remote sensing

MDPI

Supplementary material

Optimizing Near Real-Time Detection of Deforestation on Tropical Rainforests using Sentinel-1 Data

Supplementary material of Optimizing Near Real-Time Detection of Deforestation on Tropical Rainforests using Sentinel-1 Data

Table S1: Characteristics of the collected forest Time Series.

Polarization	Period	Treatment	# Samples per treat.		Backscattering intensity (γ0)	
			Total	Mean	Mean	Std. dev.
VHg0	1 yr	harmon	139873	56.8	0.056	0.0219
		harmonf			0.0559	0.0072
		orig			0.0561	0.022
		origf			0.056	0.0074
		spatial			0.0561	0.0217
		spatialf			0.056	0.0066
	2 yr	harmon	212362	86	0.0567	0.022
		harmonf			0.0567	0.0073
		orig			0.0567	0.0222
		origf			0.0567	0.0075
		spatial			0.0567	0.0219
		spatialf			0.0567	0.0066
VVg0	1 yr	harmon	139893	56.8	0.2393	0.0898
		harmonf			0.2387	0.0291
		orig			0.2396	0.0905
		origf			0.239	0.0306
		spatial			0.2396	0.0892
		spatialf			0.239	0.0273
	2 yr	harmon	212371	86	0.2373	0.0888
		harmonf			0.2369	0.0289
		orig			0.2375	0.09
		origf			0.2371	0.0306
		spatial			0.2375	0.0886
		spatialf			0.2371	0.0271

Table S2: Characteristics of the collected deforestation Time Series.

Polarization	Period	Treatment	# Samples		Backscattering intensity (γ^0)	
			Total	Mean	Mean	Std. dev.
VHg0	1 yr	harmon	149413	58	0.049	0.023
		harmonf			0.049	0.012
		orig			0.049	0.023
		origf			0.049	0.013
		spatial			0.049	0.022
		spatialf			0.049	0.011

Polarization	Period	Treatment	# Samples		Backscattering intensity (γ^0)	
			Total	Mean	Mean	Std. dev.
VVg0	2 yr	harmon	225265	88	0.052	0.023
		harmonf			0.052	0.012
		orig			0.052	0.023
		origf			0.052	0.012
		spatial			0.052	0.022
		spatialf			0.051	0.01
	1 yr	harmon	149792	59	0.212	0.091
		harmonf			0.212	0.044
		orig			0.212	0.093
		origf			0.212	0.048
		spatial			0.212	0.09
		spatialf			0.211	0.042
	2 yr	harmon	225514	88	0.217	0.09
		harmonf			0.217	0.041
		orig			0.217	0.092
		origf			0.217	0.044
		spatial			0.217	0.09
		spatialf			0.217	0.039

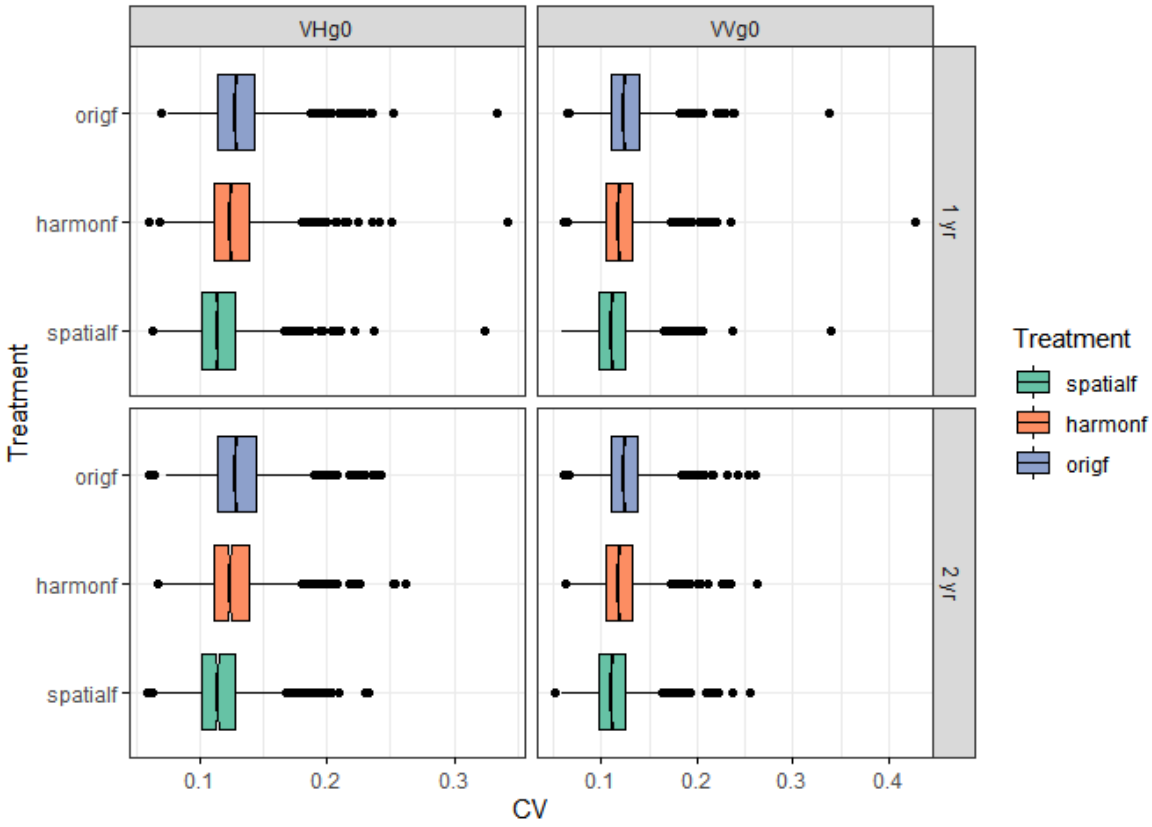


Figure S1: Box-plot of the coefficient of variation of the forest speckle-filtered time series, without stabilization (*origf*), with harmonic stabilization (*harmonf*) and with spatial stabilization (*spatialf*).

Table S1: Mean reduction of the variability of the time series, as measured by the coefficient of variation.

Period	Polarization	Change Origf-Harmonf (%)	Change Origf-Spatialf (%)
1 yr	VHg0	-2.83	-10.59
1 yr	VVg0	-4.85	-10.20
2 yr	VHg0	-3.30	-10.43
2 yr	VVg0	-4.57	-10.10

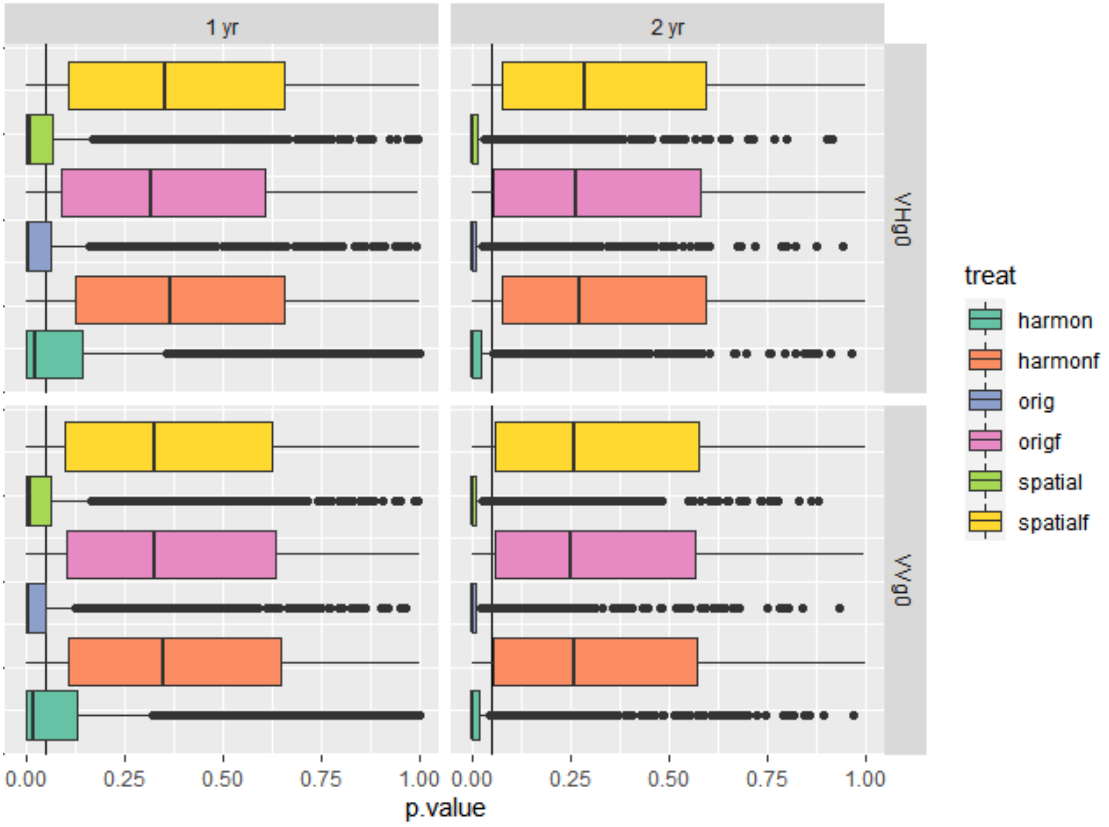


Figure S2: Results of the Shapiro-Wilk normality test applied to the treated and non-treated forested TS. orig – original Sentinel-1 backscattering samples, origf – original TS filtered, harmon – original TS stabilized using harmonic fitting, harmonf– original TS stabilized using harmonic fitting and then filtered, spatial – original TS stabilized using spatial stabilization, spatialf – original TS stabilized using spatial stabilization and then filtered.

Table S4: Results of the Shapiro-Wilk test for normality of Forest time series, in terms of number of TS passing the tests with a significance of 5%.

Polarization	Period	Treatment	Shapiro-Wilk p>0.05	
			Total	%
VHg0	1 yr	harmon	998	40.29
		harmonf	2137	86.27
		orig	696	28.10
		origf	2022	81.63
		spatial	735	29.67
		spatialf	2084	84.13
	2 yr	harmon	430	17.36
		harmonf	1989	80.30

		orig	300	12.11
		origf	1886	76.14
		spatial	336	13.56
		spatialf	1986	80.18
VVg0	1 yr	harmon	944	38.11
		harmonf	2052	82.84
		orig	633	25.56
		origf	2073	83.69
		spatial	713	28.78
		spatialf	2047	82.64
	2 yr	harmon	402	16.23
		harmonf	1900	76.71
		orig	270	10.90
		origf	1913	77.23
		spatial	309	12.47
		spatialf	1910	77.11

Table S5: Results of the Kolmogorov-Smirnoff test for gamma-distribution fitting of unfiltered Forest time series, in terms of the number of TS passing the tests with a significance lower than 5%.

Polarization	**Period**	**Treatment**	**KS p>0.05**	
			Total	**%**
VHg0	1 yr	harmon	2476	100.0
VHg0	1 yr	orig	2475	99.9
VHg0	1 yr	spatial	2477	100.0
VHg0	2 yr	harmon	2475	99.9
VHg0	2 yr	orig	2475	99.9
VHg0	2 yr	spatial	2474	99.9
VVg0	1 yr	harmon	2475	99.9
VVg0	1 yr	orig	2472	99.8
VVg0	1 yr	spatial	2474	99.9
VVg0	2 yr	harmon	2476	100.0
VVg0	2 yr	orig	2473	99.8
VVg0	2 yr	spatial	2474	99.9

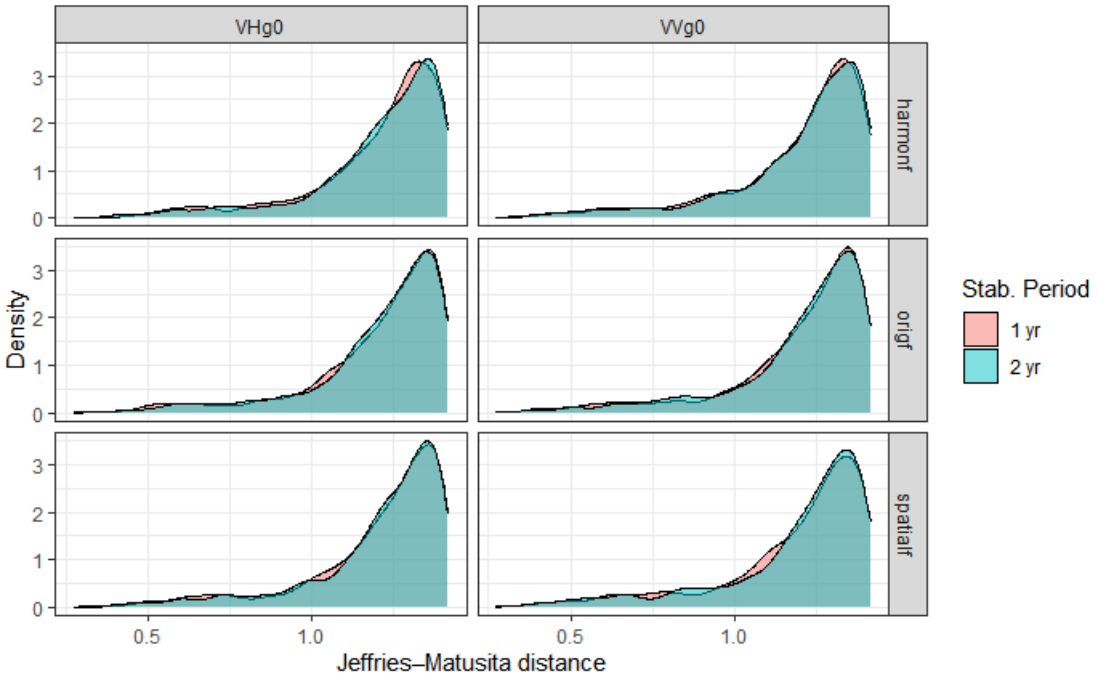


Figure S3: Jeffries-Matsushita distance of the F/DF classes as computed by the finite mixture algorithm.

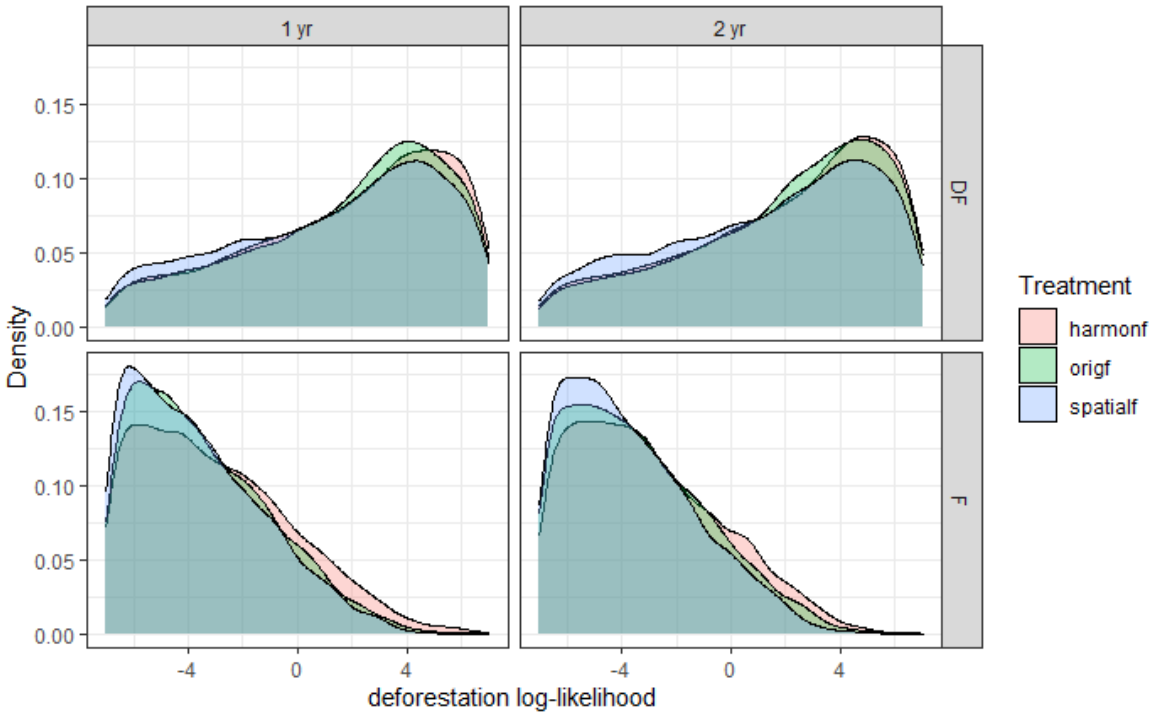


Figure S4: Density distribution of the values of the deforestation log-likelihood of the validation samples, by TS classes (DF= deforested time series, F= Forest time series).

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