



Supplement of

GCI30: a global dataset of 30 m cropping intensity using multisource remote sensing imagery

Miao Zhang et al.

Correspondence to: Bingfang Wu (wubf@aircas.ac.cn) and Chong Liu (liuc@mail.sysu.edu.cn)

The copyright of individual parts of the supplement might differ from the article licence.

Table S1. Data sources for generating the global 30-m cropland extent.

Product name	Description	Type	Selected classes	Definition	Spatial coverage	Spatial resolution	Epoch used	Website
FROM-GLC	Finer resolution observation and monitoring of global land cover	Land cover	Croplands	This type includes rice fields, Greenhouse farming, and other arable and tillage land.	Global	30-m	2017	http://data.ess.tsinghua.edu.cn/
GFSAD30	Global food security support analysis data at 30-m	Cropland layer	Croplands	This type includes all agricultural annual standing croplands, cropland fallows, and permanent plantation crops	Global	30-m	2015	https://lpdaac.usgs.gov/tools/data-pool/
CDL	USDA NASS cropland data layer	Cropland layer	Cropland	Crop-specific land cover type	Contiguous U.S.	30-m	2017	https://www.nass.usda.gov/index.php
AAFC ACI	Canada AAFC annual crop inventory	Cropland layer	Cropland	Crop-specific land cover type	Canada	30-m	2017	https://www.agr.gc.ca/atlas/aci/
ChinaCover	China 30m cropland extent	Land cover	Croplands	This type includes two sub-classes, paddy fields and dry farmland.	China	30-m	2010	http://www.geodata.cn/data/datadetails.html?dataguid=1471197&docId=12230
SERVIR	Regional land cover monitoring system for the Lower Mekong	Land cover	Cropland, & Rice paddies	Cropland includes lands with herbaceous and shrubby crops followed by harvest and a bare soil period. This category includes single, mixed, multiple, and	Lower Mekong basin	30-m	2018	https://servir.adpc.net/

				seasonal cropping systems. Tea and coffee plantations are included in this layer; but orchards, forest croplands, and forest plantations are not. Rice paddies include irrigated or flooded rice fields and low land paddy fields where rice is intensively planted.				
NLCD	USGS national land cover database	Land cover	Cultivated crops	Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. This class also includes all land being actively tilled.	U.S.	30-m	2016	https://www.mrlc.gov/
MapBiomass	Brazilian annual land use and land cover mapping project	Land cover	Agriculture	This class includes both temporary crop, and perennial crop.	Brazil	30-m	2018	https://mapbiomas.org/en/products
CLUM	Catchment scale land use of Australia	Land cover	Cropping, & irrigated cropping	This category includes both rainfed and	Australia	50-m	2018	https://www.agriculture.gov.au/

				irrigated cereals, beverage and spice crops, hay and silage, sugar, cotton, pulses, rice etc.				
INTA	National cropland map of Argentina	Cropland layer	Croplands	This class includes fields used for cultivation of summer crops, winter crops, and sugarcane. Fallow land is also included.	Argentina	30-m	2018-2019	http://www.geointa.inta.gob.ar/

Table S2. Meta information of global agro-ecological zones.

Full name	Code ID	Cropland percentage (%)	Category
Equatorial central Africa	C01	2.72	VL
East African highlands	C02	12.88	L
Gulf of Guinea	C03	17.35	M
Horn of Africa	C04	4.72	L
Madagascar(main)	C05	2.4	VL
SW Madagascar	C06	1.32	VL
North Africa Mediterranean	C07	15.26	M
Sahel	C08	6.95	L
Southern Africa	C09	3.41	VL
S. Africa Western Cape	C10	18.42	M
British Columbia To Colorado	C11	5.45	L
America northern great plains	C12	64.5	H
America corn belt	C13	27.71	M
America cotton belt-Mexican coastal plain	C14	18.34	M
Sub-boreal North America	C15	5.67	L
America West Coast	C16	14.27	L
Sierra Madre	C17	5.42	L
SW Mexico and N. Mexico highlands	C18	5.62	L
Northern South and Central America	C19	13.83	L
Caribbean	C20	27.76	M
Central-Northern Andes	C21	2.57	VL
Brazil Nordeste	C22	10.5	L
Central-Eastern Brazil	C23	12.71	L
Amazon	C24	1.19	VL
Central-North Argentina	C25	13.62	L
SE Brazil-Concepcion-Bahia Blanca	C26	40.35	H
SW Southern Cone	C27	3.06	VL
Semi-arid Southern Cone	C28	3.4	VL
Caucasus	C29	28.38	M
Central Asia Pamir mountains	C30	16.79	M
Western Asia	C31	12.53	L
China Gansu-Xinjiang	C32	10.09	L
China Hainan	C33	35.77	M
China Huang Huaihai	C34	95.27	H
China Inner Mongolia	C35	24.27	M
China Loess region	C36	46.44	H
China Lower Yangtze	C37	40.97	H
North East China	C38	44.1	H
China Qinghai-Tibet	C39	1.21	VL
Southern China	C40	20.16	M
South-West China	C41	25.85	M
Taiwan	C42	19.37	M
East Asia	C43	14.24	L
Southern Himalayas	C44	43.26	H
Southern Asia	C45	71.36	H
Southern Japan and Korea	C46	11.32	L
Mongolia region	C47	0.4	VL
S. Asia Punjab to Gujarat	C48	64.98	H

SE Asia islands	C49	9.4	L
SE Asia mainland	C50	37.06	M
Eastern Siberia	C51	0.13	VL
Eastern Central Asia	C52	3.71	VL
North Australia	C53	3.86	VL
Australia Queensland to Victoria	C54	24.14	M
Australia Nullarbor-Darling	C55	48.92	H
New Zealand	C56	4	L
Boreal Eurasia	C57	1.14	VL
Ukraine to URAL Mountains	C58	51.75	H
Mediterranean Europe and Turkey	C59	26.7	M
W. Europe(non-Mediterranean)	C60	50.57	H
Boreal North America	C61	0.33	VL
URAL to Altai Mountains	C62	32.93	M
Australian Desert	C63	0.28	VL
Old World Deserts	C64	0.63	VL
Sub Arctic America	C65	0	VL

Table S3. Meta information of PhenoCam sites used in this study.

Site ID	Latitude	Longitude	Elevation (m)	Data start date	Data last date
arsbrooks10	41.9749	-93.6905	312	2019-07-10	2020-09-27
arsltarmdcr	39.0587	-75.8513	17	2017-05-10	2020-09-26
arsltarucbec1	40.7537	-78.0057	400	2019-05-16	2020-09-26
arsmnswanlake1	45.6845	-95.7997	370	2015-10-02	2020-09-27
arsmorris1	45.6167	-96.1269	341	2017-07-25	2020-09-20
arsope3ltar	39.0309	-76.8442	41	2017-04-10	2020-09-26
ashbottoms	38.8668	-96.9028	374	2015-08-18	2017-01-15
bouldincorn	38.109	-121.535	10	2017-07-12	2020-09-23
burdetterice1	35.8284	-89.9879	10	2019-07-23	2020-09-27
burdettericea	35.8089	-90.0327	-5	2015-06-18	2017-05-22
burdettericec	35.8089	-90.0284	70	2015-07-02	2017-05-22
cafboynorthltar01	46.7551	-117.1261	73	2017-09-14	2020-09-26
cafcookeastltar01	46.7815	-117.0821	70	2017-05-09	2020-09-26
cafcookwestltar01	46.784	-117.0908	795	2017-06-26	2020-09-26
goodwater	39.2285	-92.1194	794	2015-09-25	2020-09-27
goodwaterbau	39.2312	-92.1522	807	2018-06-06	2020-09-27
hawbeckerddy	40.6608	-77.8488	264	2015-09-24	2018-04-24
humnokericea	34.5852	-91.7517	274	2015-06-24	2020-09-27
humnokericec	34.5889	-91.7517	310	2015-06-24	2020-09-27
jurong	31.8068	119.2173	61	2017-10-21	2020-09-27
kelloggcorn	42.4375	-85.3225	70	2014-05-24	2019-11-18
keplerltar	40.7231	-77.9245	15	2018-04-25	2019-05-15
mandanh5	46.7754	-100.9511	288	2015-09-16	2020-09-26
mandani2	46.7614	-100.9257	378	2016-04-22	2020-09-26
manilacotton	35.8872	-90.1371	593	2016-06-05	2020-09-26
mead1	41.1651	-96.4766	590	2016-07-12	2020-09-27
mead3	41.1797	-96.4397	73	2016-07-12	2020-09-27
NEON.D06.KONA.DP1.00033	39.1104	-96.6129	361	2016-05-06	2020-09-27
NEON.D10.STER.DP1.00033	40.4619	-103.0293	363	2016-12-18	2020-09-27
rosemountc6	44.7288	-93.0888	443	2015-10-22	2017-01-01
rosemountcons	44.6946	-93.0578	1366	2017-01-09	2020-09-27
rosemountconv	44.691	-93.0576	288	2017-01-13	2020-09-27
rosemountg21	44.7143	-93.0898	283	2015-10-26	2017-01-01
shangqiu	34.5155	115.595	283	2018-01-24	2020-09-27
silverton	44.9986	-122.6948	290	2013-07-22	2020-09-26
slovenia3moskanjci	46.4098	15.9963	55	2019-04-03	2020-09-27
southerngreatplains	36.6058	-97.4888	16	2012-05-16	2020-09-26
uiefmaize2	40.0628	-88.1961	224	2018-08-08	2020-09-26
uiefsorghum	40.0065	-88.2032	224	2018-08-15	2020-07-10
usof6	35.7333	-90.0403	70	2018-05-18	2020-09-27

Table S4. Cropping intensity estimated by five different products at country/region level.

Index	Country/region name*	GCI30	MCD12Q2	VIP4	Ray and Foley	SACRA
1	Afghanistan	1.00	1.10	1.10	0.40	0.99
2	Albania	1.19	1.03	1.36	0.66	0.99
3	Algeria	0.78	0.96	1.08	0.52	0.88
4	Angola	0.91	0.93	n.a.	0.83	0.85
5	Antigua and Barbuda	1.00	0.67	n.a.	n.a.	n.a.
6	Argentina	0.98	1.12	1.16	1.02	1.13
7	Armenia	1.00	1.00	1.01	0.96	1.46
8	Australia	0.77	0.96	1.15	0.52	0.98
9	Austria	1.17	1.02	1.01	0.99	0.87
10	Azerbaijan	1.05	0.99	1.34	0.66	1.39
11	Bahamas	0.94	0.67	n.a.	n.a.	0.77
12	Bahrain	1.00	n.a.	n.a.	0.78	n.a.
13	Bangladesh	1.56	1.10	1.58	1.67	1.70
14	Barbados	0.95	0.83	n.a.	n.a.	n.a.
15	Belgium	1.22	0.99	1.03	1.20	0.81
16	Belize	1.24	1.36	n.a.	0.79	0.96
17	Benin	1.05	0.94	1.25	0.87	1.37
18	Bhutan	1.04	0.96	1.50	0.85	0.86
19	Bolivia	1.21	1.21	n.a.	0.74	0.97
20	Bosnia and Herzegovina	1.03	1.00	1.00	n.a.	0.78
21	Botswana	0.76	1.00	n.a.	0.62	0.89
22	Brazil	1.31	1.31	1.21	0.82	1.06
23	Brunei	1.20	1.83	n.a.	2.30	0.86
24	Bulgaria	0.98	1.02	1.01	0.89	1.02
25	Burkina Faso	1.00	0.98	n.a.	1.04	0.98
26	Burundi	1.03	0.98	n.a.	0.89	1.24
27	Byelarus	1.14	1.03	1.00	0.73	0.93
28	Cambodia	1.12	1.00	1.09	0.76	1.38
29	Cameroon	1.00	0.95	1.29	0.64	1.36
30	Canada	0.99	1.00	1.01	0.52	0.96
31	Central African Republic	1.08	1.00	1.00	0.45	0.69
32	Chad	1.00	0.95	n.a.	0.82	0.85
33	Chile	0.89	1.00	1.13	0.77	0.72
34	China	1.12	1.09	1.28	1.29	1.12
35	Colombia	1.07	0.84	1.00	1.04	1.17
36	Congo	1.04	0.65	1.08	0.54	1.22
37	Costa Rica	0.97	1.08	n.a.	0.99	1.01
38	Croatia	1.03	1.00	1.00	n.a.	0.85
39	Cuba	1.03	0.98	1.00	0.46	0.67
40	Cyprus	0.89	1.00	n.a.	0.80	0.98
41	Czech Republic	1.16	1.07	1.01	0.78	1.02

42	Denmark	1.20	1.09	1.24	1.08	1.62
43	Djibouti	0.76	n.a.	n.a.	n.a.	1.17
44	Dominica	1.33	n.a.	n.a.	n.a.	n.a.
45	Dominican Republic	1.37	1.04	n.a.	0.68	0.97
46	Ecuador	1.03	0.92	n.a.	0.96	1.57
47	Egypt	1.44	1.55	1.96	1.75	0.99
48	El Salvador	0.98	1.02	1.00	0.80	1.01
49	Equatorial Guinea	1.30	n.a.	1.52	0.45	1.89
50	Eritrea	0.89	0.99	n.a.	0.95	0.96
51	Estonia	1.05	1.01	1.00	0.68	1.00
52	Ethiopia	1.02	0.98	1.52	0.99	1.43
53	Finland	1.00	1.00	1.01	0.60	1.00
54	France	1.02	0.96	1.05	0.85	1.23
55	Gabon	1.32	0.55	1.44	0.46	1.86
56	Gambia, The	0.99	0.97	n.a.	1.03	1.00
57	Gaza Strip	0.69	0.95	n.a.	n.a.	1.00
58	Georgia	1.01	1.00	1.16	0.77	0.95
59	Germany	1.17	1.04	1.17	1.66	1.10
60	Ghana	1.11	0.90	1.26	0.90	1.54
61	Greece	1.01	0.97	1.19	0.91	1.09
62	Grenada	1.33	0.67	n.a.	n.a.	n.a.
63	Guadeloupe	1.06	0.76	n.a.	n.a.	n.a.
64	Guatemala	1.00	0.96	1.17	0.83	0.81
65	Guinea	1.00	0.97	n.a.	0.92	1.04
66	Guinea-Bissau	0.92	0.87	n.a.	0.14	0.93
67	Guyana	1.74	1.24	2.33	0.46	0.82
68	Haiti	1.46	0.91	n.a.	0.97	0.83
69	Honduras	1.04	1.00	n.a.	0.72	0.90
70	Hungary	1.05	1.03	1.03	1.03	0.95
71	India	1.20	1.19	1.29	1.14	1.43
72	Indonesia	1.32	1.03	1.11	0.90	1.14
73	Iran	0.85	1.03	1.11	0.76	1.05
74	Iraq	0.72	0.91	1.09	0.75	1.14
75	Ireland	1.07	1.01	1.00	0.31	1.45
76	Israel	0.92	1.01	1.00	0.72	0.99
77	Italy	1.02	1.01	1.05	0.96	1.04
78	Ivory Coast	1.23	0.70	1.18	0.97	1.68
79	Jamaica	1.06	1.19	n.a.	0.69	0.67
80	Japan	1.02	0.99	1.00	0.79	0.79
81	Jersey	1.19	0.91	n.a.	n.a.	n.a.
82	Jordan	0.85	0.93	1.00	0.73	0.57
83	Kazakhstan	0.93	0.97	1.03	0.69	1.01
84	Kenya	1.03	1.02	1.97	0.82	1.82

85	Kuwait	1.20	1.14	1.00	0.81	0.56
86	Kyrgyzstan	1.00	1.00	1.00	0.70	1.06
87	Laos	1.03	0.95	1.06	1.01	1.23
88	Latvia	1.07	1.03	1.01	0.58	0.97
89	Lebanon	0.97	0.96	1.29	0.96	1.11
90	Lesotho	0.98	0.99	1.00	0.70	0.83
91	Liberia	1.32	0.81	1.72	0.86	1.47
92	Libya	0.53	0.85	n.a.	0.38	0.17
93	Liechtenstein	1.12	n.a.	1.00	n.a.	0.33
94	Lithuania	1.12	1.04	1.01	0.77	0.98
95	Luxembourg	1.19	1.00	1.07	n.a.	1.18
96	Macedonia	0.98	1.00	1.04	n.a.	0.99
97	Madagascar	0.98	1.04	n.a.	0.84	0.82
98	Malawi	0.95	1.00	1.13	1.03	0.86
99	Malaysia	1.23	1.35	1.00	0.80	0.93
100	Mali	0.97	0.99	n.a.	0.83	0.94
101	Malta	0.99	1.04	n.a.	n.a.	n.a.
102	Man, Isle of	1.13	1.10	n.a.	n.a.	0.75
103	Martinique	1.07	0.65	n.a.	n.a.	n.a.
104	Mauritania	1.04	1.27	n.a.	0.81	0.86
105	Mexico	1.01	1.01	1.15	0.62	0.90
106	Moldova	1.04	1.01	1.01	0.79	0.99
107	Mongolia	0.88	1.00	1.00	0.32	0.99
108	Montenegro	1.23	1.06	1.00	n.a.	0.94
109	Montserrat	1.00	0.74	n.a.	n.a.	n.a.
110	Morocco	0.73	0.88	1.07	0.79	0.92
111	Mozambique	0.90	0.97	1.02	0.97	0.70
112	Myanmar (Burma)	1.08	1.07	1.25	1.45	1.46
113	Namibia	0.76	0.90	n.a.	0.43	0.91
114	Nepal	1.20	1.15	n.a.	1.91	1.32
115	Netherlands	1.11	0.98	1.03	1.21	0.87
116	New Zealand	1.14	1.14	n.a.	0.88	1.05
117	Nicaragua	1.01	1.10	n.a.	0.46	0.97
118	Niger	1.00	0.73	n.a.	0.94	0.55
119	Nigeria	1.02	0.91	1.31	1.16	1.35
120	North Korea	1.00	1.00	1.00	1.09	0.92
121	Norway	1.03	1.00	1.00	0.43	0.95
122	Oman	1.01	1.00	n.a.	0.93	0.19
123	Pakistan	1.36	1.47	1.74	0.94	1.57
124	Panama	1.11	1.02	n.a.	0.46	1.21
125	Papua New Guinea	1.05	0.82	n.a.	1.08	0.99
126	Paraguay	1.72	1.47	1.49	1.75	1.01
127	Peru	0.80	1.02	1.00	0.70	1.16

128	Philippines	1.46	1.09	1.55	1.32	1.08
129	Poland	1.15	1.03	1.05	0.93	1.05
130	Portugal	0.94	1.02	1.15	0.92	0.91
131	Puerto Rico	1.13	1.07	n.a.	0.50	0.42
132	Qatar	1.04	1.50	n.a.	n.a.	n.a.
133	Romania	1.02	1.02	1.03	0.99	0.81
134	Russia	0.97	0.99	1.03	0.45	1.03
135	Rwanda	1.36	1.17	n.a.	1.28	1.83
136	San Marino	1.03	1.00	1.00	n.a.	n.a.
137	Saudi Arabia	0.86	0.90	n.a.	0.29	0.59
138	Senegal	1.00	0.98	n.a.	0.74	1.00
139	Serbia	1.01	1.00	1.00	n.a.	0.90
140	Sierra Leone	1.20	0.94	n.a.	0.88	1.60
141	Slovakia	1.11	1.07	1.01	0.90	0.94
142	Slovenia	1.14	1.00	1.00	n.a.	0.65
143	Solomon Islands	1.22	0.52	n.a.	n.a.	1.74
144	Somalia	0.85	1.14	2.04	0.69	1.85
145	South Africa	0.83	0.94	1.00	0.44	0.84
146	South Korea	1.01	1.00	1.01	1.03	0.95
147	Spain	0.82	0.94	1.12	0.78	1.17
148	Sri Lanka	1.39	1.24	1.29	1.04	1.13
149	St. Kitts and Nevis	0.82	1.00	n.a.	n.a.	n.a.
150	St. Lucia	0.67	0.67	n.a.	n.a.	n.a.
151	Sudan	0.87	0.99	1.08	0.68	0.96
152	Suriname	1.70	1.70	n.a.	0.99	0.53
153	Swaziland	0.89	0.95	n.a.	0.80	0.96
154	Sweden	1.06	1.07	1.02	0.48	1.01
155	Switzerland	1.24	0.97	1.00	0.71	0.75
156	Syria	0.79	0.86	1.10	0.85	1.14
157	Tajikistan	0.94	0.99	1.01	1.09	1.06
158	Tanzania, United Republic of	0.84	0.98	1.05	0.92	1.20
159	Thailand	1.11	0.98	1.16	0.98	1.38
160	Togo	1.05	0.95	1.13	0.61	1.70
161	Trinidad and Tobago	1.14	0.75	1.33	n.a.	1.33
162	Tunisia	0.68	0.89	1.25	0.73	0.93
163	Turkey	0.90	0.97	1.15	0.80	1.08
164	Turkmenistan	0.92	0.94	1.11	0.96	1.05
165	Turks and Caicos Islands	1.18	0.67	n.a.	n.a.	n.a.
166	Uganda	1.30	1.01	1.02	0.86	1.40
167	Ukraine	1.04	1.02	1.02	0.70	0.97
168	United Arab Emirates	1.05	0.71	n.a.	1.35	n.a.
169	United Kingdom	1.02	1.01	1.12	0.76	1.46
170	United States	0.97	1.00	1.04	0.71	0.97

171	Uruguay	1.28	1.46	1.06	0.74	1.33
172	Uzbekistan	1.01	1.05	1.03	0.80	1.21
173	Venezuela	0.91	0.97	1.00	0.59	0.97
174	Vietnam	1.58	1.27	1.25	1.39	1.31
175	West Bank	0.93	0.98	1.00	n.a.	0.97
176	Western Sahara	0.55	n.a.	n.a.	n.a.	n.a.
177	Yemen	1.11	1.05	n.a.	0.78	0.84
178	Zaire	1.12	0.78	1.01	n.a.	1.01
179	Zambia	0.90	1.13	1.10	0.48	0.94
180	Zimbabwe	0.93	1.01	1.00	0.74	0.84

Note:

* some countries or regions (mostly small islands) are not included in the table because there is no statistical CI value from GCI30 or reference datasets.

n.a. stands for not available.

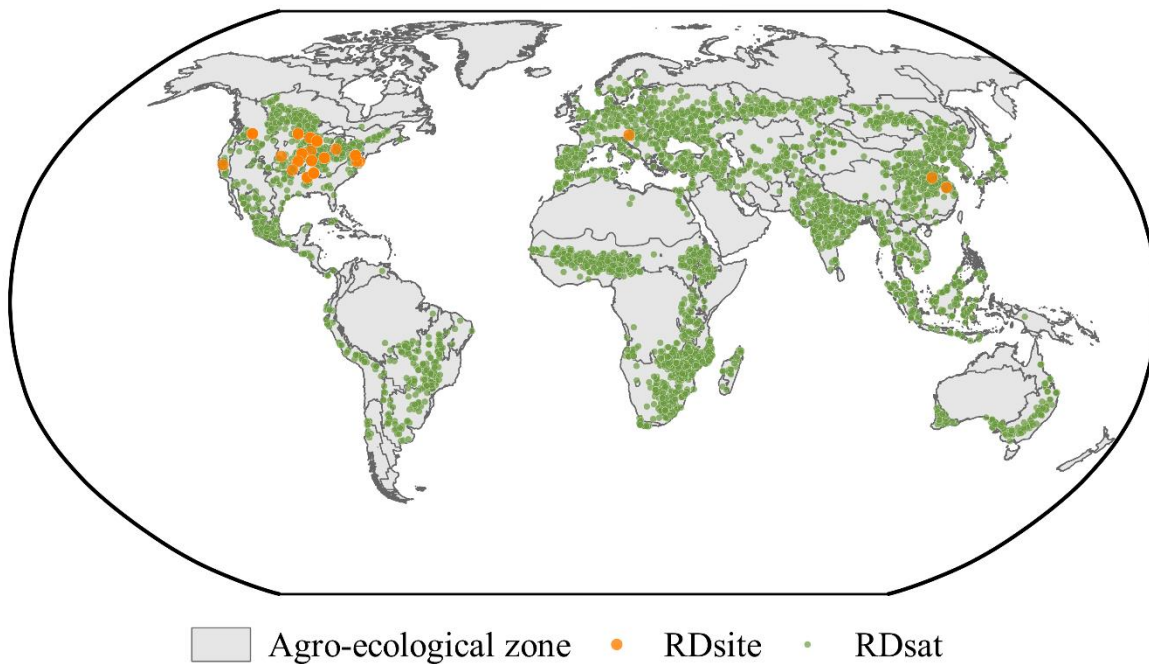


Figure S1. Global distribution of Agro-ecological zone (AEZ) boundaries, RDsat and RD site.

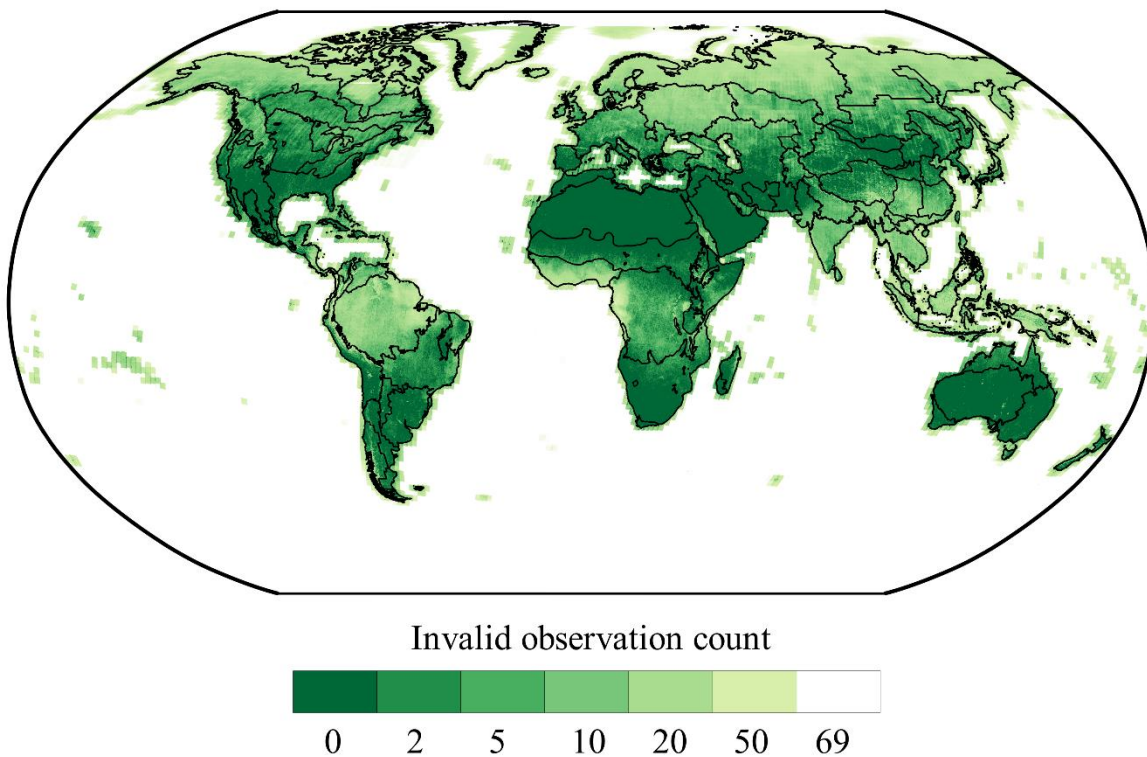


Figure S2. Invalid observation count of the 16-day harmonized TOA reflectance composite from 2016 to 2018.

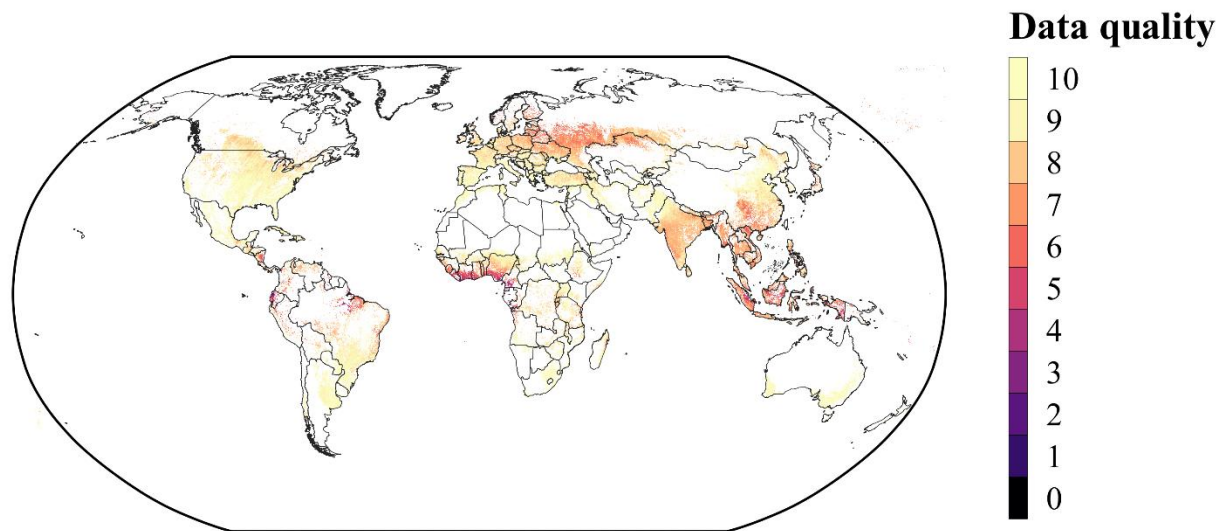


Figure S3. Data quality map of GCI30 measured as the invalid number of 16-day composite during 2016-2018. Zero indicates lowest data quality while 10 indicates highest data quality.