A hurricane wind risk and loss assessment of Caribbean agriculture

PREEYA MOHAN

Sir Arthur Lewis Institute of Social and Economic Studies, University of the West Indies, Trinidad and Tobago. Email: preeya.mohan@sta.uwi.edu

ERIC STROBL (Corresponding Author)

Aix-Marseille School of Economics & IPAG Research Lab, Centre de la vieille Charité, 2 rue de la Charité, 13002 Marseille, France. Email: eric.strobl@polytechnique.edu
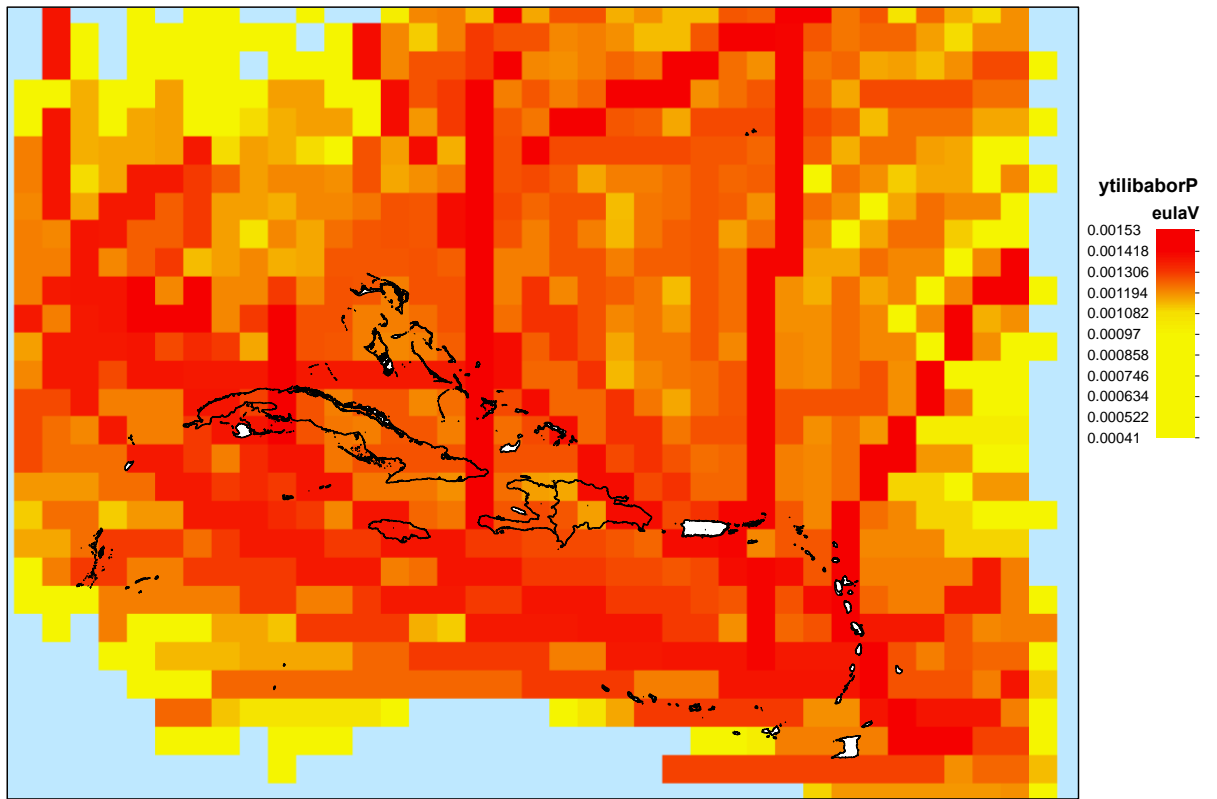
ONLINE APPENDIX

Figure A1. *Spatial probability map of hurricane passing derived from synthetic tracks*

Notes: (1) Cells size is 100km. (2) Probability refers to the annual probability that the hurricane will pass over the cell. (3) Probabilities derived from simulation of 100,000 years.

Figure A2. *Hurricanes during 1980-2010*

Notes: Red portion of lines indicate when the tropical storm was of hurricane strength, while orange when it was below, i.e., less than 119 km/hr.
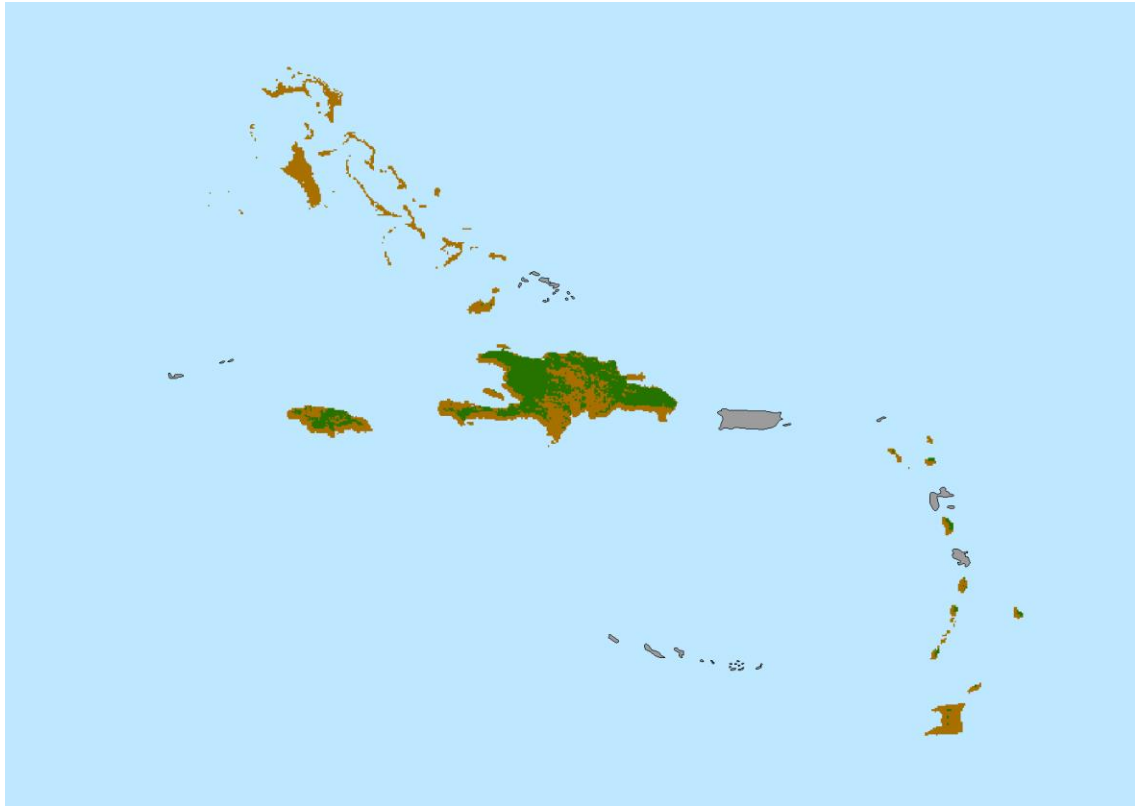
Figure A3. *Cropland cell identification*

Notes: (1) Green cells indicate cropland area, whereas brown cells are non-cropland.
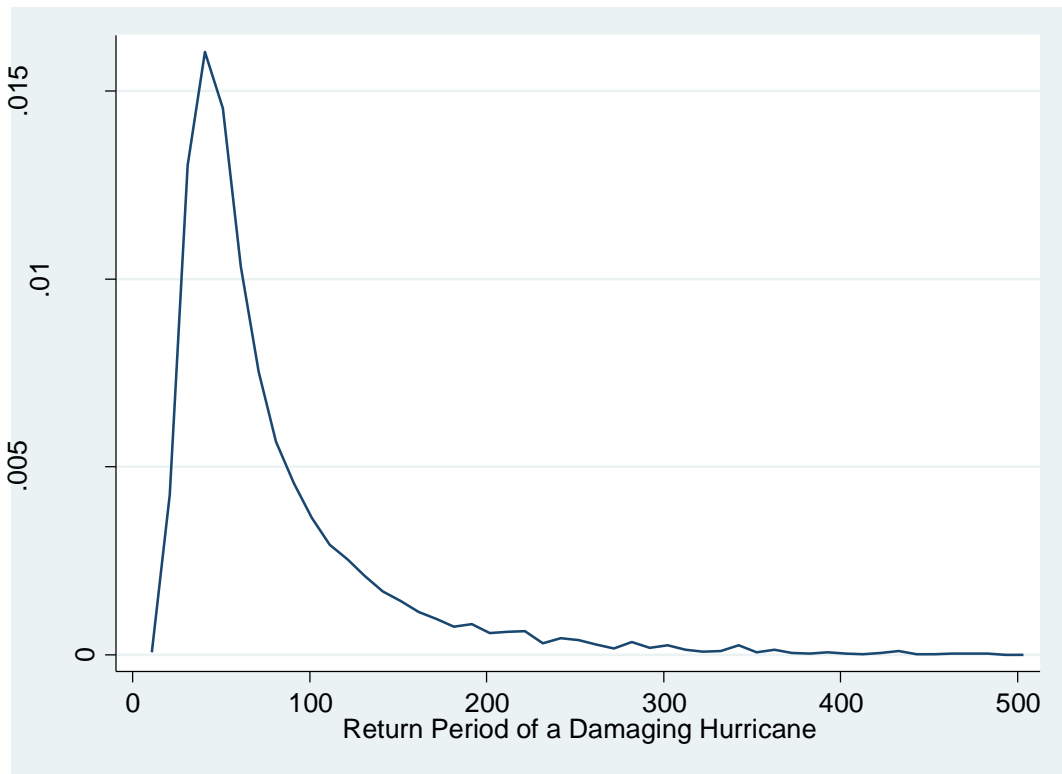(2) Islands in grey are those not included in our sample.

Figure A4. *Kernel density distribution of damaging hurricanes return period (RP) over all cropland cells*

Table A1. *Cropland area*

Country	UNFAO	GLC	Pittman
Antigua and Barbuda	0.205	0.000	0.006
Bahamas	0.015	0.320	0.015
Barbados	0.326	0.000	0.049
Cuba	0.617	0.614	0.122
Dominica	0.347	0.007	0.017
Dominican Republic	0.506	0.401	0.095
Grenada	0.324	0.000	0.020
Haiti	0.642	0.526	0.140
Jamaica	0.415	0.526	0.061
St. Kitts & Nevis	0.219	0.281	0.000
St. Lucia	0.180	0.000	0.024
St. Vincent & the Grenadines	0.256	0.000	0.021
Trinidad & Tobago	0.105	0.204	0.066

Notes: (1) Data in the UNFAO column is the percentage of cropland of total land area as identified by the UNFAO. (2) The Pittman column represents the share of cropland when all positive probability cells are considered as cropland, as taken from Pittman *et. al* (2010). (3) The GLC refers to the share of cropland as determined by the Global Land Cover database.

Table A2. *Cropland Probit regression results*

Variable	(1)	(2)
El	.0001454***	.0001454***
	(.000012)	(.000012)
el^2	-5.42e-08***	-5.42e-08***
	(7.21e-09)	(7.21e-09)
Slope	-7.380239***	-7.379834***
	(.5711463)	(.5711194)
$Slope^2$	8.64739***	8.646961***
	(.6358978)	(.6358688)
Nl	-.0055645***	-.0058376***
	(.0018627)	(.0014214)
nl^2	-.0000111	
	(.0000417)	
near_night	.017487***	.0177557***
	(.0019163)	(.0015006)
$near\_nigh^2$	-.0001744	-.0001857***
	(.0000428)	(7.11e-06)
X	.0941667***	.0941654***
	(.0010717)	(.0010717)
Y	.2097939***	.2097976***
	(.0028665)	(.0028666)
Shore	-.4408943***	-.440804***
	(.0072285)	(.0072209)
Observations	291064	291064
Log pseudolikelihood	-71464.33921	-71464.34515

Notes: (1) Standard errors in parentheses. (2) ***, ** and * identify 1, 5 and 10% significance levels. (3) Country indicator variables included but not reported. (4) El: elevation in meters; slope: slope in meters; nl: nightlight intensity, near_night: average nightlight intensity in neighboring cells; X: longitude in degrees; Y: latitude in degrees; shore: distance to shore in kilometers. (5) The number of observations refers to all grid cells across all countries.

Table A3. *Summary of agricultural crop production data for 2010*

Country	Volume (1000s tons)	Agriculture value added (% of GDP)	Diversification index	Tree crops (% of total crops)	Main crops
Antigua and Barbuda	13	2.25	0.56	93	Mangoes, melon
Bahamas	116	2.10	0.64	99	Sugar, grape fruit
Barbados	377	1.47	0.19	99	Sugar, coconut
Cuba	21969	5.00	0.31	93	Sugar, tomato
Dominica	114	15.45	0.58	68	Banana, yam
Dominican Republic	9196	23.50	0.44	97	Sugar, banana
Grenada	35	5.70	0.60	92	Nutmeg, banana
Haiti	4259	23.0	0.46	74	Mangoes, cocoa
Jamaica	2391	6.72	0.19	90	Sugar, coffee
St. Kitts and Nevis	5	1.55	0.60	88	Sugar, coconut
St. Lucia	69	3.87	0.92	94	Banana, coconut
St. Vincent and the Grenadines	121	7.26	0.49	87	Banana, sweet potato
Trinidad and Tobago	139	6.39	0.53	92	Sugar, coconut

Notes: (1) Author's compilation based on UNFAO 2014 and WDI Indicators. (2) Diversification index is the Herfindahl index of agricultural production defined at the crop level using a total of 170 crops.

Table A4. *Regression results from regressing annual agricultural production on L(V)*

Variable	(1)	(2)	(3)	(4)	(5)
PDI_t	-.0467948**	-.0447436**	-.0445566**	-.0003178	-138.4285
	(.0206142)	(.0183482)	(.0186209)	(.0004491)	(330.6836)
PDI_{t-1}		-.0490799**	-.0494064**	-.0002181	-75.39968
		(.0212927)	(.021452)	(.0004103)	(285.0678)
PDI_{t-2}			.0061469	-.0006705	-425.8771
			(.0195077)	(.0006806)	(560.2826)
Observations	390	390	390	390	390
Countries	13	13	13	13	13
F-test β= 0	5.15**	3.58*	2.70*	11.01**	4.16**
R^2 (within)	0.0194	0.0408	0.0413	0.109	0.097

Notes: (1) Standard errors in parentheses. (2) ***, ** and * identify 1, 5 and 10% significance levels. (3) Results are the estimation of equation (4). (4) Columns 1 through 3 use maximum storm wind speed and a threshold of 178 km/hr, column 4 uses maximum storm wind speed and a threshold of 119 km/hr, while column 5 uses sum of wind speeds over 178 km/hr over the duration of a storm to define PDI.

Table A5. *Regression results by country sub-sample*

Sub-Sample:	(1) More Agricultural Based	(2) Less Agricultural Based	(3) More Concentrated	(4) Less Concentrated	(5) More Tree Crop Based	(6) Less Tree Crop Based
H_t	-.0743466*	.0000125	-.0510671*	-.0668906	-.097109*	-.0003619
	(.0368589)	(.0005445)	(.0277638)	(.0502095)	(.044523)	(.000837)
H_{t-1}	-.0865099**	-.0006576	-.0595745*	-.0808197	-.1010799*	-.0016133
	(.0365097)	(.0005924)	.0288374	(.0504638)	(.0483067)	(.0014125)
Observations	240	149	239	150	239	150
Countries	8	5	8	5	8	5
F-test β= 0	10.72***	909.18***	632.23***	3.38	27.42***	68.25***
R2 (within)	0.1878	0.3633	0.1808	0.2636	0.2088	0.2584

Notes: (1) Standard errors in parentheses. (2) ***, ** and * identify 1, 5 and 10% significance levels. (3) The cut-off to be relatively more agricultural, more concentrated, or more tree crop based are the top 8 ranked countries in these categories.