Circa-2015 Global Lake Mapping Using Landsat-8

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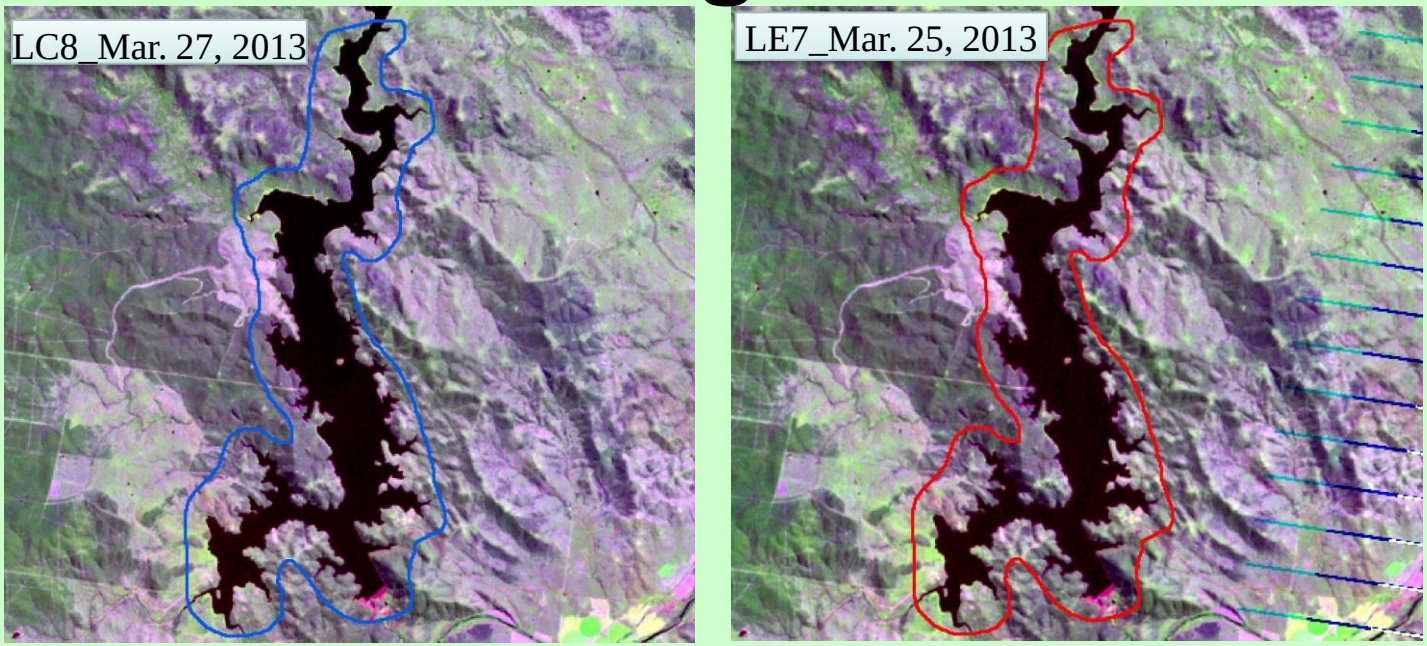
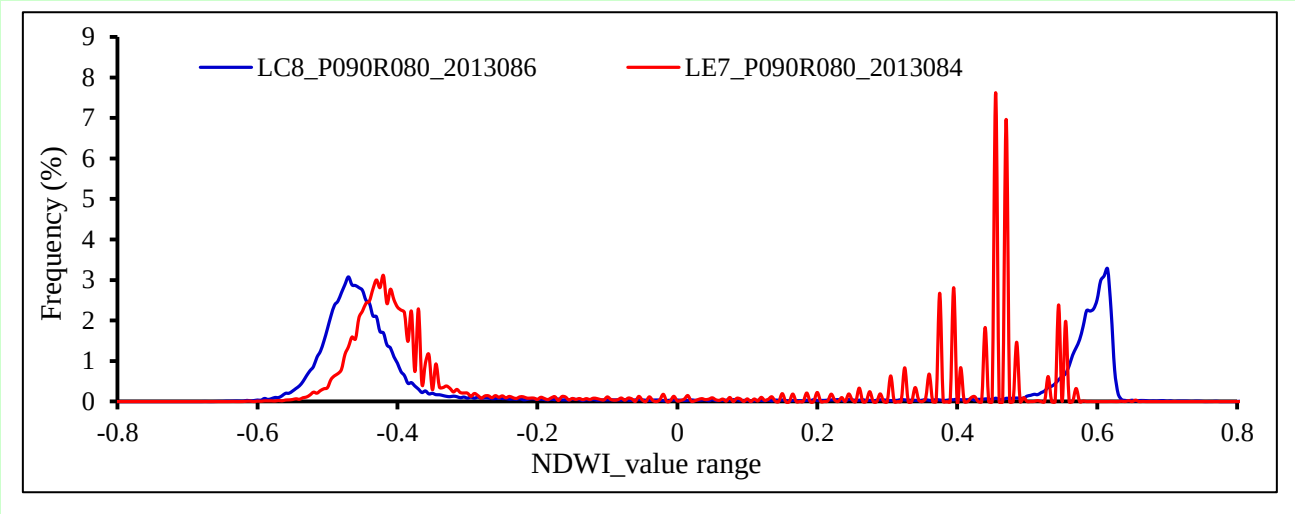
Circa-2015 Lake Mapping

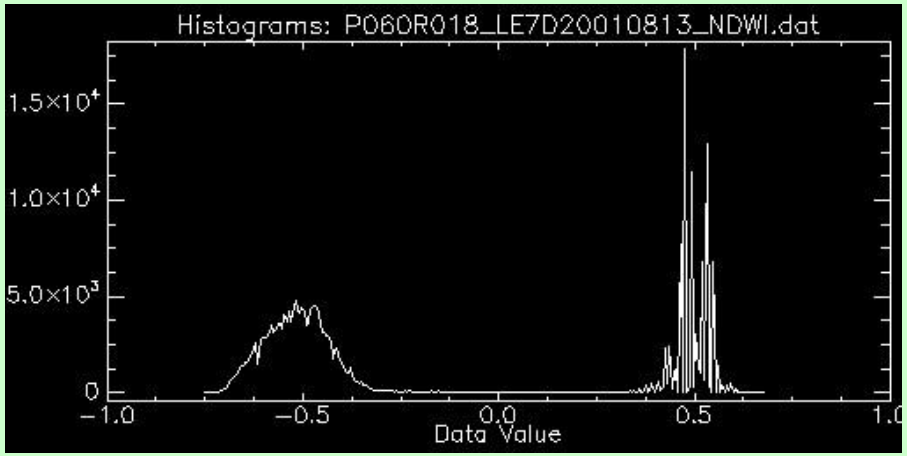
- ☑ Better products are expected;
  - Using Landsat-8: a better sensor;
  - Using circa-2000 as reference.
- ☑ Improvements: Representative lake extents
  - Multi-temporal approach;
  - Circa-2000 as a reference;
  - Cloud masking;
  - Minimizing labor-work using automated QA/QC;
  - Uncertainty measure.
- ☑ Current progress.

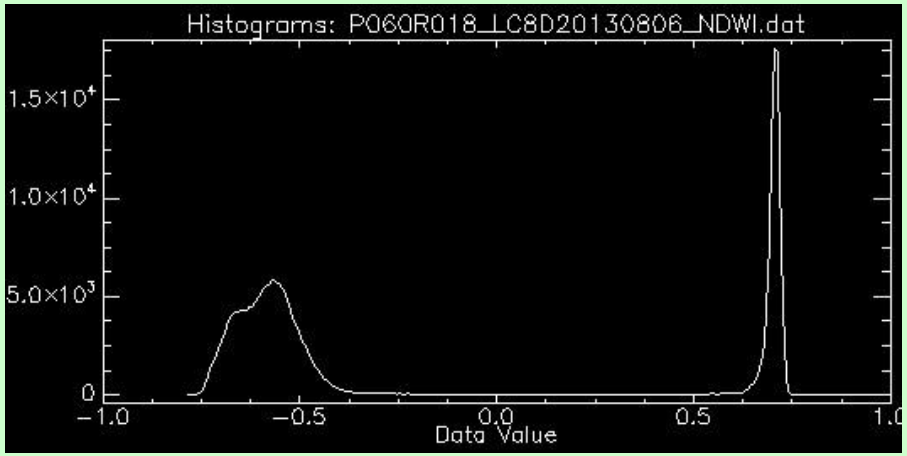
Landsat 8: Lake mapping benefits from high SNRs





LE7: 08/13/2001 LC8: 08/06/2013

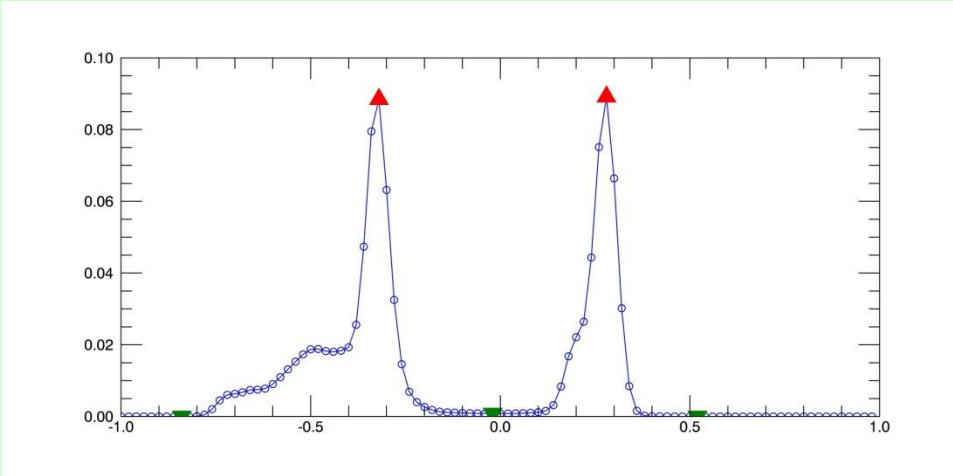


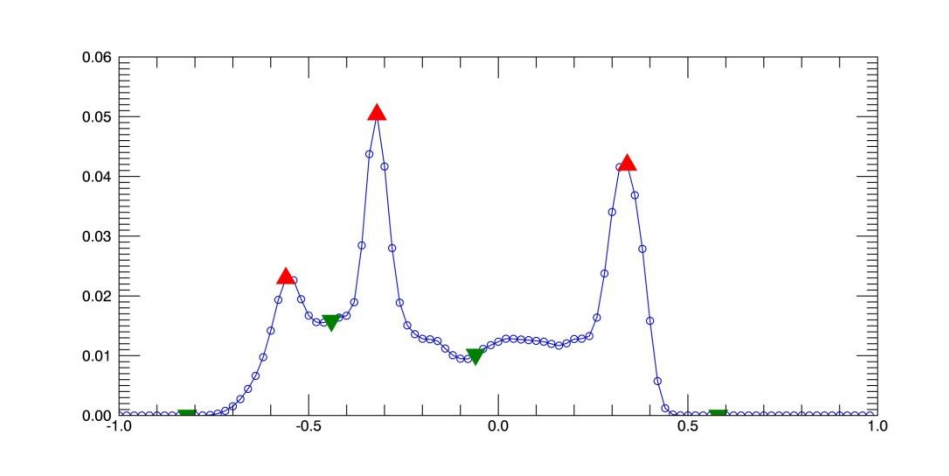


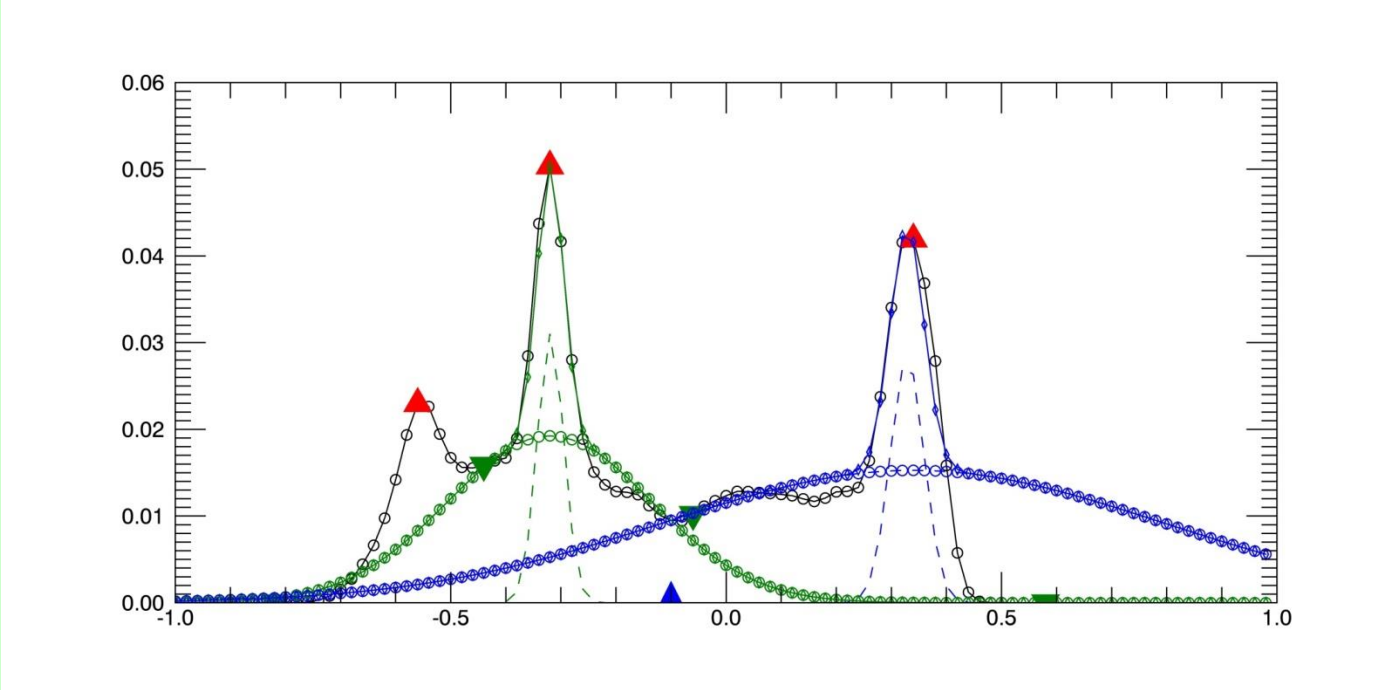
Mapping Log

- ☑ No.1 out of 5: P029R029_LC8D20160602 Version 5.2 processing starts at Tue Jul 26 13:41:38 2016.....
- ☑ CloudCover over land: 3.64%.
- ☑ DEM file used = E:\Test\Samples2016\DEMTest\JP2\GLSDEM_P029R029_30m.JP2
- ☑ Reference Layer: 8510 Lakes in 1526821 water pixels.
- ☑ NDWI determined by the reference layer has 1 modal distribution.
- ☑ Global segmentation after cleanout: 16909 Lakes detected in 1897072 water pixels.
- ☑ After first-round local segmentation:
- ☑ Total Water Pixels: 1372014
- ☑ Total Lake Number: 9887
- ☑ Lakes need to be iterated: 124
- ☑ Iteration #1: 9967 Lakes detected in 1370184 water pixels. 46 Lakes for further iterations.
- ☑ Iteration #2: 9970 Lakes detected in 1370085 water pixels. 7 Lakes for further iterations.
- ☑ Iteration #3: 9968 Lakes detected in 1369952 water pixels. 2 Lakes for further iterations.
- ☑ Iteration #4: 9973 Lakes detected in 1369926 water pixels. 0 Lakes for further iterations.
- ☑ Total 6459 Lakes mapped in 1365188 water pixels, 89.414% compared to Reference lakes in 1526821 water pixels.
- ☑ Uncertainty: [-10.66%, 8.05%], based on 5334 lakes.
- ☑ Total processing time: 2.383317 minutes.

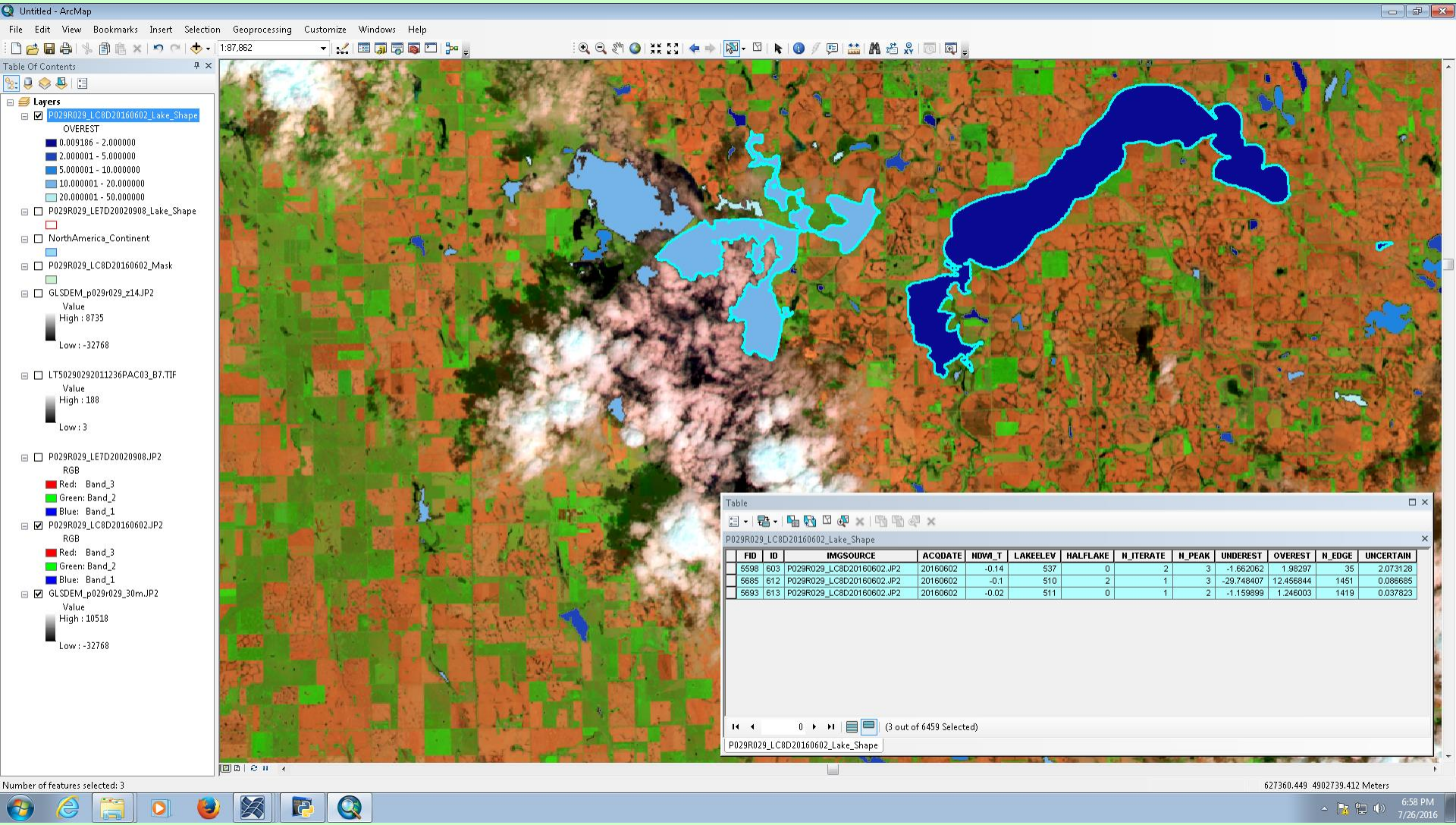
Uncertainty Modeling







Uncertainty Measure



FID	ID	IMGSOURCE	ACQDATE	NDWI_T	LAKEELEV	HALFLAKE	N_ITERATE	N_PEAK	UNDEREST	OVEREST	N_EDGE	UNCERTAIN
5598	603	P029R029_LC8D20160602.JP2	20160602	-0.14	537	0	2	3	-1.662062	1.98297	35	2.073128
5685	612	P029R029_LC8D20160602.JP2	20160602	-0.1	510	2	1	3	-29.748407	12.456844	1451	0.086685
5693	613	P029R029_LC8D20160602.JP2	20160602	-0.02	511	0	1	2	-1.159899	1.246003	1419	0.037823

Circa 2015 OLI Image Acquisition Time

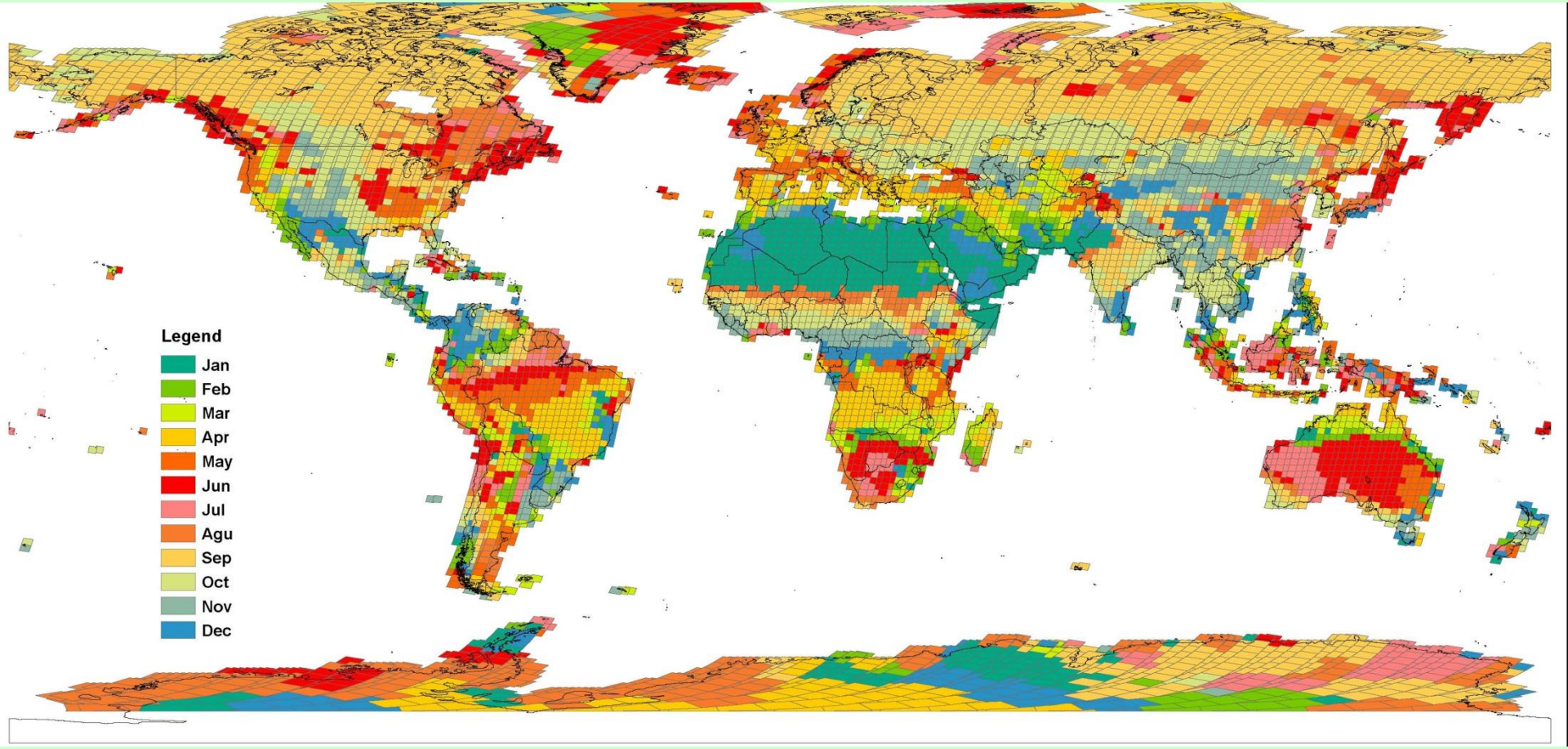
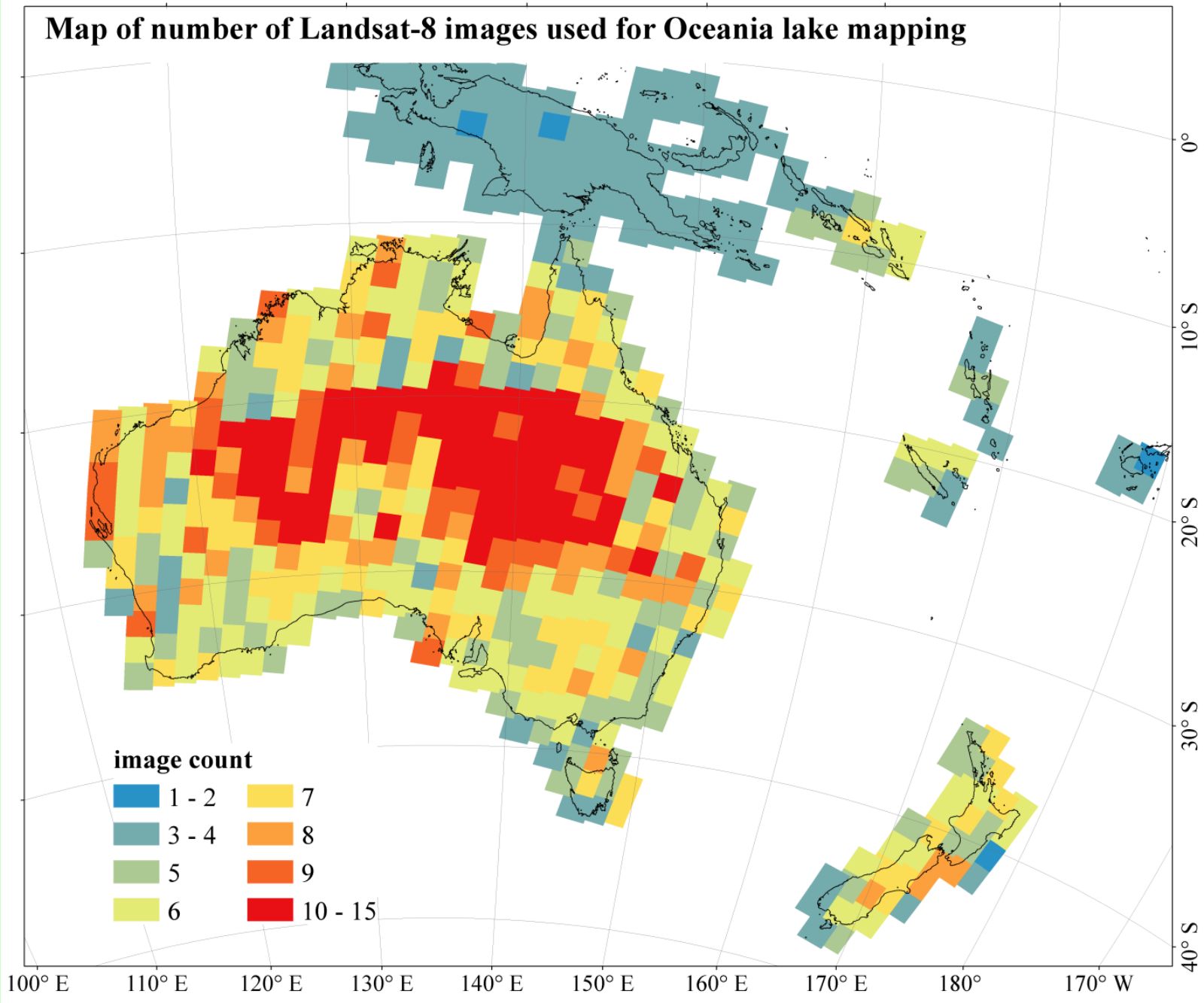
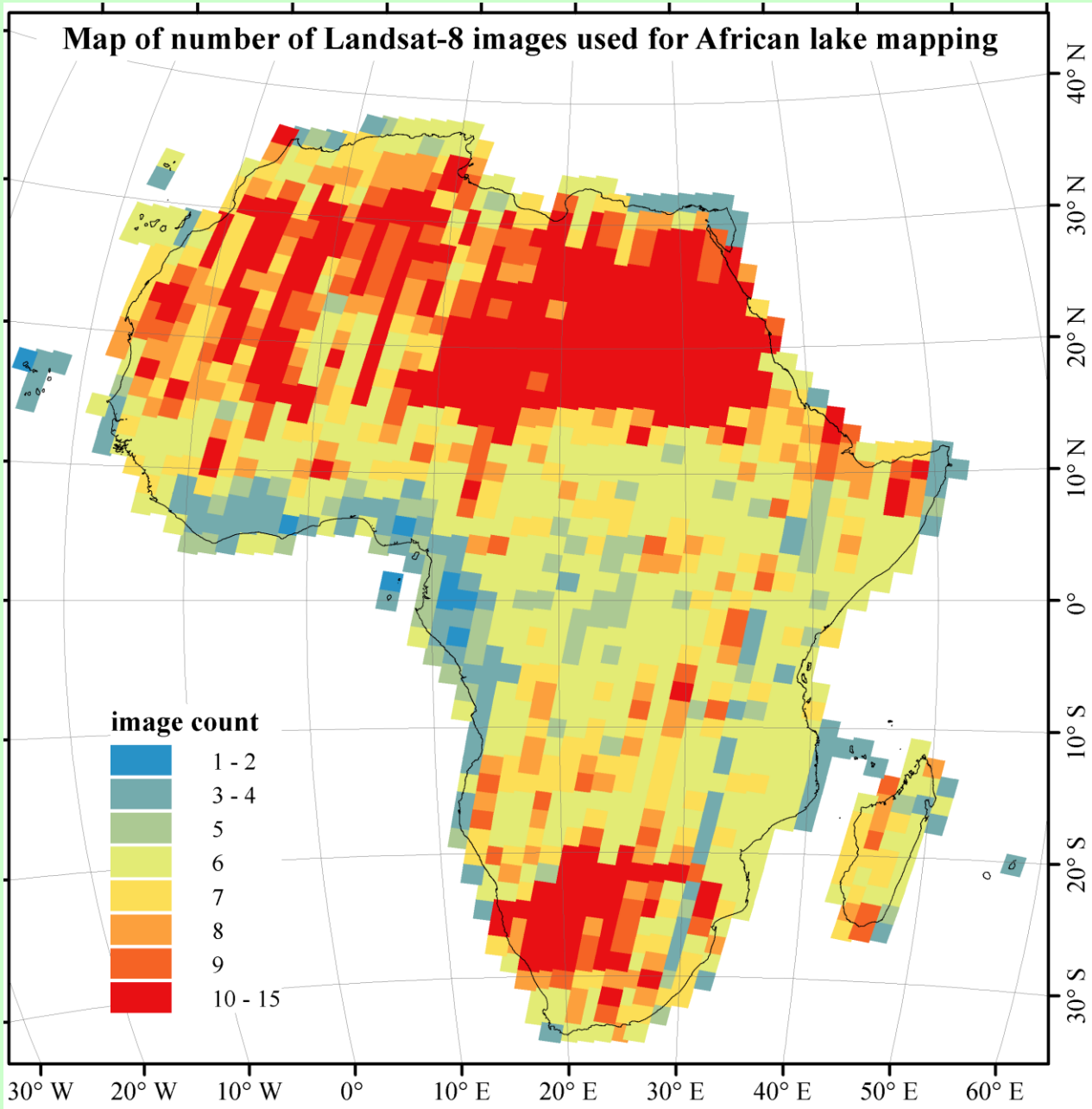
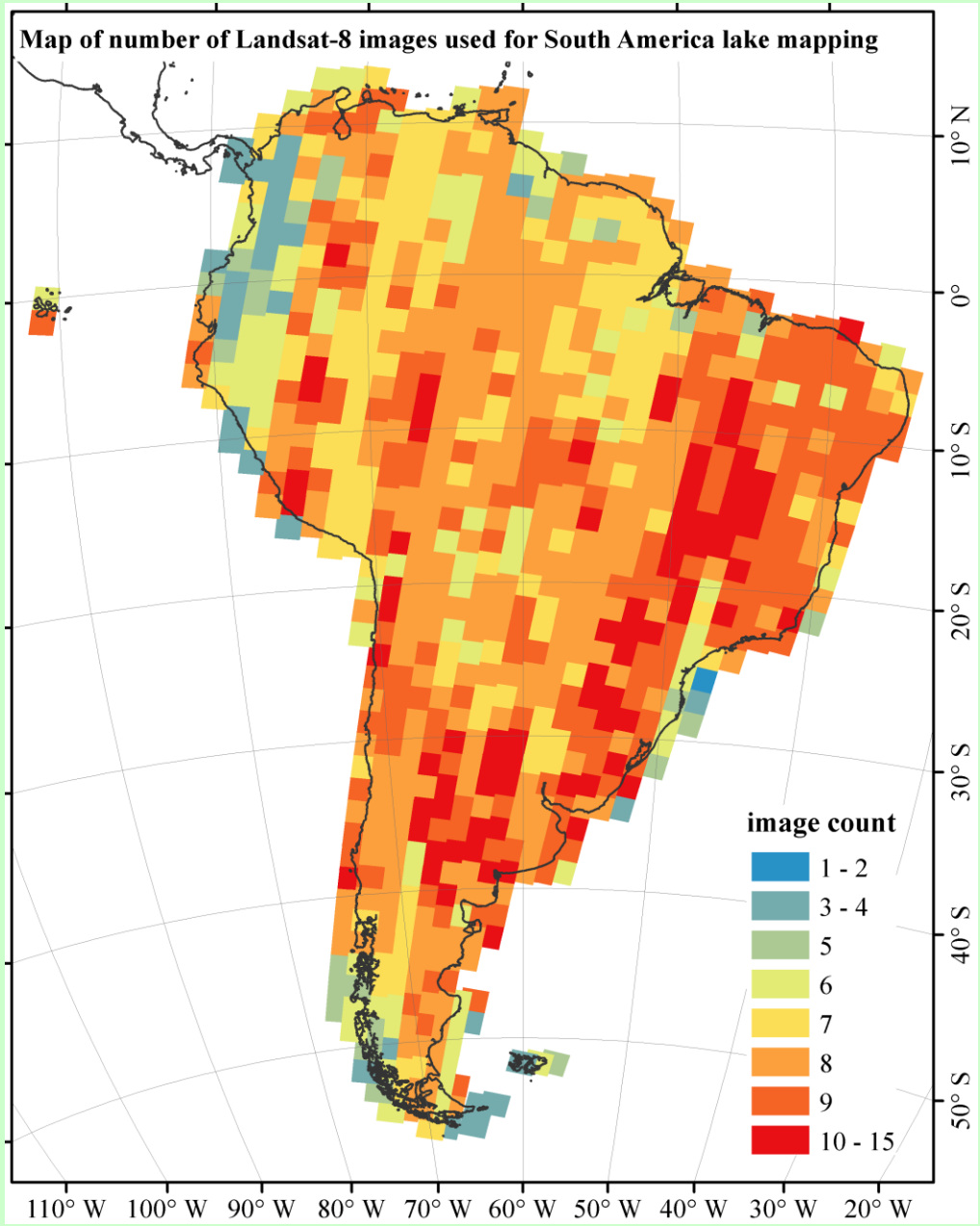


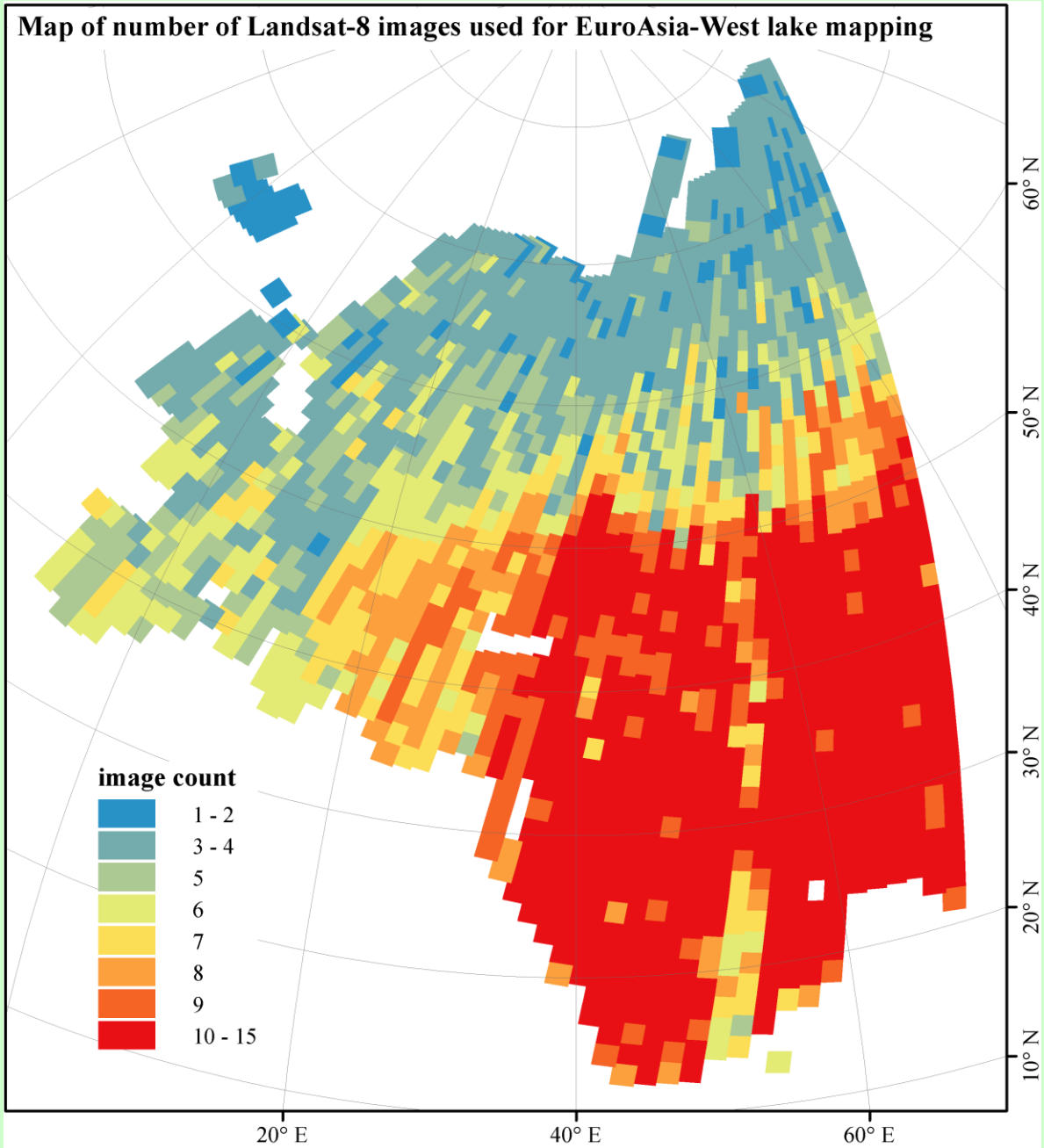
Image Acquisition

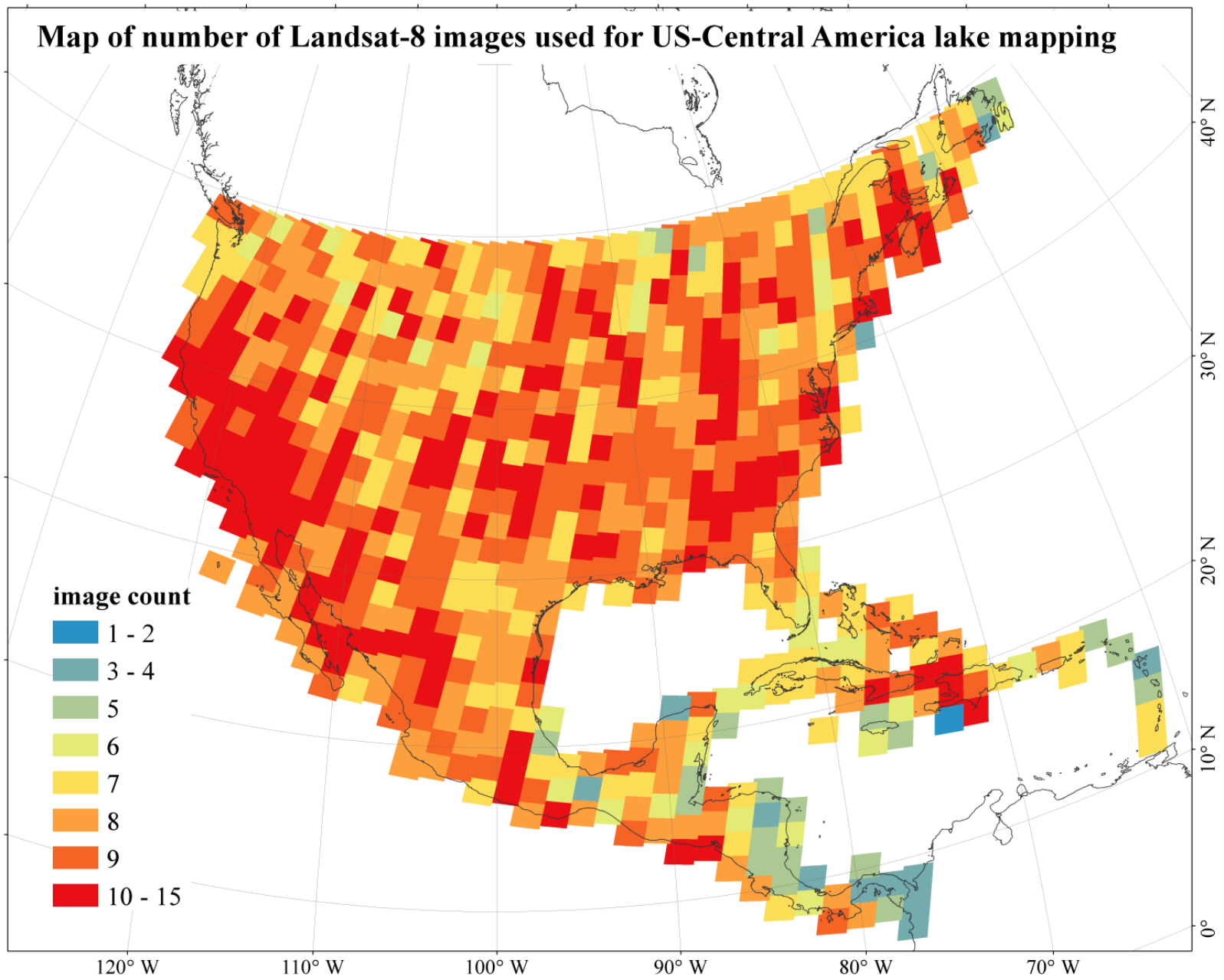
	Total	2013	2014	2015	2016
Oceania	3439	755	1285	1399	0
Africa	9755	1671	3188	4896	0
South America	6099	807	1054	3158	1080
US&central America	5706	1069	1960	1603	1074
EurAsia-west	11215	1406	3611	5620	578


Map of number of Landsat-8 images used for Oceania lake mapping
image count
1 - 2
3 - 4
5
6
7
8
9
10 - 15
0°
10° S
20° S
30° S
40° S
100° E
110° E
120° E
130° E
140° E
150° E
160° E
170° E
180°
170° W

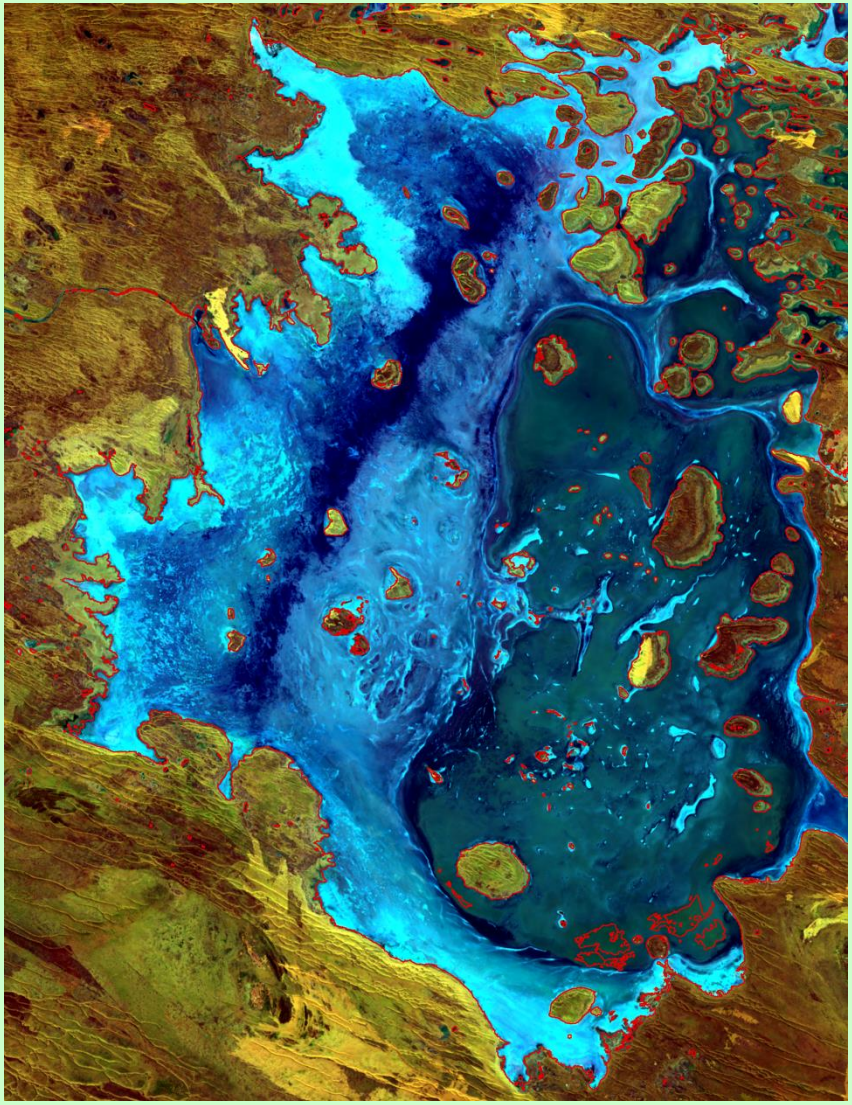

Map of number of Landsat-8 images used for African lake mapping
image count
1 - 2
3 - 4
5
6
7
8
9
10 - 15
40° N
30° N
20° N
10° N
0°
10° S
20° S
30° S
30° W
20° W
10° W
0°
10° E
20° E
30° E
40° E
50° E
60° E

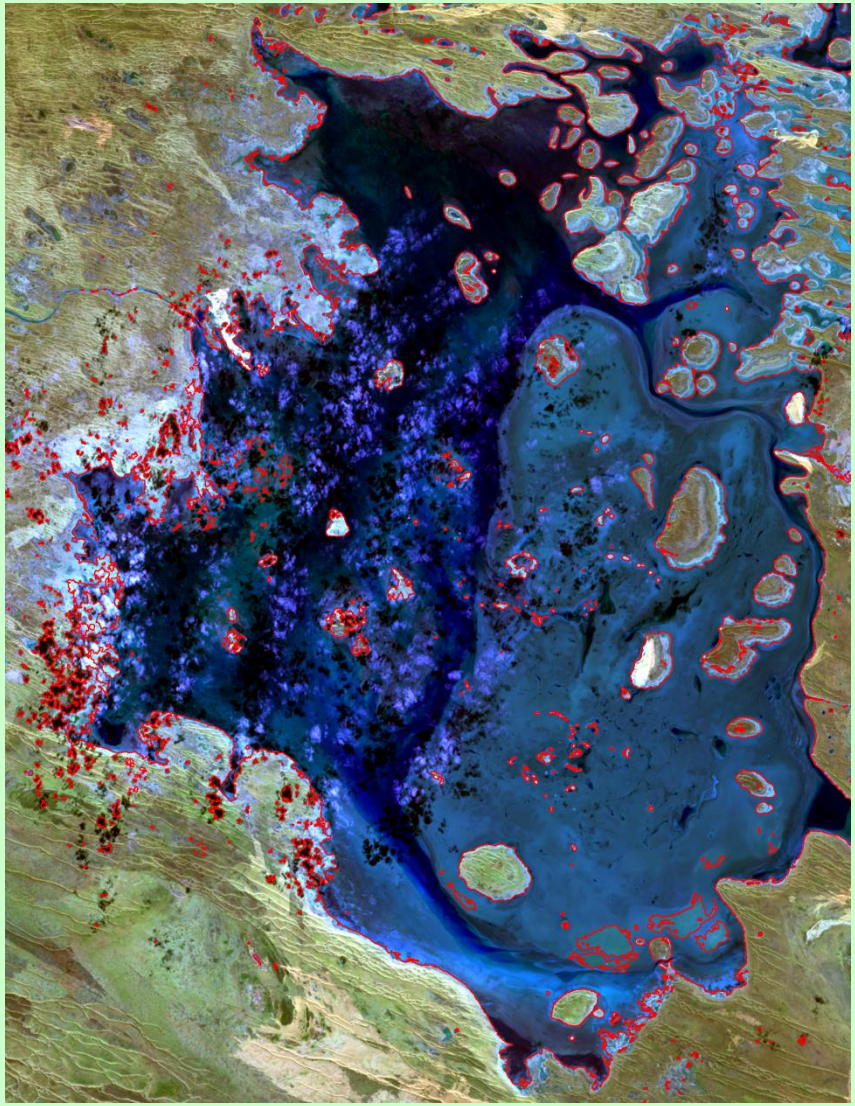

Map of number of Landsat-8 images used for South America lake mapping
image count
1 - 2
3 - 4
5
6
7
8
9
10 - 15
10° N
0°
10° S
20° S
30° S
40° S
50° S
110° W
100° W
90° W
80° W
70° W
60° W
50° W
40° W
30° W
20° W

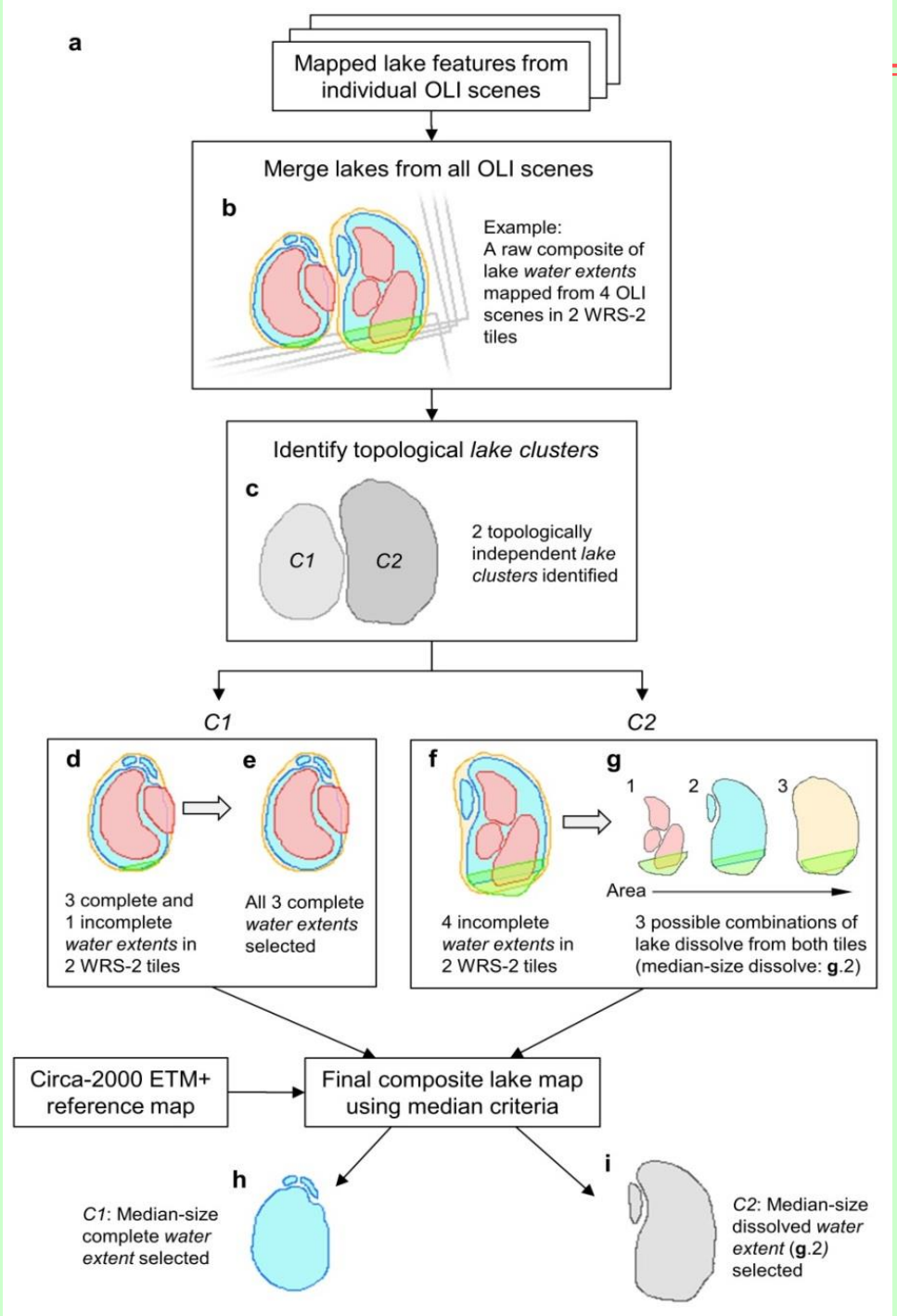

Map of number of Landsat-8 images used for EuroAsia-West lake mapping
image count
1 - 2
3 - 4
5
6
7
8
9
10 - 15
60° N
50° N
40° N
30° N
20° N
10° N
20° E
40° E
60° E


Map of number of Landsat-8 images used for US-Central America lake mapping
image count
1 - 2
3 - 4
5
6
7
8
9
10 - 15
120° W
110° W
100° W
90° W
80° W
70° W
40° N
30° N
20° N
10° N
0°

Lake Disappointment

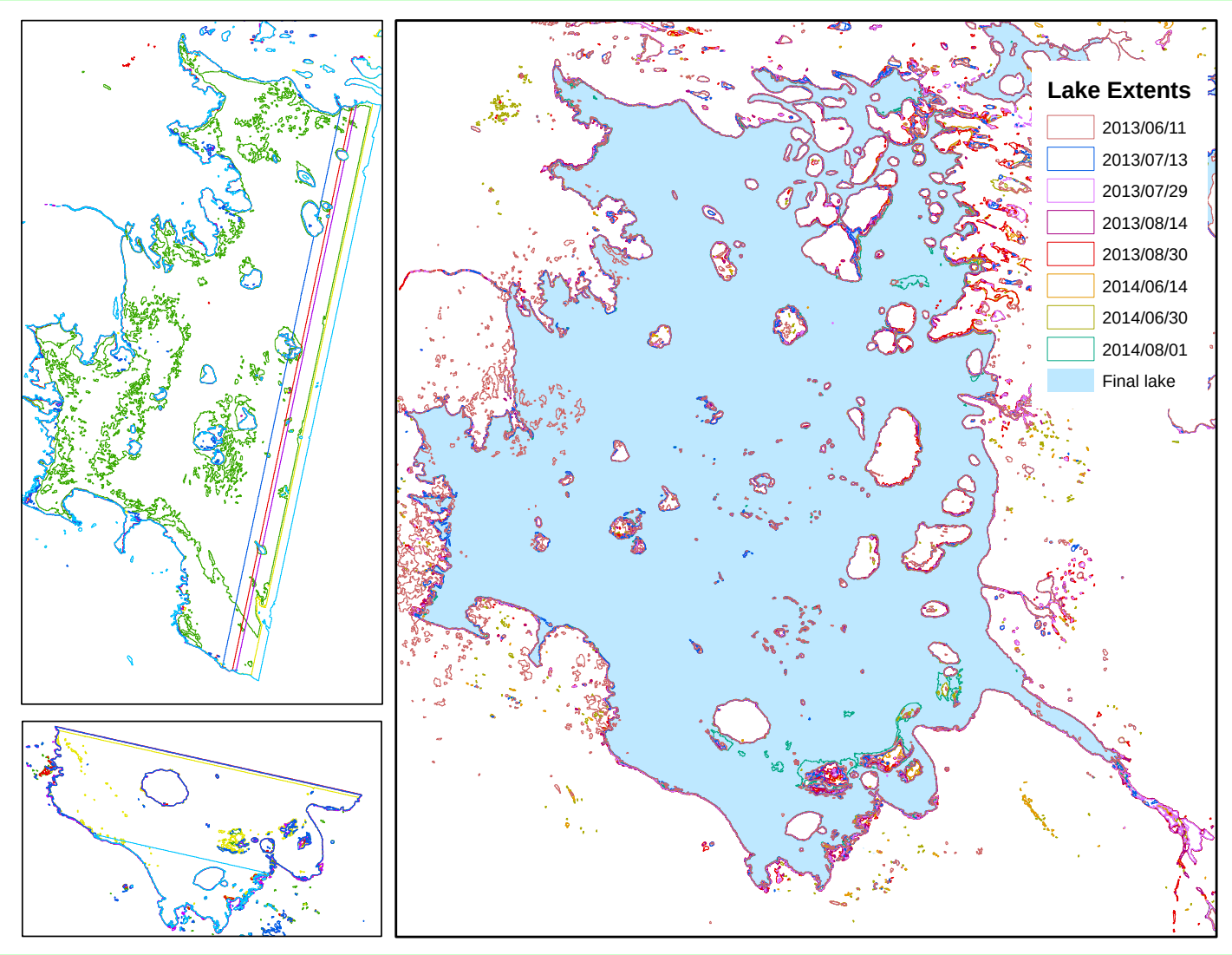


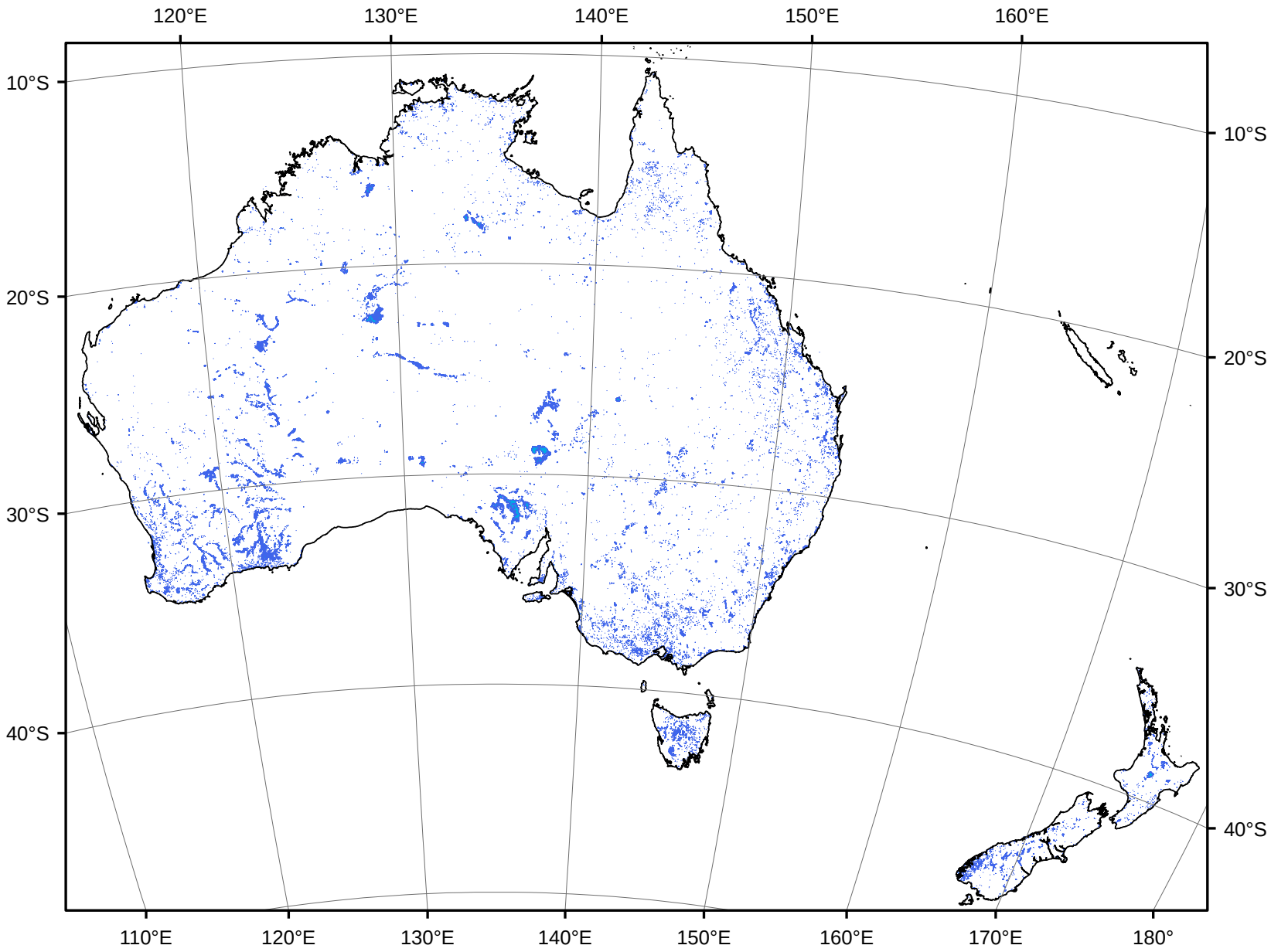


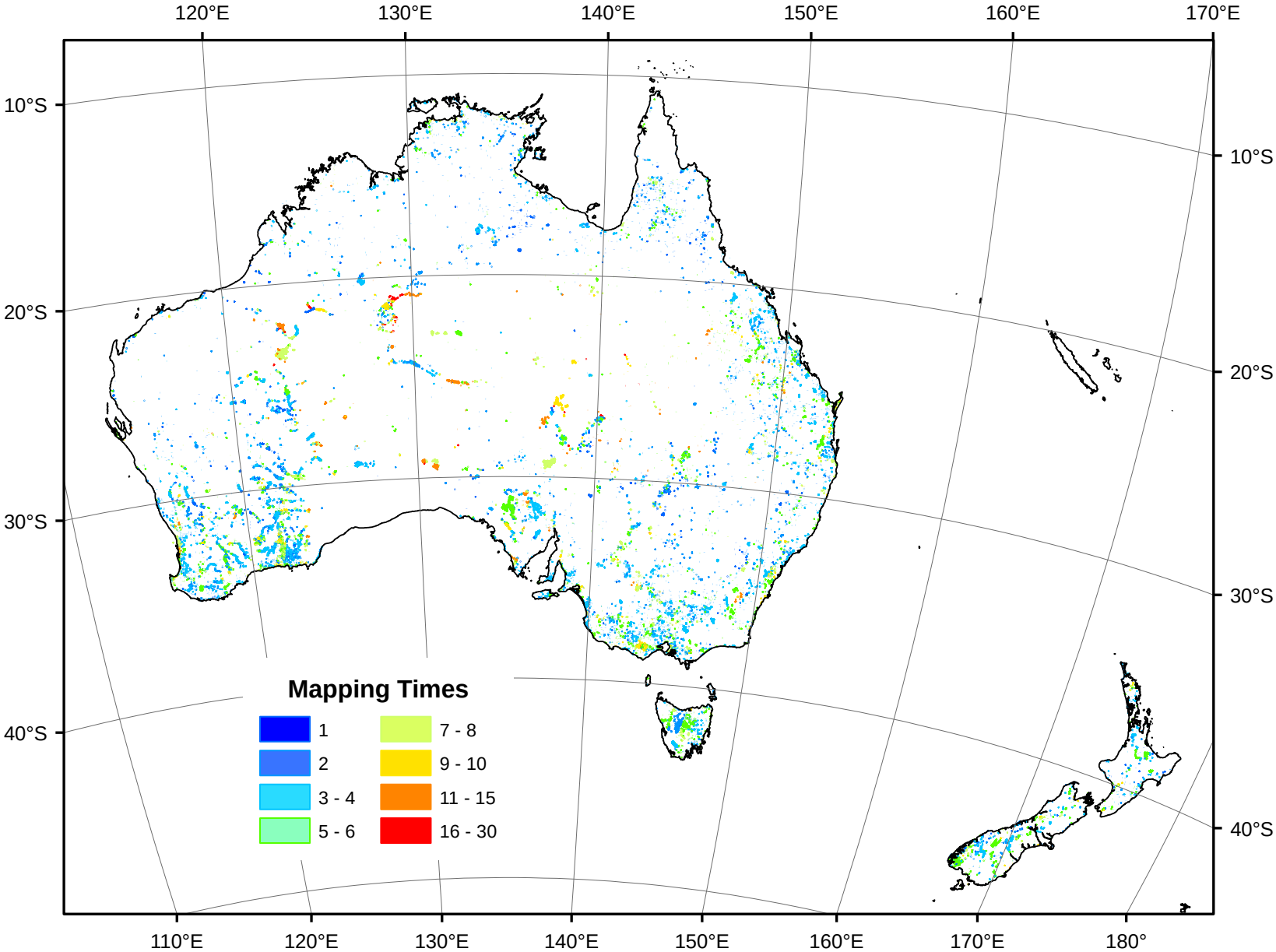


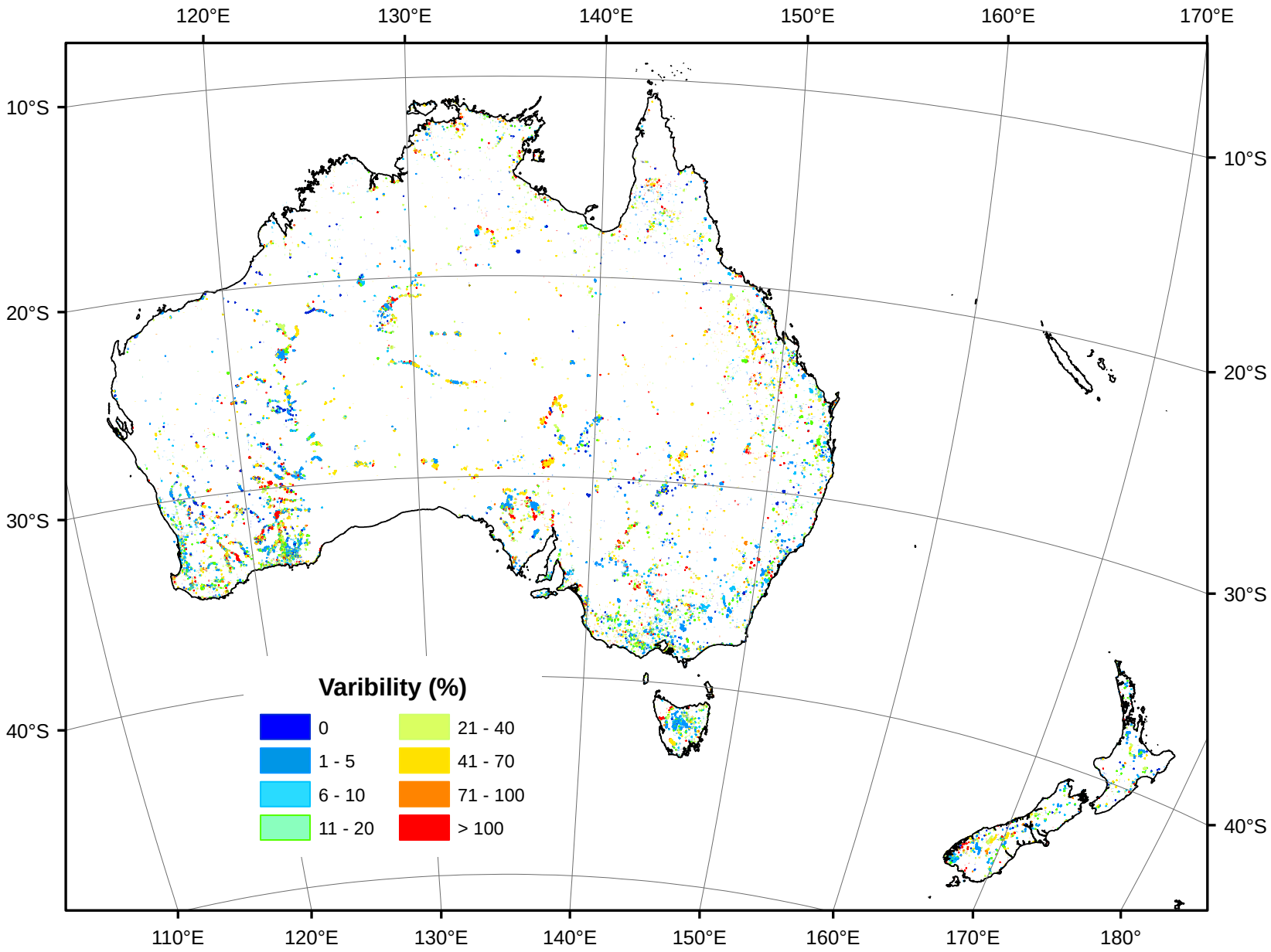
Representative lake extents from multi-temporal images

- ☑ Spatial link lake pairs;
- ☑ Full lakes;
- ☑ Half lakes.

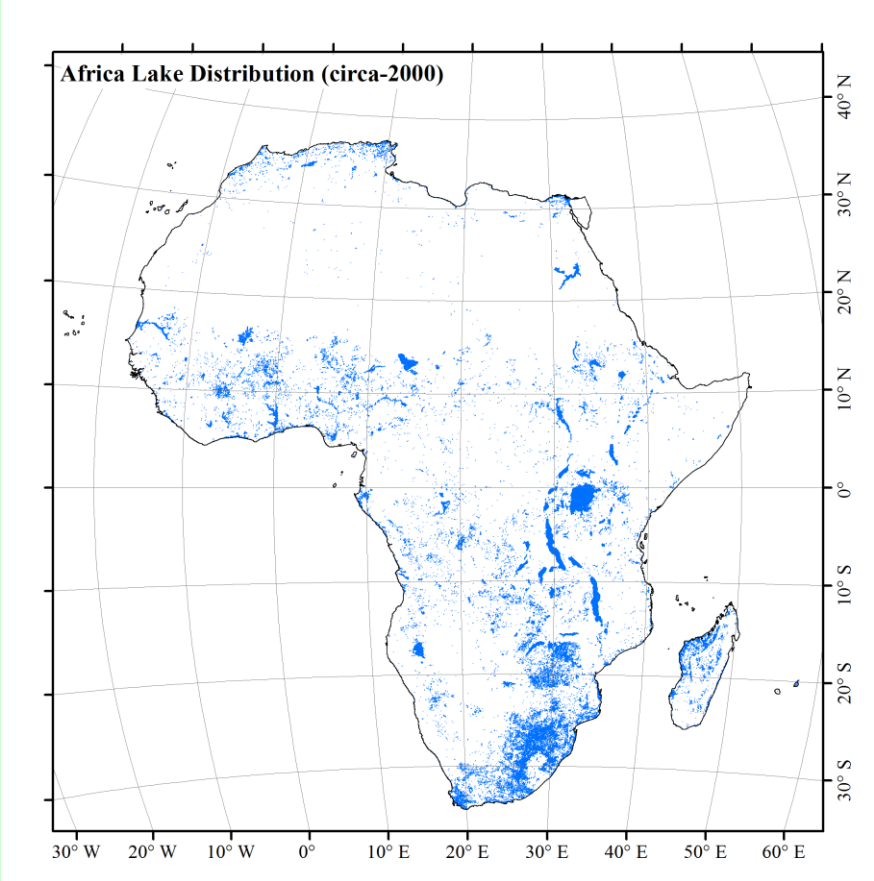

Lake Extents
2013/06/11
2013/07/13
2013/07/29
2013/08/14
2013/08/30
2014/06/14
2014/06/30
2014/08/01
Final lake

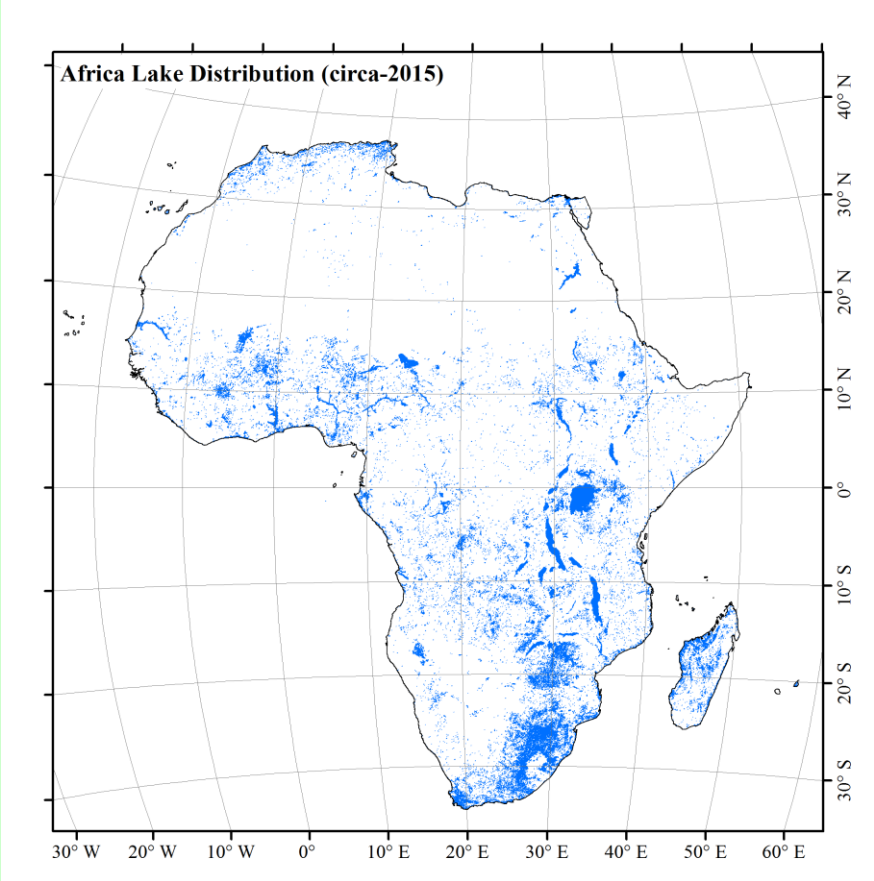

120°E
130°E
140°E
150°E
160°E
10°S
20°S
30°S
40°S
110°E
120°E
130°E
140°E
150°E
160°E
170°E
180°


120°E
130°E
140°E
150°E
160°E
170°E
10°S
20°S
30°S
40°S
110°E
180°
Mapping Times
1
2
3 - 4
5 - 6
7 - 8
9 - 10
11 - 15
16 - 30


120°E
130°E
140°E
150°E
160°E
170°E
10°S
20°S
30°S
40°S
110°E
120°E
130°E
140°E
150°E
160°E
170°E
180°
Varibility (%)
0
1 - 5
6 - 10
11 - 20
21 - 40
41 - 70
71 - 100
> 100

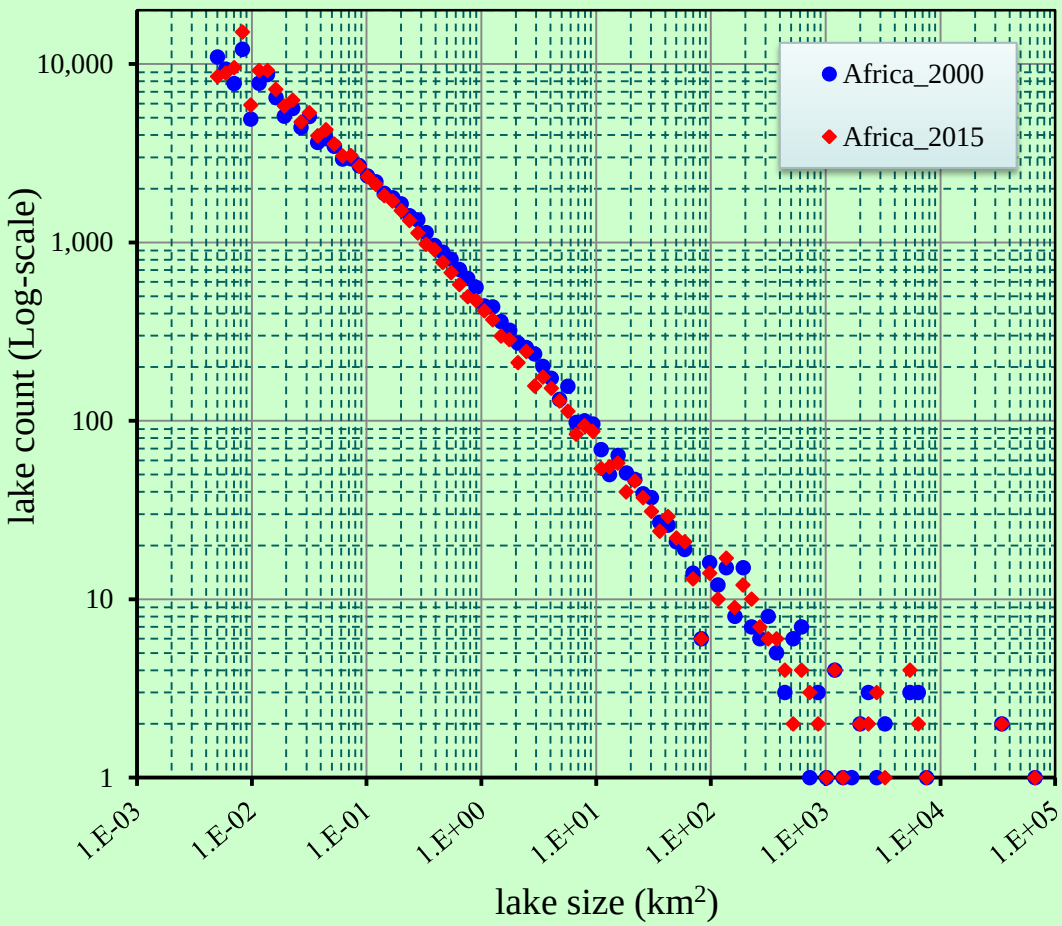
Africa: circa-2000 vs. circa-2015

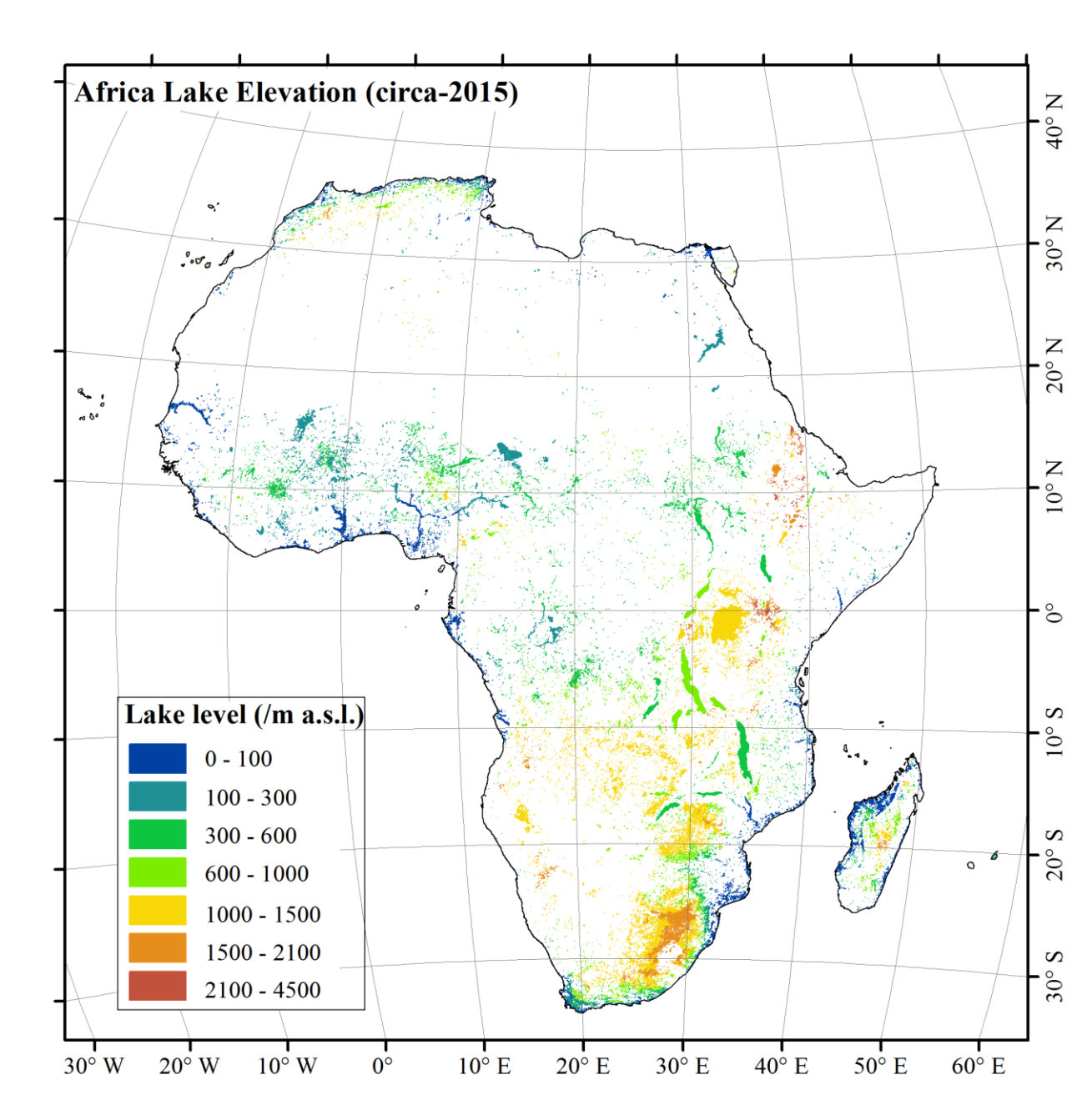


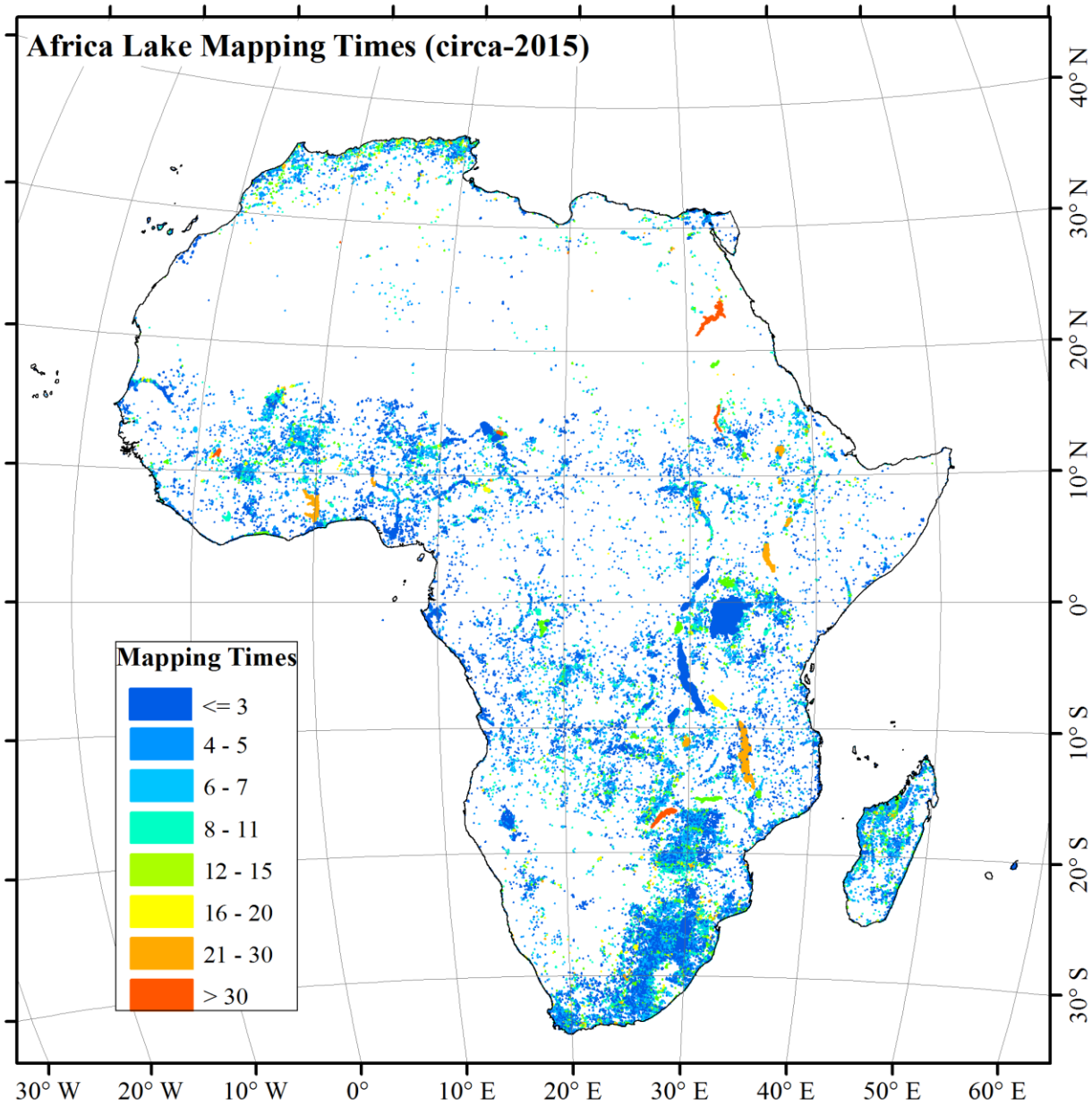


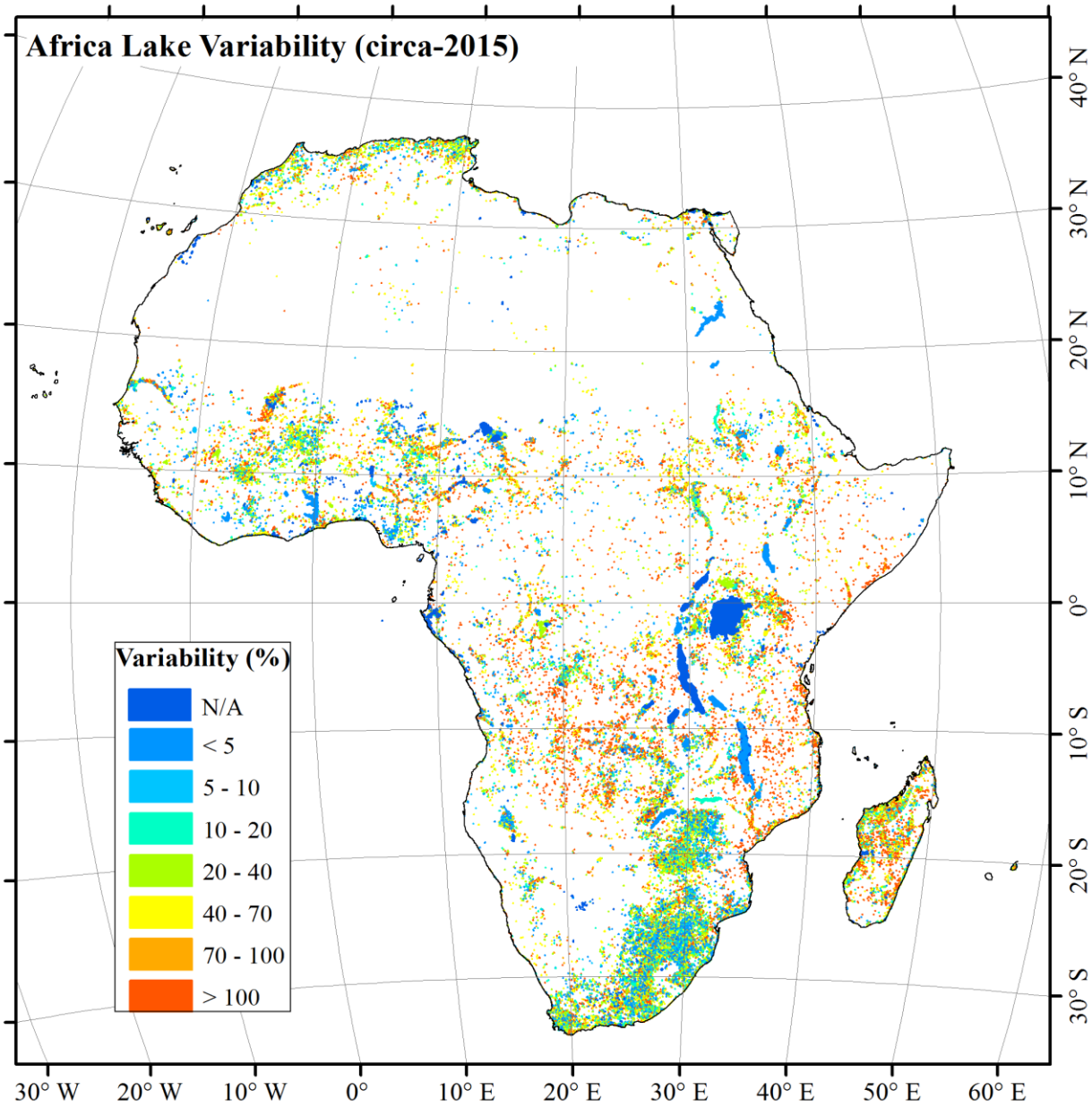
Lake size distributions

Lake Size (km²)	circa-2000	circa-2015
<0.01	49180	52823
0.01-0.1	60575	65495
0.1-0.5	13886	12816
0.5-1.0	2581	2191
1.0-10	3027	2561
10-50	405	374
50-100	55	54
100-500	83	83
500-1000	14	10
1000-5000	15	14
5000-10000	6	6
>10000	3	3
Total_Num	129830	136430
Total_Area (km²)	248426.005	240592.539




Africa Lake Elevation (circa-2015)
Lake level (/m a.s.l.)
0 - 100
100 - 300
300 - 600
600 - 1000
1000 - 1500
1500 - 2100
2100 - 4500
40° N
30° N
20° N
10° N
0°
10° S
20° S
30° S
30° W
20° W
10° W
0°
10° E
20° E
30° E
40° E
50° E
60° E


Africa Lake Mapping Times (circa-2015)
Mapping Times
<= 3
4 - 5
6 - 7
8 - 11
12 - 15
16 - 20
21 - 30
> 30
40° N
30° N
20° N
10° N
0°
10° S
20° S
30° S
30° W
20° W
10° W
0°
10° E
20° E
30° E
40° E
50° E
60° E


Africa Lake Variability (circa-2015)
Variability (%)
N/A
< 5
5 - 10
10 - 20
20 - 40
40 - 70
70 - 100
> 100
30° W
20° W
10° W
0°
10° E
20° E
30° E
40° E
50° E
60° E
40° N
30° N
20° N
10° N
0°
10° S
20° S
30° S

Ongoing efforts

	Lake num * Times	Area (km^2)	Averaged mapping times
South America	8,921,913	3,814,391	9
US & Central America	5,341,895	4,070,752	11
EuroAsia_west	2,494,560	1,034,519	12

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