Future impacts of ozone driven damages on agricultural systems--GC43H-1401

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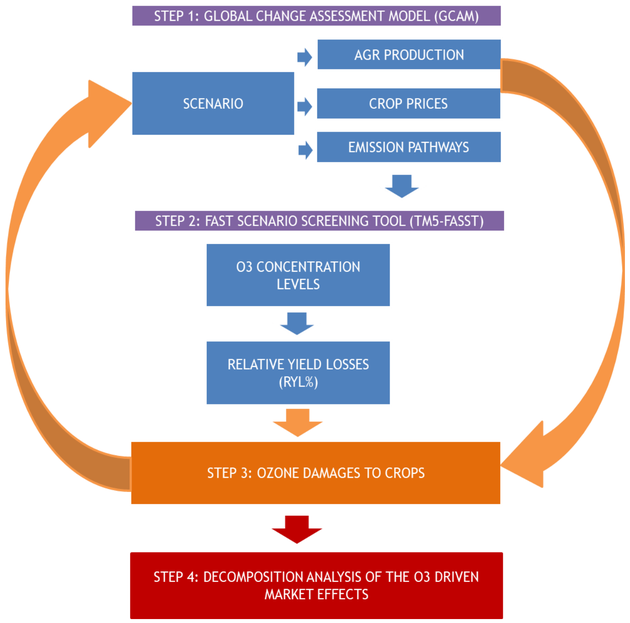
BACKGROUND

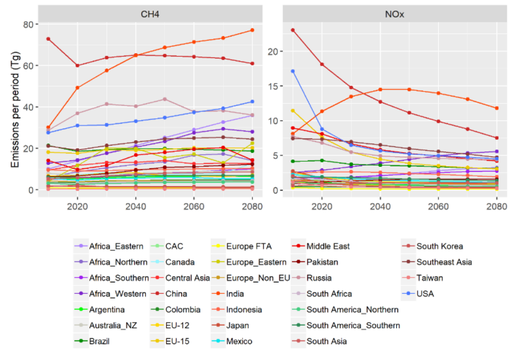
- Ozone is the most hazardous pollutant for crop yields: visible foliar injuries, reduced photosynthesis, gene alteration, and a **reduction in yields**
- It always produces **negative impacts**
- Mitigation actions for **decreasing NOx or CH_4** would be the most effective to reduce O_3 concentration
- Climate policies and changes in meteorological conditions **affect future O_3** concentration levels

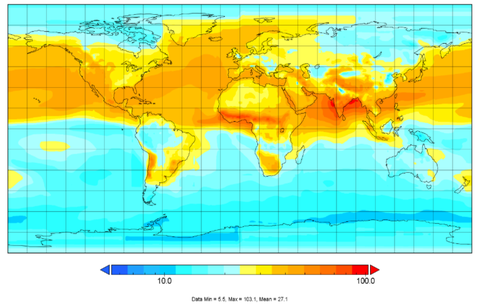
METHODOLOGY



- $RYL_{t,i,j} = 1 - \frac{\exp(-\frac{M12_{t,i}}{a_j})^{b_j}}{\exp(-\frac{20}{a_j})^{b_j}}$ and $1 - \frac{\exp(-\frac{M7_{t,i}}{a_j})^{b_j}}{\exp(-\frac{25}{a_j})^{b_j}}$
- $\text{Economic Damage}_{t,i,j} = RYL_{t,i,j} \times P_{t,i,j} \times Q_{t,i,j}$
- $\Delta NPV_{t,i,j} = NPV_{t,i,j}(\text{scen}) - NPV_{t,i,j}(\text{base}) = \Delta P_{t,i,j} + \Delta Y_{t,i,j} + \Delta sL_{t,i,j} + \Delta LU_{t,i}$

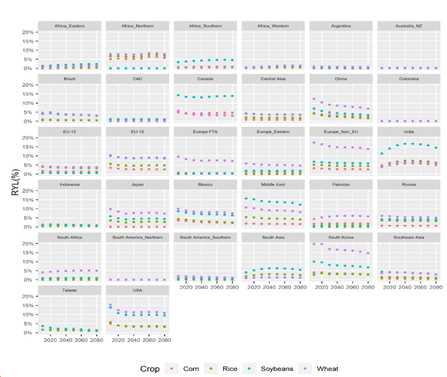
1- EMISSIONS and O_3 CONCENTRATIONS

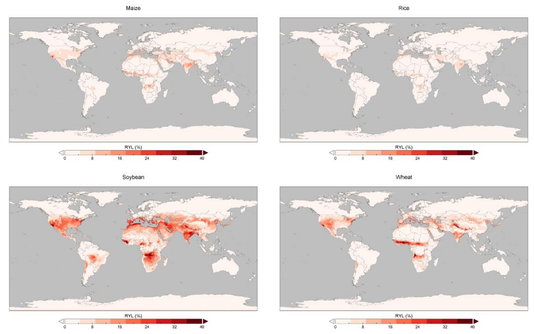




Monthly mean (7 hours) daytime O_3 (log ppbv) in 2050

2- RELATIVE YIELD LOSSES (RYLs)



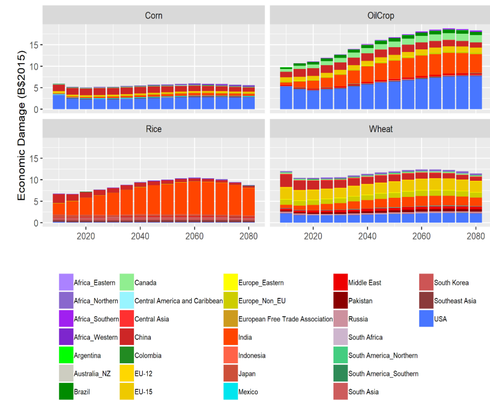


O3-related RYLs in 2080

MAIN FINDINGS

- Projected emissions of O_3 precursor reduce the agricultural damages, compared to present, except for some regions (India)
- Annual economic impact of O_3 driven losses from 2010-2080 ($B) are 5.0-6.0, 9.8-18.8, 6.7-10.6 and 10.4-12.5 for corn, soybeans, rice and wheat, respectively
- When O_3 effects are considered, cumulative NPV of crop production would decrease up to $90.8B at a global level, with large differences between regions

3-ECONOMIC DAMAGES



4- DECOMPOSITION ANALYSIS OF EFFECTS IN AGRICULTURAL MARKETS

Region	ΔP	ΔY	ΔsL	ΔLU	ΔNPV
Africa_Eastern	-2.75	-4.38	2.02	-3.27	**-8.40**
Africa_Northern	-6.95	-0.42	-0.79	-3.60	**-11.77**
Africa_Southern	-0.54	-1.47	0.73	-2.36	**-3.65**
Africa_Western	2.09	-14.29	6.35	-2.63	**-8.49**
Argentina	-11.38	0.17	-2.45	-6.69	**-20.36**
Australia_NZ	-3.20	-0.67	0.77	-5.66	**-8.76**
Brazil	-9.10	5.76	1.68	-7.24	**-8.91**
Canada	-8.06	8.62	2.07	-5.05	**-2.41**
CAC	-2.18	0.18	0.29	-2.44	**-4.16**
Central Asia	-2.96	1.81	0.74	-2.48	**-2.89**
China	-178.19	200.04	4.92	-85.95	**-59.19**
Colombia	-0.62	0.02	0.40	-1.53	**-1.73**
EU-12	-11.49	4.87	-3.07	-7.02	**-16.70**
EU-15	-73.76	59.90	3.24	-37.75	**-48.40**
Europe_Eastern	-6.93	3.09	-0.43	-3.18	**-7.46**
Europe_Non_EU	-31.71	35.49	4.12	-11.28	**-3.38**
European FTA	-1.11	1.33	0.26	-0.44	**0.04**
India	215.30	-114.89	-9.87	27.75	**118.19**
Indonesia	-2.74	0.17	0.09	-1.02	**-3.50**
Japan	-8.08	6.57	0.18	-6.86	**-8.20**
Mexico	-13.14	14.70	2.92	-6.77	**-2.27**
Middle East	-21.74	20.79	2.01	-7.26	**-6.19**
Pakistan	1.24	-5.90	-1.73	-0.15	**-6.54**
Russia	-6.07	3.88	-0.62	-6.69	**-9.50**
South Africa	-0.74	-0.92	-0.79	-1.32	**-3.78**
SouthAmer_North	-0.18	0.01	0.36	-0.79	**-0.60**
SouthAmer_South	-3.98	1.29	-0.93	-4.46	**-8.08**
South Asia	1.65	-4.44	-0.74	0.10	**-3.44**
South Korea	-0.34	-1.69	0.22	-1.11	**-2.91**
Southeast Asia	-12.22	5.95	2.23	-7.21	**-11.25**
USA	-111.47	172.04	23.82	-10.55	**73.89**
TOT	**-311.32**	**397.59**	**37.99**	**-214.95**	**-90.80**

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