FUTURE IMPACT OF CLIMATE AND PRECURSOR EMISSION CHANGE ON OZONE-RELATED MORTALITY IN EUROPE, INCLUDING THE EFFECT OF HIGHER AMBIENT TEMPERATURES

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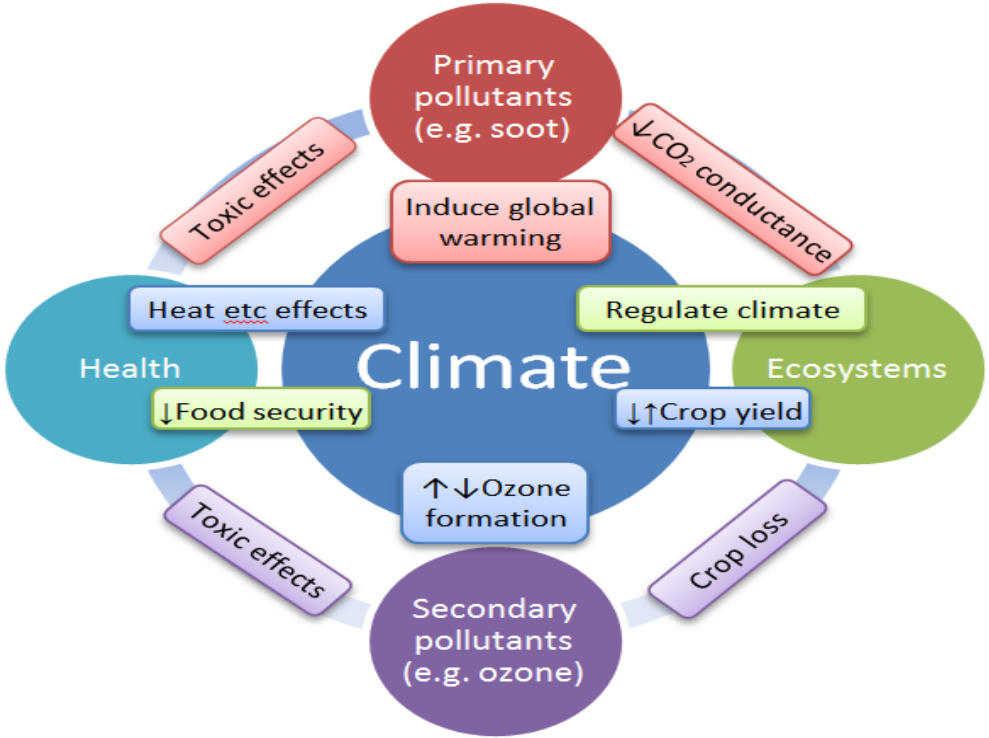
CLIMATE CHANGE AND TROPOSPHERIC OZONE

- Near-surface tropospheric ozone is a highly oxidative pollutant, associated with respiratory, and according to recent evidence, also cardiovascular mortality due to short- and long-term exposure
- As the result of changes in ozone precursor emissions, climate, population size and susceptibility – health effects of near-surface ozone are expected to be different in the future

CLIMATE & AIR QUALITY INTERACTIONS AND DIRECT & INDIRECT EFFECTS ON HEALTH



Orru, Ebi et al 2017,
Curr Environ Health Rep

CLIMATE CHANGE AND AMBIENT TEMPERATURES INCREASE

- Rising global average temperature is associated with widespread changes in weather patterns
- As the consequence of this, the extreme weather events such as heat waves are likely to become more frequent or more intense with human-induced climate change as well as less “cooling off” at night
- By the end of this century, the extreme heat event what have been appearing once-in-20-year will happen every second year (NASA)

Search

ACCEPTED

Assessment of changing conditions, environmental policies, time-activities, exposure and disease

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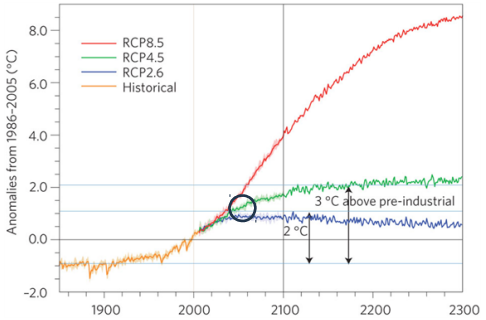
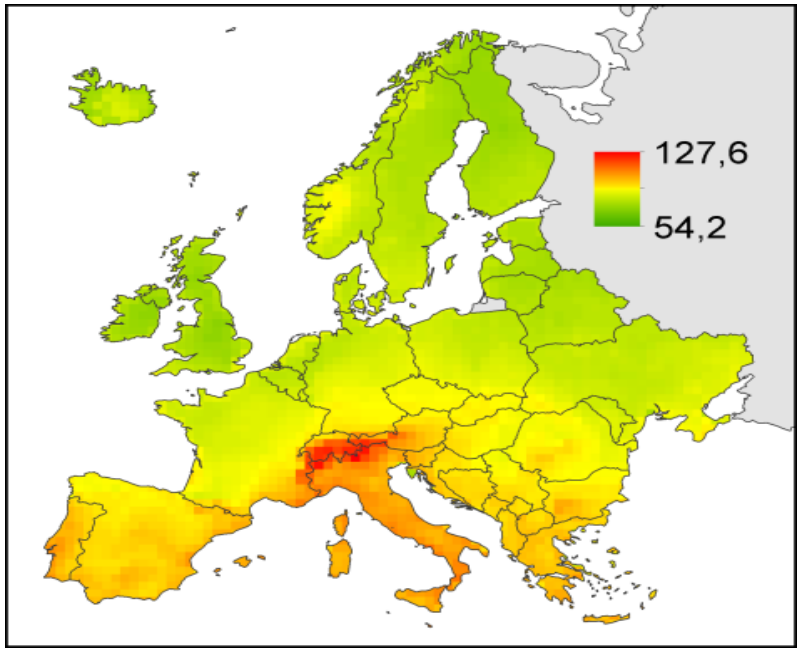
WHAT WAS DONE



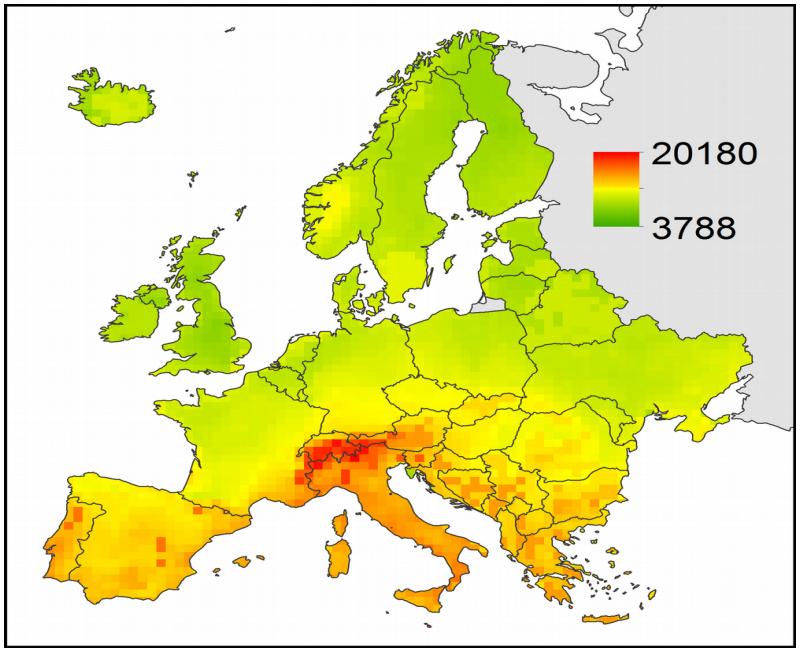
- European ozone concentrations were modelled at a grid size of 50x50 km using MATCH and future temperature, and relative humidity were estimated
- Climate projections from the regional climate model RCA4 were used. For the surface ozone and temperatures, the global climate model EC-EARTH was used as input for the regional climate model, forced by the greenhouse gas emission scenario RCP4.5
- Two periods were compared: the current climate as 1991-2000 and future climate as 2046–2055
- The impacts on long- and (short-term) mortality due to ozone exposure and heat related premature deaths in Europe were calculated using health impact assessment (HIA) principles

CURRENT OZONE LEVELS



Long-term exposure

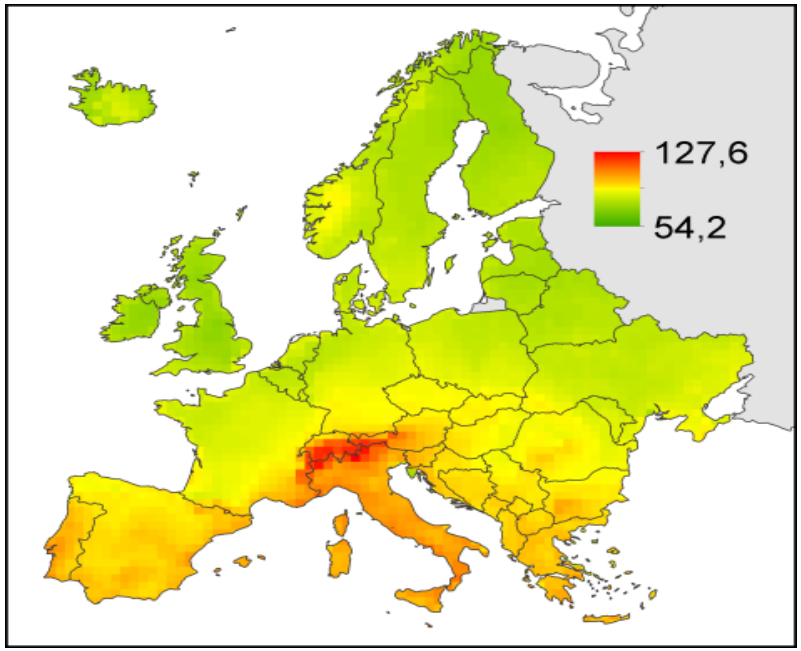
Mean of ozone daily 8h max conc (µg/m³)



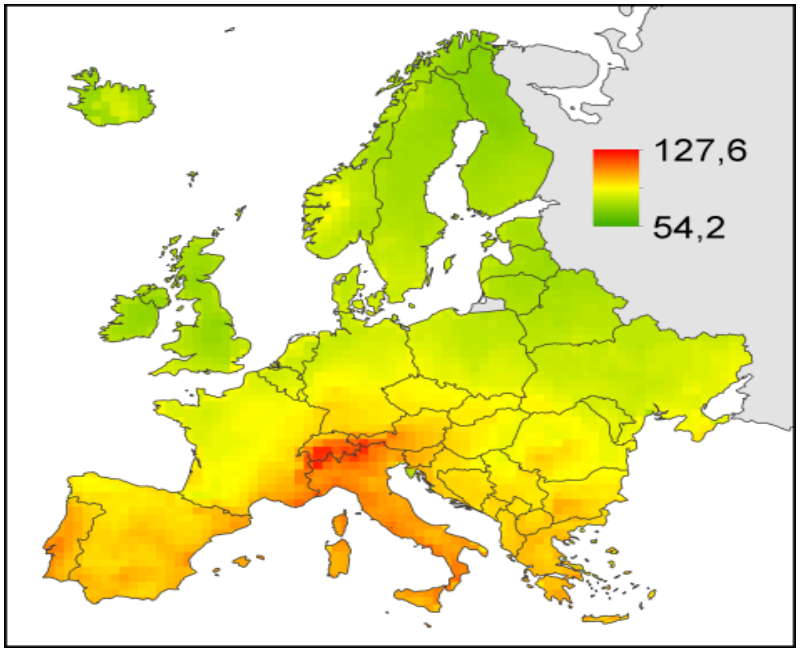
Short-term exposure

SOMO25 of ozone daily 8h max conc (µg/m³ · d)

CLIMATE CHANGE EFFECTS ON OZONE LEVELS



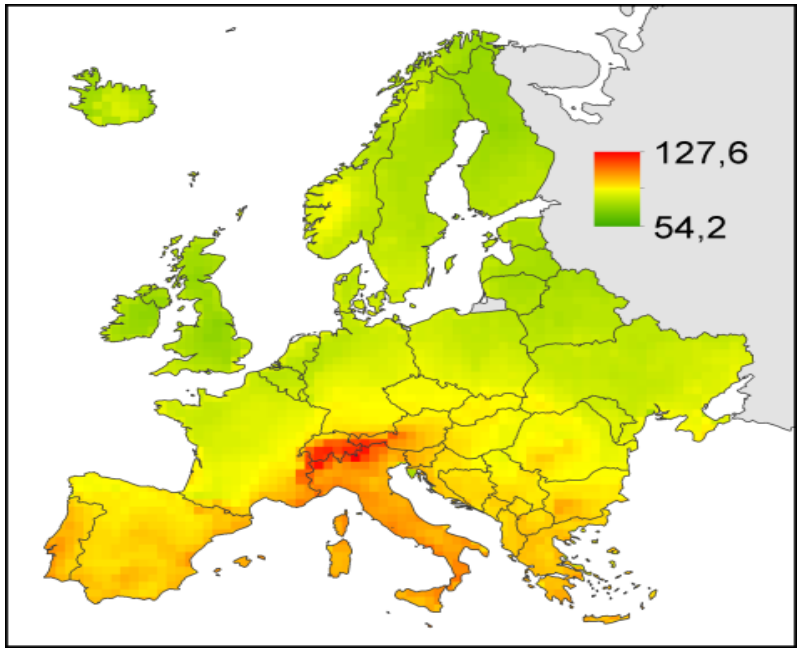
Current climate, current emissions



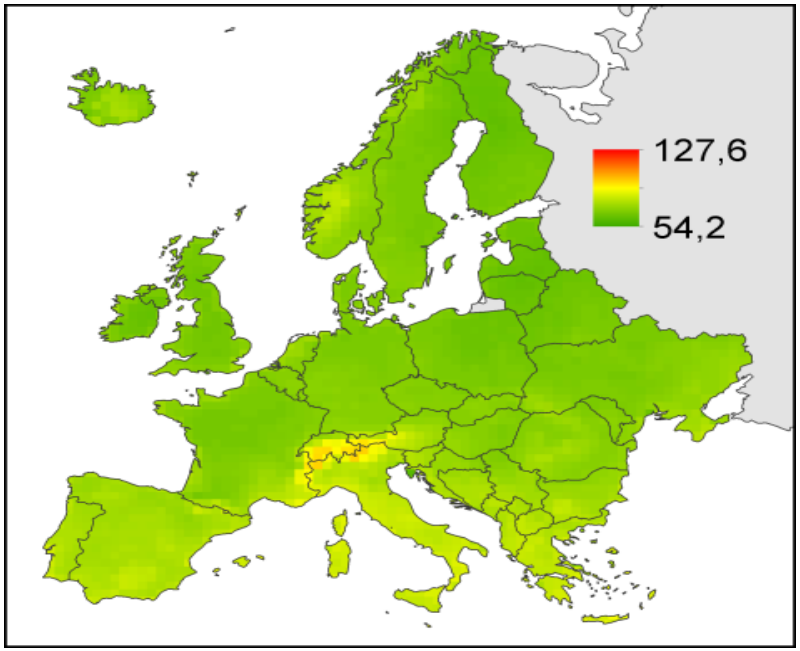
Future climate, current emissions

Mean of ozone daily 8h max conc (µg/m^3)

EMISSIONS CHANGE EFFECTS ON OZONE LEVELS



Current climate, current emissions



Current climate, future emissions

Mean of ozone daily 8h max conc (µg/m^3)

NUMBER OF PREMATURE DEATHS ANNUALLY

	Ozone *(long-term exposure, 25 ppb threshold)*					High temperature	
	Current situation	Future climate	Future populations	Future emissions	Future combined	Current climate	Future climate
Belgium	662	709	726	594	677	1031	1489
Luxembourg	29	32	44	27	43	51	76
Germany	7020	7273	6326	5381	4826	8126	11951
France	6130	6321	7021	4180	4822	5411	8698
Italy	8348	8297	8135	5701	5442	6007	10815
Sweden	680	639	790	481	525	911	1503
Finland	387	356	405	266	257	568	905
Baltic States	823	751	731	531	425	1025	1344
Total EU	**55 597**	**55 3803**	**57 250**	**39 088**	**39 867**	**54 988**	**87 398**

SENSITIVITY ANALYSIS AND DISCUSSIONS

- Results are highly sensitive to use of exposure indicators (short/long-term, 1/8h max) and threshold (35, 25, 10 ppb)
- Population change (size as well as aging) might increase or decrease the health effects, depending on the country
- Large emission decrease is expected; however, earlier emission decrease projection have not been currently realized (actual emissions are higher)

NUMBER OF PREMATURE DEATHS ANNUALLY
CURRENT *vs* FUTURE CLIMATE

	Ozone *(short-term exposure)*					
	SOMO35	↑	SOMO25	↑	SOMO10	↑
Belgium	104	25%	344	10%	916	3%
Luxembourg	5	20%	15	13%	38	5%
Germany	1221	12%	3219	5%	7408	2%
France	1122	14%	2918	5%	6219	2%
Italy	1914	2%	3572	0%	6318	0%
Sweden	96	-9%	320	-4%	765	-2%
Finland	56	-16%	185	-6%	465	-3%
Baltic States	121	-16%	399	-7%	984	-3%
Total EU	**55 621**	**55 403**	**39 210**	**38 105**	**54 988**	**87 398**

CONCLUSIONS

- Climate and emission changes will substantially affect ozone and temperature related mortality and the ratio between them in the middle of this century in Europe
- While the heat burden is currently of the same order of magnitude as ozone, due to increasing temperatures and decreasing ozone precursor emission, the difference will be twice as large in 2050
- And all this will happen under 2° ↑ that was agreed in Paris

THANK YOU!

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