Purpose
  - Extract pixel values from one or more raster files at a specific set of point locations
  - Optionally, perform field data match-ups to extract pixel values from raster files whose date match that of the field data.
- Application
  - Lake level analysis within alternate non-spatial software (e.g. Excel or R)

Tool: Pixel extract by points



Input

One or more daily CI 2009 images

Pixel values outside the defined valid range or already set to *no data* are assigned a value of “” (or empty string)

CSV output

One entry for each pixel at each (selected) point from each image

	A	B	C	D	E	F	G
1	date	x	y	val	file	result_ug_	sampling_l
2	3/1/2009	-122.866	39.06457	25	C:/work/meris_frs_	5.2	CL-01
3	3/1/2009	-122.682	38.96463	91	C:/work/meris_frs_	15	CL-03
4	3/1/2009	-122.702	39.01238	82	C:/work/meris_frs_	9.4	CL-04
5							

Tool: Pixel extract by points

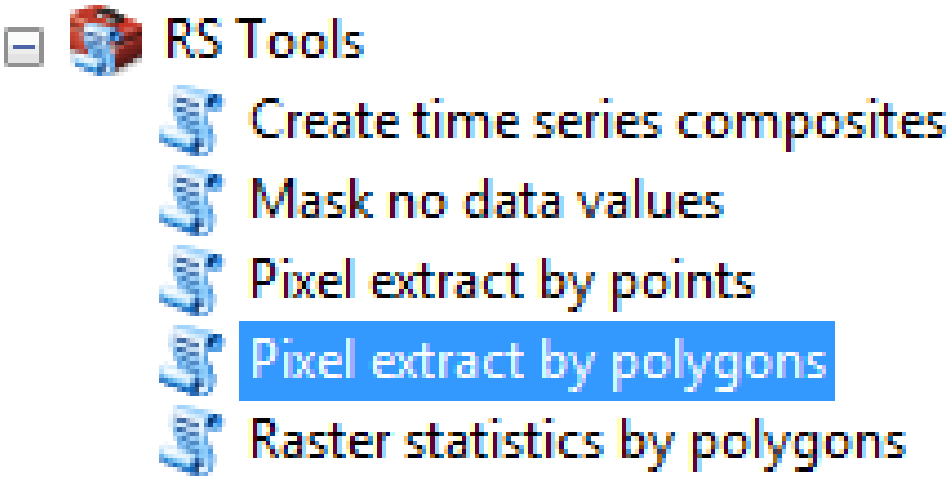
- Output
  - **No match-up option**: a comma-separated text file (.csv) with a row containing the pixel value at each point location from each raster
  - **Match-up option**: a comma-separated text file (.csv) with a row containing the pixel value at each point location from each raster whose date *matches* the date of the point

Standard fields

Optional fields

	A	B	C	D	E	F	G
1	date	x	y	val	file	result_ug_	sampling_l
2	3/1/2009	-122.866	39.06457	25	C:/work/meris_frs_	5.2	CL-01
3	3/1/2009	-122.682	38.96463	91	C:/work/meris_frs_	15	CL-03
4	3/1/2009	-122.702	39.01238	82	C:/work/meris_frs_	9.4	CL-04
5							

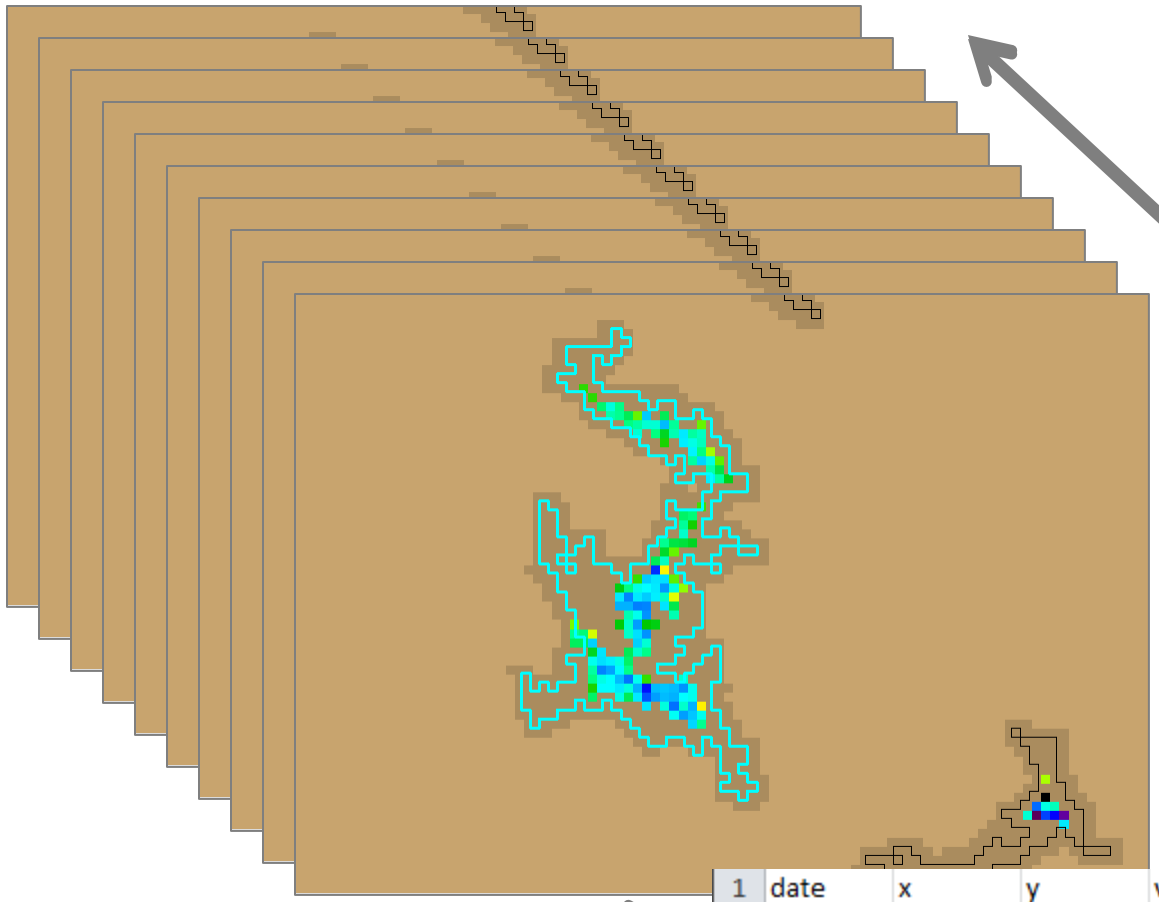
Tool use: Pixel extract by polygons



Tool: Pixel extract by polygons

- Purpose
  - Extract all valid pixel values from one or more raster files in a set of polygons
- Application
  - Lake level analysis within alternate non-spatial software (e.g. Excel or R)

Tool: Pixel extract by polygons



Input

One or more daily CI 2009 images

Pixel values outside the defined valid range or already set to *no data* are assigned a value of “” (or empty string)

CSV output

1	date	x	y	val	file	name
43	4/1/2009	-34073.8	-25153.4	115	C:/work/meri	Don Pedro Reservoir
44	4/1/2009	-33773.8	-25153.4	137	C:/work/meri	Don Pedro Reservoir
45	4/1/2009	-33473.8	-25153.4	85	C:/work/meri	Don Pedro Reservoir
46	4/1/2009	-33173.8	-25153.4		C:/work/meri	Don Pedro Reservoir
47	4/1/2009	-32873.8	-25153.4	115	C:/work/meri	Don Pedro Reservoir
48	4/1/2009	-32573.8	-25153.4		C:/work/meri	Don Pedro Reservoir

One entry for each pixel in each (selected) polygon from each image

Tool: Pixel extract by polygons

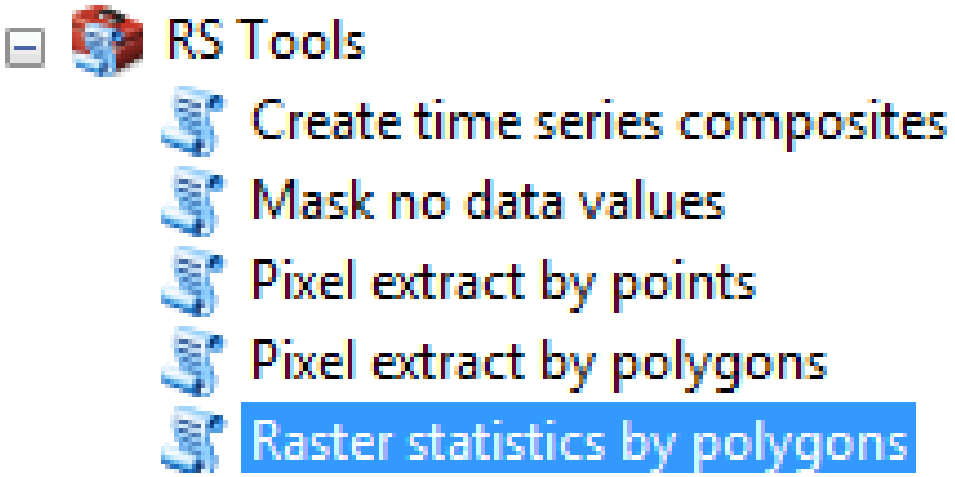
- Output
  - a comma-separated text files (.csv) with a row containing all the pixel values within each polygon from each raster

Standard fields

Optional fields

	A	B	C	D	E	F
1	date	x	y	val	file	name
2	1/1/2009	511208.7	4330036	74	C:/work/meris_frs_reg	Clear Lake
3	1/1/2009	511508.7	4330036	36	C:/work/meris_frs_reg	Clear Lake
4	1/1/2009	511808.7	4330036	27	C:/work/meris_frs_reg	Clear Lake
5	1/1/2009	512108.7	4330036	71	C:/work/meris_frs_reg	Clear Lake
6	1/1/2009	512408.7	4330036	96	C:/work/meris_frs_reg	Clear Lake
7	1/1/2009	512708.7	4330036	57	C:/work/meris_frs_reg	Clear Lake
8	1/1/2009	513008.7	4330036	48	C:/work/meris_frs_reg	Clear Lake
9	1/1/2009	513308.7	4330036	40	C:/work/meris_frs_reg	Clear Lake
10	1/1/2009	513608.7	4330036	78	C:/work/meris_frs_reg	Clear Lake

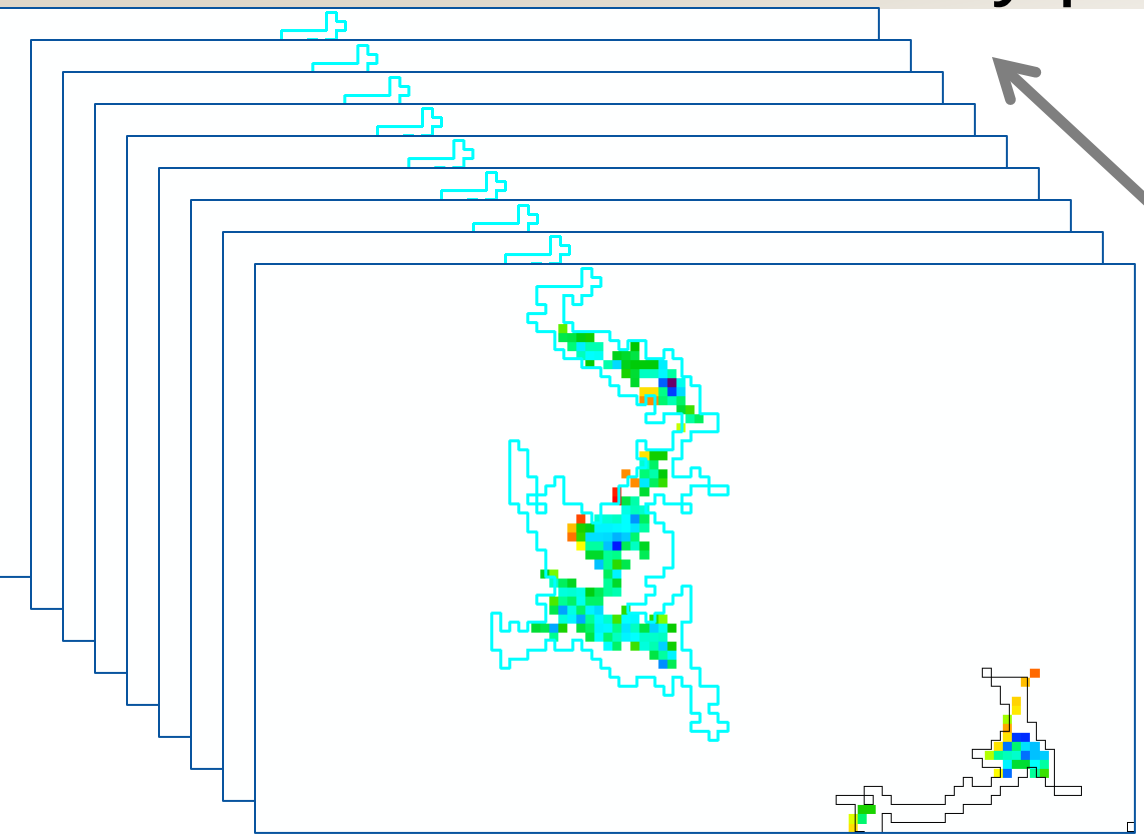
Tool use: Raster statistics by polygons



Tool: Raster statistics by polygon

- Purpose
  - Summarize all valid pixel values within polygons from one or more rasters
- Application
  - Lake level analysis especially small lakes

Tool: Raster statistics by polygons



Input

One or more **masked** daily CI 2009 images

No data values are ignored

CSV output

One entry for each (selected) polygon from each image

	A	B	C	D	E	F	G	H	I	
1	date	OBJECTID	name	ZONE_CO	COUNT	AREA	MIN	MAX	MEAN	file
2	4/1/2009	1	Don Pedro	1	154	13860000	48	158	101.4481	C:/work/meris_t
3	4/2/2009	1	Don Pedro	1	121	10890000	108	160	130.1157	C:/work/meris_t
4	4/4/2009	1	Don Pedro	1	142	12780000	10	139	104.0423	C:/work/meris_t
5	4/5/2009	1	Don Pedro	1	130	11700000	76	140	108.8308	C:/work/meris_t
6	4/7/2009	1	Don Pedro	1	88	7920000	60	138	102.4432	C:/work/meris_t
7	4/8/2009	1	Don Pedro	1	11	990000	137	197	169.4545	C:/work/meris_t

Tool: Raster statistics by polygon

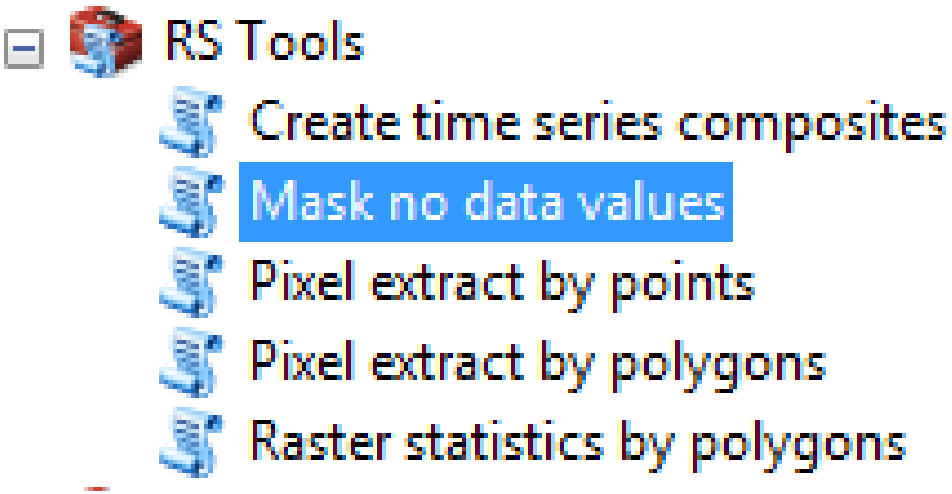
- Output
  - a comma-separated text file (.csv) with a row containing the statistic(s) from each unique polygon location from each raster

Standard fields

Varies depending on the statistic(s) selected

	A	B	C	D	E	F	G	H
1	date	OBJECTID	name	ZONE_CODE	COUNT	AREA	MEAN	file
20	1/31/2010	4	Middle Alkali Lake	4	769	69210000	3.878414	C:\Users\A
21	1/31/2010	5	Honey Lk Wldfwl Mgmt Pnds	5	3027	272430000	0.786587	C:\Users\A
22	2/10/2010	1		1	11201	1008090000	14.41934	C:\Users\A
23	2/10/2010	2	Goose Lake	2	4806	432540000	100.0299	C:\Users\A
24	2/10/2010	3	Upper Lake	3	1564	140760000	88.2759	C:\Users\A
25	2/10/2010	4	Middle Alkali Lake	4	769	69210000	73.45319	C:\Users\A
26	2/10/2010	5	Honey Lk Wldfwl Mgmt Pnds	5	3027	272430000	106.3442	C:\Users\A

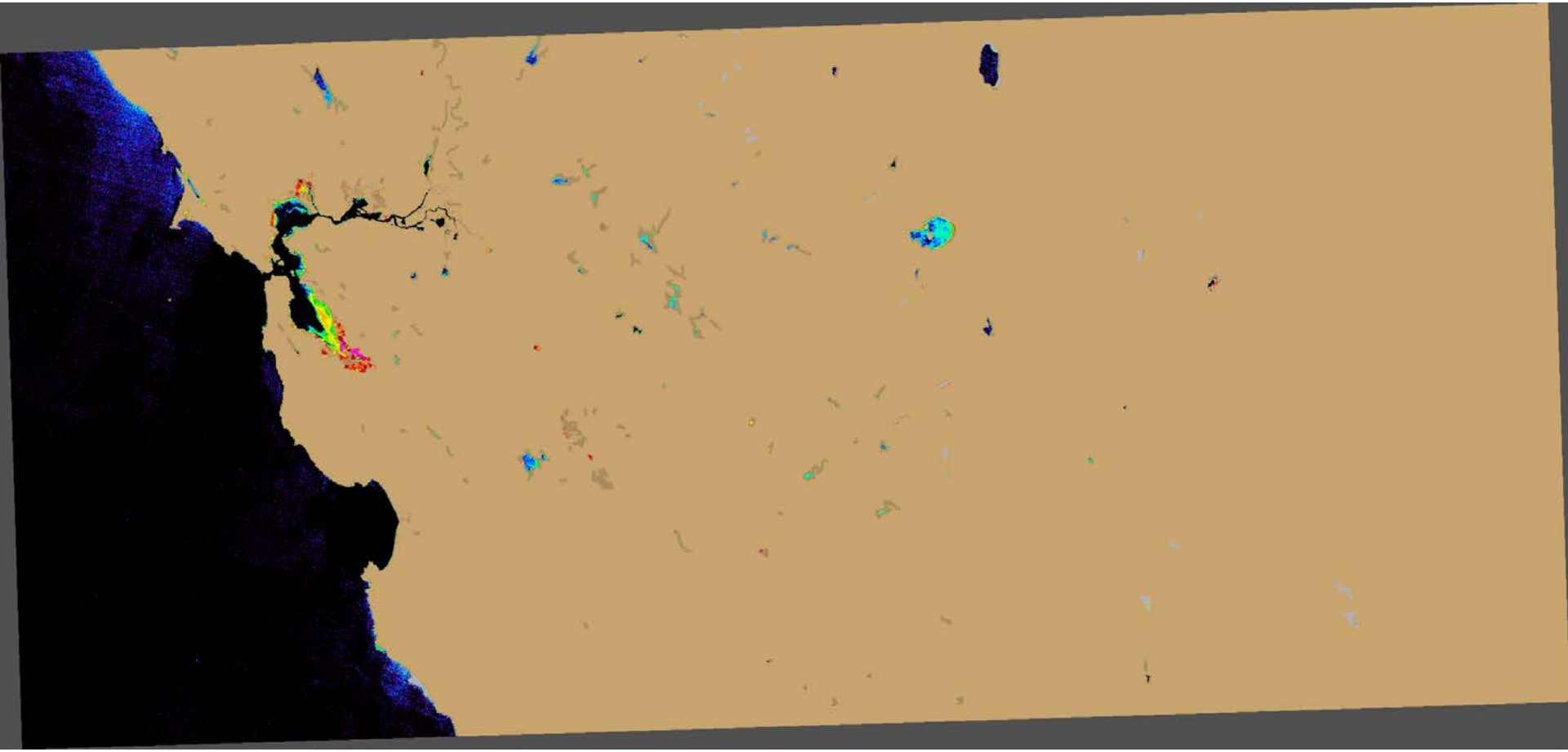
Tool use: Create Time Series composites



Tool: Mask no data values

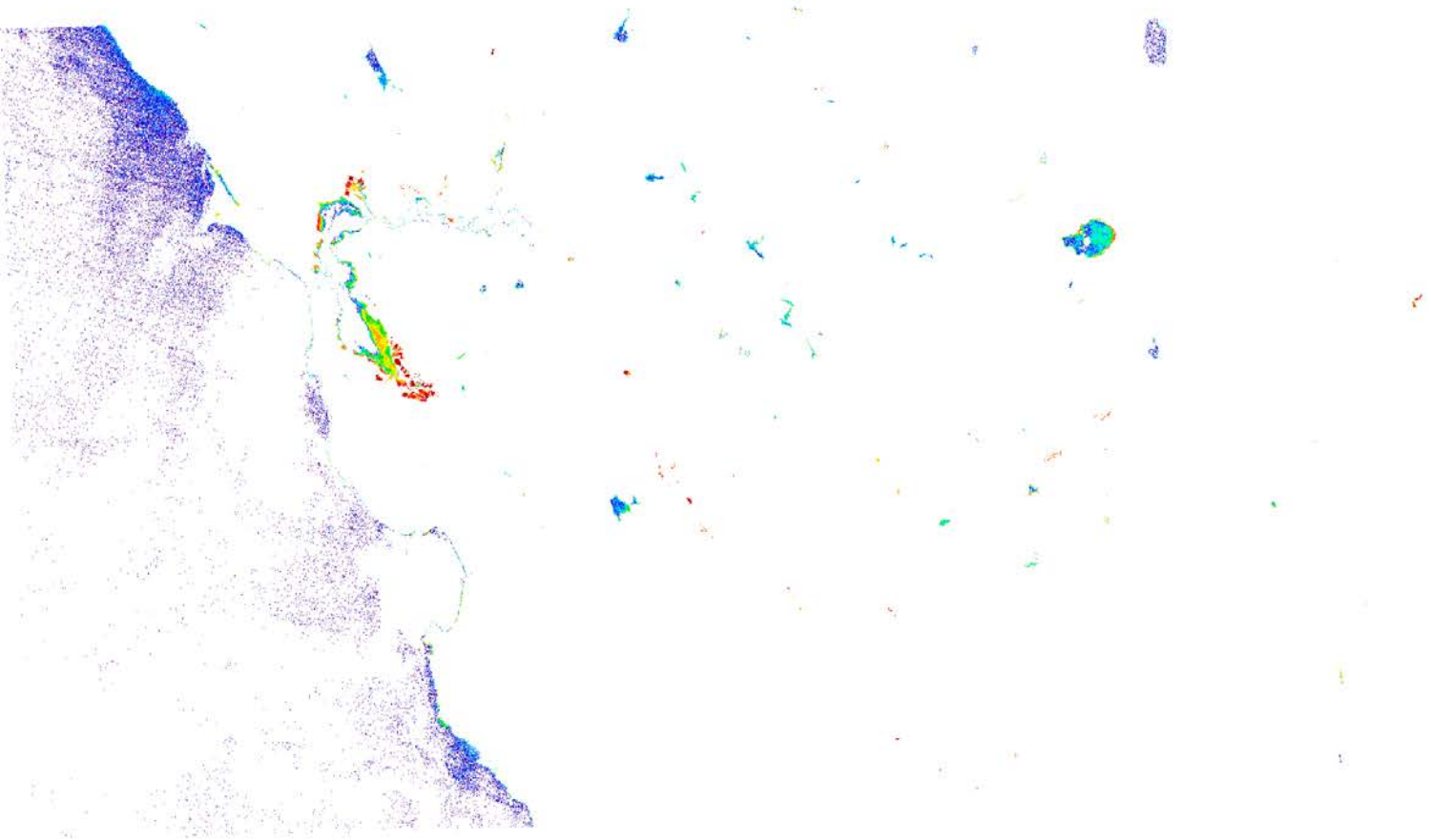
- Purpose
  - Convert invalid data (i.e. values outside a user defined range) to *no data* values
- Application
  - If running the ***Raster statistics*** tools on the **daily** image products
  - If running the ***Pixel extract by points*** tool on the **daily** image products AND the *Interpolate* option is checked

Tool: Mask no data values



Sample un-masked daily product

Tool: Mask no data values



Sample masked output