



## Supplement of

## The RapeseedMap10 database: annual maps of rapeseed at a spatial resolution of 10 m based on multi-source data

Jichong Han et al.

Correspondence to: Zhao Zhang (sunny\_zhang@bnu.edu.cn)

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12 Table S1 Thresholds of different indicators in different regions

					8	
Zones	Red	Green	VH	NDYI	NRGBI	Connected components
Zone I	0.07	0.11	-11	0.05	-0.05	40
Zone II	0.07	0.11	-12	0.05	-0.05	20
Zone III	0.07	0.11	-12	0.05	-0.05	20

## 15 Table S2 Confusion matrix table in this study\_

		Class		
		Non	Rapeseed	
Defenence	Non	X <sub>11</sub>	X <sub>12</sub>	
Reference	Rapeseed	X <sub>21</sub>	X22	

17 Table S3 The comparison of rapeseed (pixels) in Canada, USA, GBR, and France from different

data sources in 2018, 2019, with rows from reference classification, while columns from our
derived maps. Annual Crop Inventory (ACI), Cropland Data Layer (CDL), Crop Map of

Existing products		Non-rapeseed	Rapeseed	Total	PA	UA	F1
A CL 2019	Non-rapeseed		434,530,41				
ACI 2018	Rapeseed	469,895,705	114,144,421,6	161,133,992,1	0.71	0.96	0.82
(Callada)	Total		reseed         Rapeseed         Total         P.           434,530,41         434,530,41         5,705         114,144,421,6         161,133,992,1         0.7           5,705         114,144,421,6         161,133,992,1         0.7         118,489,725,7         0.7           551,173,7         2,80         778,389,57         109,966,237         0.7           833,506,94         619,139,3         619,139,3         619,139,3         619,139,3         0.7           4,08         935,079,60         118,636,368         0.7         996,993,53         0.7           1,43         712,890,46         893,501,89         0.3         757,732,89         0.3           5545926         5545926         574324984         0.7         197264126         0.7				
	Non-rapeseed	Non-rapeseed         Rapeseed         Total         PA           Non-rapeseed         434,530,41					
CDL 2018 (USA) Total CDL 2019 (USA) Rapeseed CDL 2019 (USA) Total Non-rapeseed CDL 2019 Rapeseed 251,284,08	Rapeseed	321,272,80	778,389,57	109,966,237	0.71	0.93	0.81
		833,506,94					
Existing products         Non-rapeseed         Rapeseed         Total           ACI 2018 (Canada)         Non-rapeseed         434,530,41         161,133,9           (Canada)         Total         118,489,725,7         161,133,9           Total         118,489,725,7         101,133,9           (USA)         Non-rapeseed         551,173,7           Rapeseed         321,272,80         778,389,57         109,966,           (USA)         Total         833,506,94         118,636,           (USA)         Non-rapeseed         619,139,3         118,636,           (USA)         Rapeseed         251,284,08         935,079,60         118,636,           (USA)         Total         996,993,53         109,966         118,636,           (GBR)         Non-rapeseed         180,611,43         712,890,46         893,501           (GBR)         Total         757,732,89         101         197264126           Non-rapeseed         5545926         101         197264126							
	Rapeseed	251,284,08	935,079,60	118,636,368	0.79	0.94	0.86
(03A)	Total	Non-rapeseed         Rapeseed         Total         PA           434,530,41         434,530,41         469,895,705         114,144,421,6         161,133,992,1         0.71           118,489,725,7         551,173,7         551,173,7         321,272,80         778,389,57         109,966,237         0.71           833,506,94         619,139,3         619,139,3         0.79         996,993,53         996,993,53           448,424,3         180,611,43         712,890,46         893,501,89         0.80           757,732,89         5545926         82606784         191718200         274324984         0.70					
CROME 2019	Non-rapeseed		448,424,3	Rapeseed         Total         PA           434,530,41         14,144,421,6         161,133,992,1         0.71           18,489,725,7         551,173,7         778,389,57         109,966,237         0.71           833,506,94         619,139,3         935,079,60         118,636,368         0.79           996,993,53         448,424,3         712,890,46         893,501,89         0.80           757,732,89         5545926         191718200         274324984         0.70			
Non-rapeseed         551,173,7           CDL 2018         Rapeseed         321,272,80         778,389,57           (USA)         Total         833,506,94           Description         Non-rapeseed         619,139,3           CDL 2019         Rapeseed         251,284,08         935,079,60           (USA)         Total         996,993,53           (USA)         Total         996,993,53           (CROME 2018         Non-rapeseed         180,611,43         712,890,46           (GBR)         Total         757,732,89           Non-rapeseed         S545926         5545926           LCMF 2018         Rapeseed         82606784         191718200	712,890,46	893,501,89	0.80	0.94	0.86		
(OBK)	Total		757,732,89		al     PA       ,992,1     0.71       6,237     0.71       6,368     0.79       91,89     0.80       4984     0.70		
	Non-rapeseed		5545926				
(Error co)	Rapeseed	82606784	191718200	274324984	0.70	0.97	0.81
(France)	Total		197264126	109,966,237       0.71         118,636,368       0.79         893,501,89       0.80         274324984       0.70			

20 England (CROME), Land Cover Map of France (LCMF).

22 Table S4 Confusion matrix of rapeseed validation based on the random sampling points. Map

Zones	Class	Rapeseed	Non	Total	UA	PA	F1
Zone I	Rapeseed	1820	469	2289	0.89	0.80	0.84
	Non	235	2017	2252			
	Total	2055	2486				
	Rapeseed	5721	730	6541	0.95	0.88	0.91
Zone II	Non	302	6267	6569			
	Total	6023	6997				
Zone III	Rapeseed	72	9	81	0.91	0.89	0.90
	Non	7	78	85			
	Total	79	87				

23 categories are columns while reference categories are rows.



<sup>27</sup>date
<sup>28</sup>Figure S1. Sentinel-2 and Google Earth images at the flowering stage of rapeseed for visual
<sup>29</sup>comparison. The temporal profile of the spectral index (NDYI) and backscattering coefficient
<sup>30</sup>(VV, VH). The filled color areas with one positive/negative standard deviation were illustrated.
<sup>31</sup>We selected the rapeseed parcels in different climate types and years (a) Canada, (c) Chile, (e)
<sup>32</sup>Germany. For selecting the suitable images, we chose the Google Earth images according to
<sup>33</sup>the dates as close as possible to those of the Sentinel-2 images (images: Copernicus Sentinel-2
<sup>34</sup>data).



36 Figure S2. Histogram of the time interval between the date of the VH maximum value and the

37 peak flowering date (the date of the local VH minimum value) of all sample blocks in different

38 years: (a) 2017-2019, (b) 2017, (c) 2018, (d) 2019. The blue and red dotted lines are the median

39 of days and 45 days, respectively.





41 Figure S3. The histogram of green band, red band, NDYI, and VH based on sample rapeseed

42 parcels in different regions: (a-d) zone I, (e-h) zone III, (i-l) zone II. The red dashed line

43 indicates the threshold of the corresponding indicator.



44

2018/7/15 - 2018/7/19

2018/7/20 - 2018/7/30

- 45 Figure S4. Rapeseed identification results based on the pixel-based algorithm on different dates.
- 46 (c) is the union of (a) and (b). We found that the cumulative aggregate-based approach can
- 47 reduce the misclassification from the effects of phenology and bad-quality observations (image
- 48 source: Copernicus Sentinel-2 data 2018).





50 Figure S5. Geographic distribution of validation sample points at  $0.2^{\circ} \times 0.2^{\circ}$  grids 



52

Figure S6. Spatially details of rapeseed maps in 20 countries with diverse crop structures in 2018. The base maps were RGB images composite using bands from the red, green, and blue bands of the Sentinel-2 images with good-quality observations in the flowering period of

56 rapeseed (image source: Copernicus Sentinel-2 data).





58 Figure S7. Spatial comparison between rapeseed classifications obtained by our pixel- and

59 phenology-based method and other crop products in Canada (ACI, 2018), USA (CDL, 2019),

60 and GBR (CROME, 2018).



62 Figure S8. Spatial comparison between rapeseed classifications obtained by our pixel- and

63 phenology-based method and land cover map of France in 2018.



Figure S9. The normalized rapeseed planting areas are derived from rapeseed maps in eachcountry.



69 Figure S10. The 25 zones selected for investigating rotation information. The areas that met the

- 70 following three criteria: high image quality, high rapeseed classification accuracy, and large
- 71 extent of planted rapeseed. Rapeseed rotation in these areas was calculated based on the
- 72 frequency of each rapeseed pixel



Figure S11. Spatial distribution of rapeseed rotation patterns in different areas from 2017~2019.