

*Health and Environment International Trust,  
Mapua, New Zealand*

# **CLIMATE CHANGE AND LABOUR PRODUCTIVITY WITH PARTICULAR REFERENCE TO THE AGRICULTURAL SECTOR – Cambiamenti climatici e produttività del lavoratori on particolare riferimento al settore agricolo**

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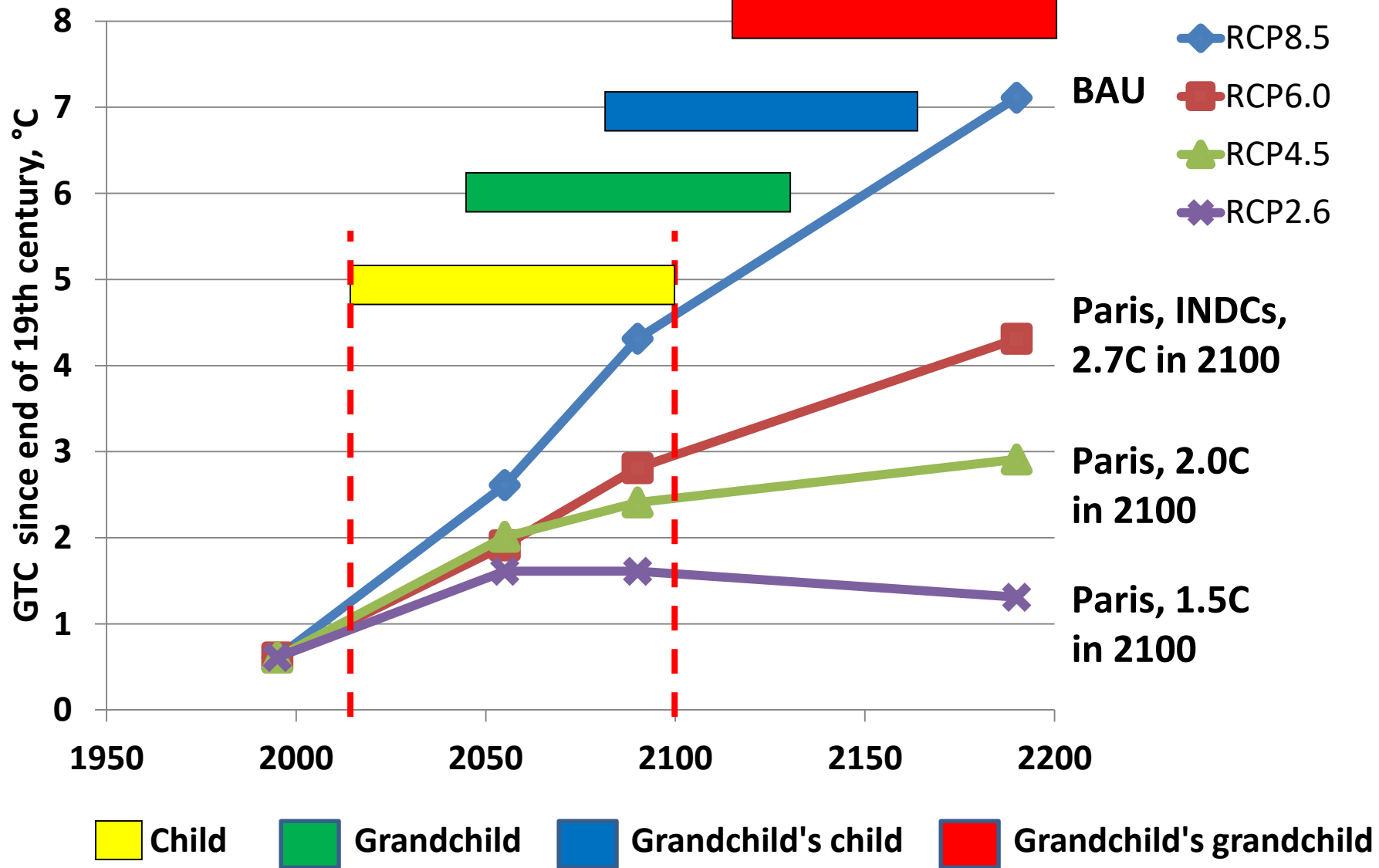
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*Seminar Univ Firenze, Florence July 13, 2017*

# Time trends of modeled global temperature change; Data in IPCC report and Paris (COP21) agreements



# Climate change impacts on working people

- The importance of measuring workplace heat exposures and effects on health and productivity and assessing likely impacts due to climate change in different parts of the world. HEAT-SHIELD focuses on Europe, and includes Tourism, Transport and the three groups below.....
- In parallel the global HOTHAPS program carries out field studies in several tropical developing countries. Risk groups include workers in *agriculture*

- and *construction*



and *manufacturing* (factories seldom have air conditioning)



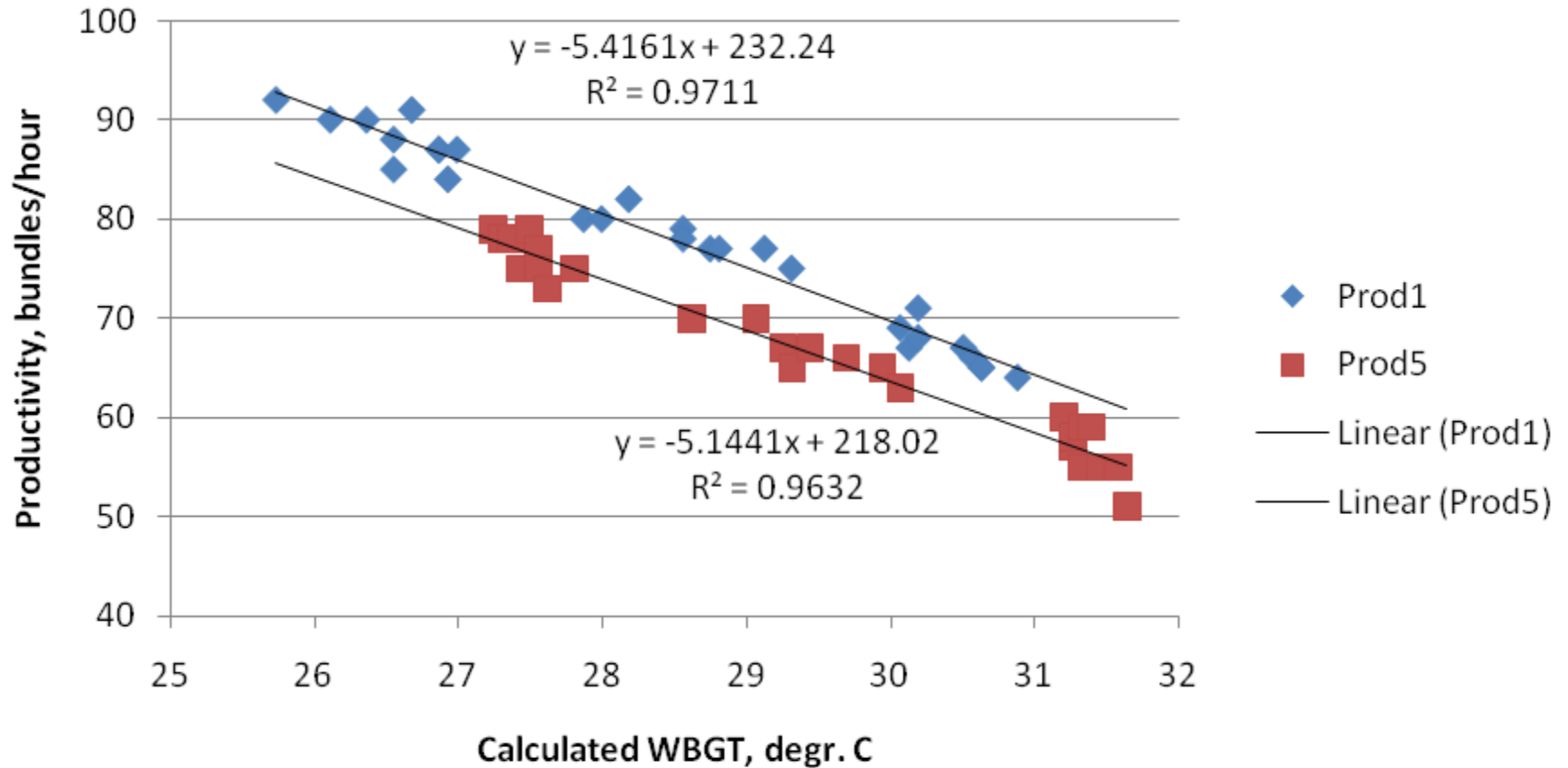
# Special risks and issues for agricultural workers: a vulnerable group

- Deaths of acute heat stroke ..... exhaustion, fainting ....
- Many thousand deaths in Central America and Sri Lanka due to unexplained chronic kidney disease
- Often work in the sun (high heat radiation)
- Often very heavy physical work (adds to heat stress)
- Often low income people with few resources
- Difficulty in replacing large sweat amounts (up to 10 litres in a day) with safe drinking water
- Tropical workers: Higher malaria risk due to dawn and dusk work
- Not enough energy: Reduced food production for family due to heat

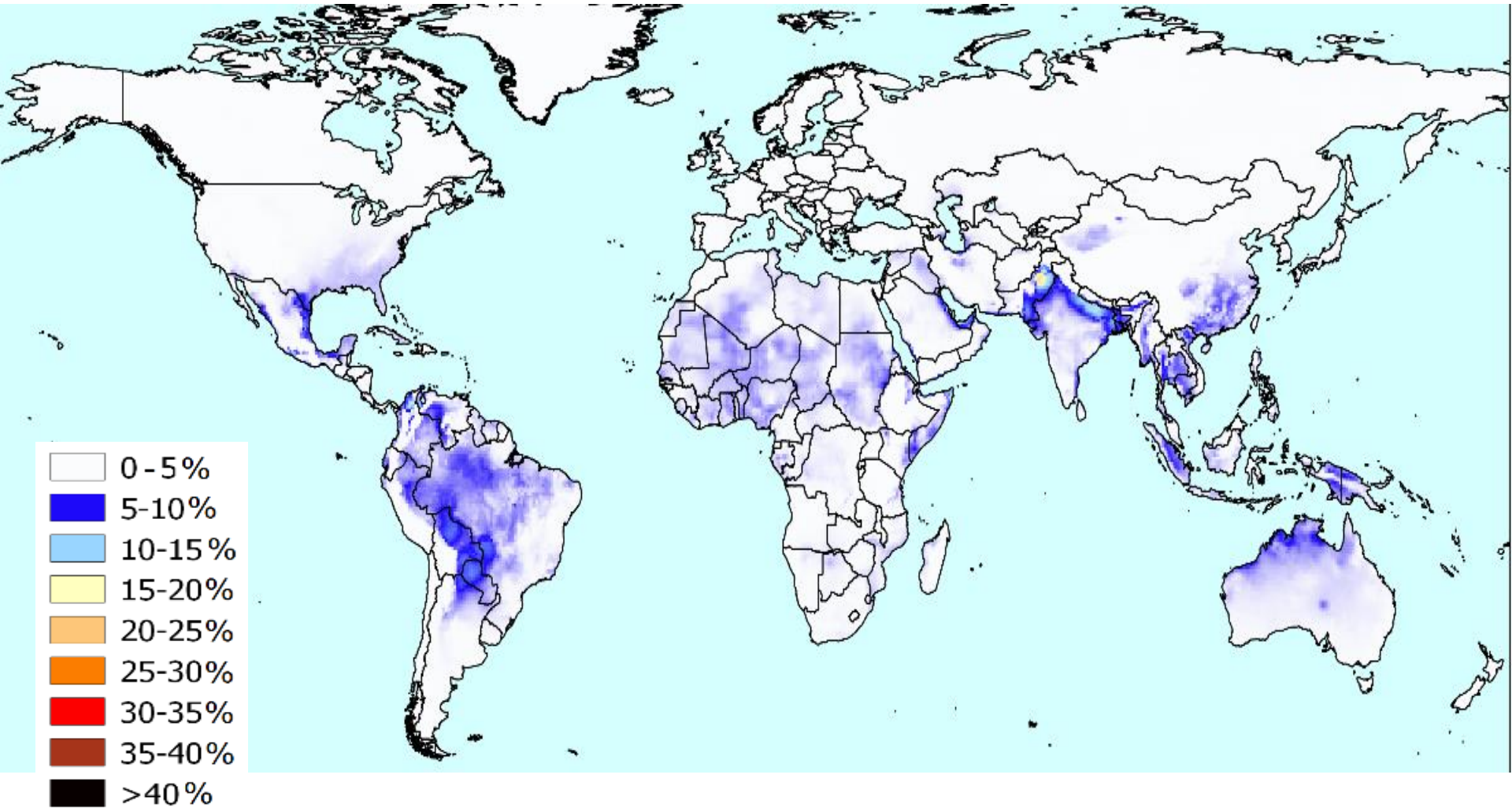
# Heat impact on productivity of rice harvesters in West Bengal

(Sahu et al., 2013)

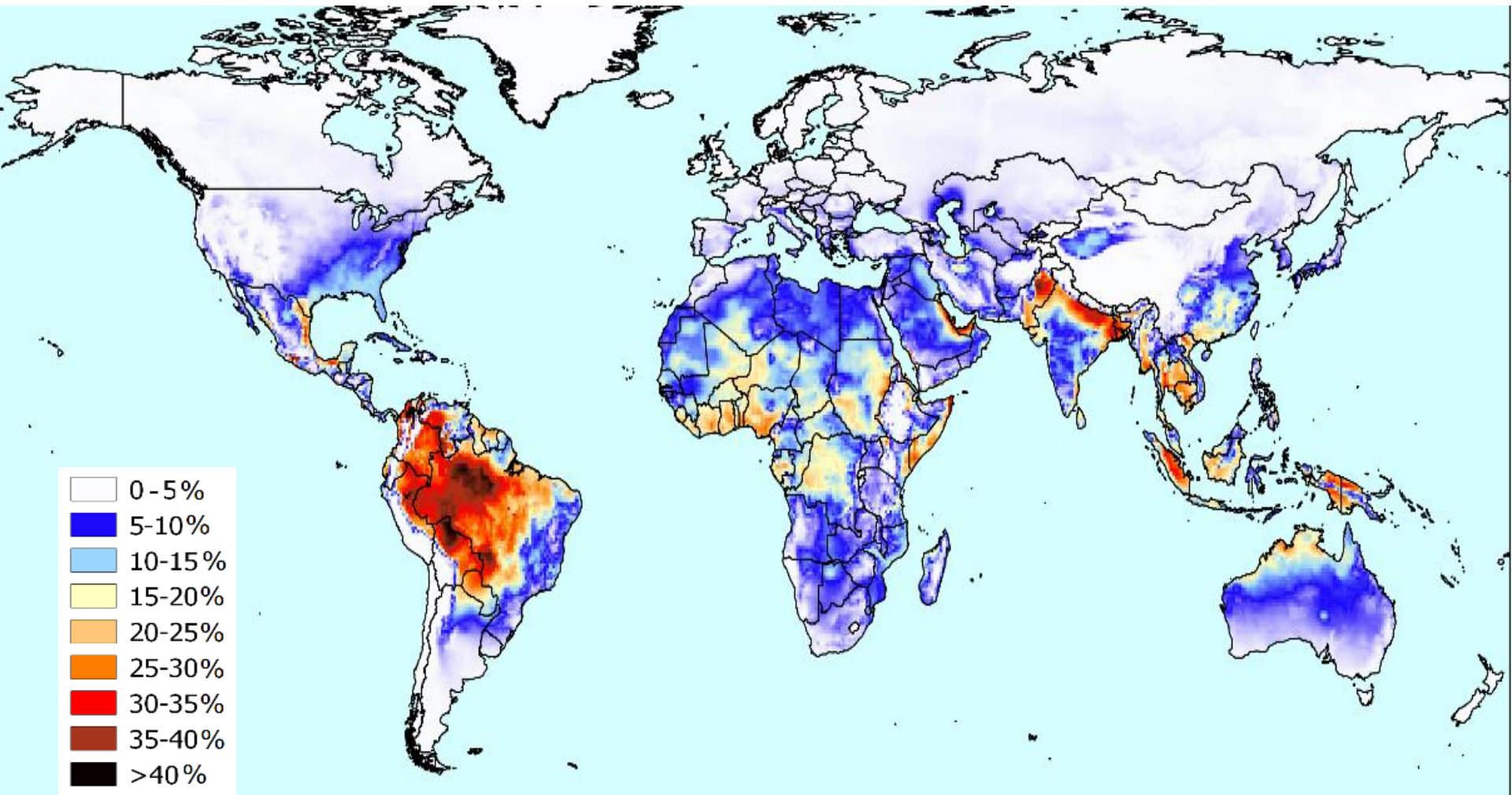
## Relationship between calculated WBGT and hourly productivity



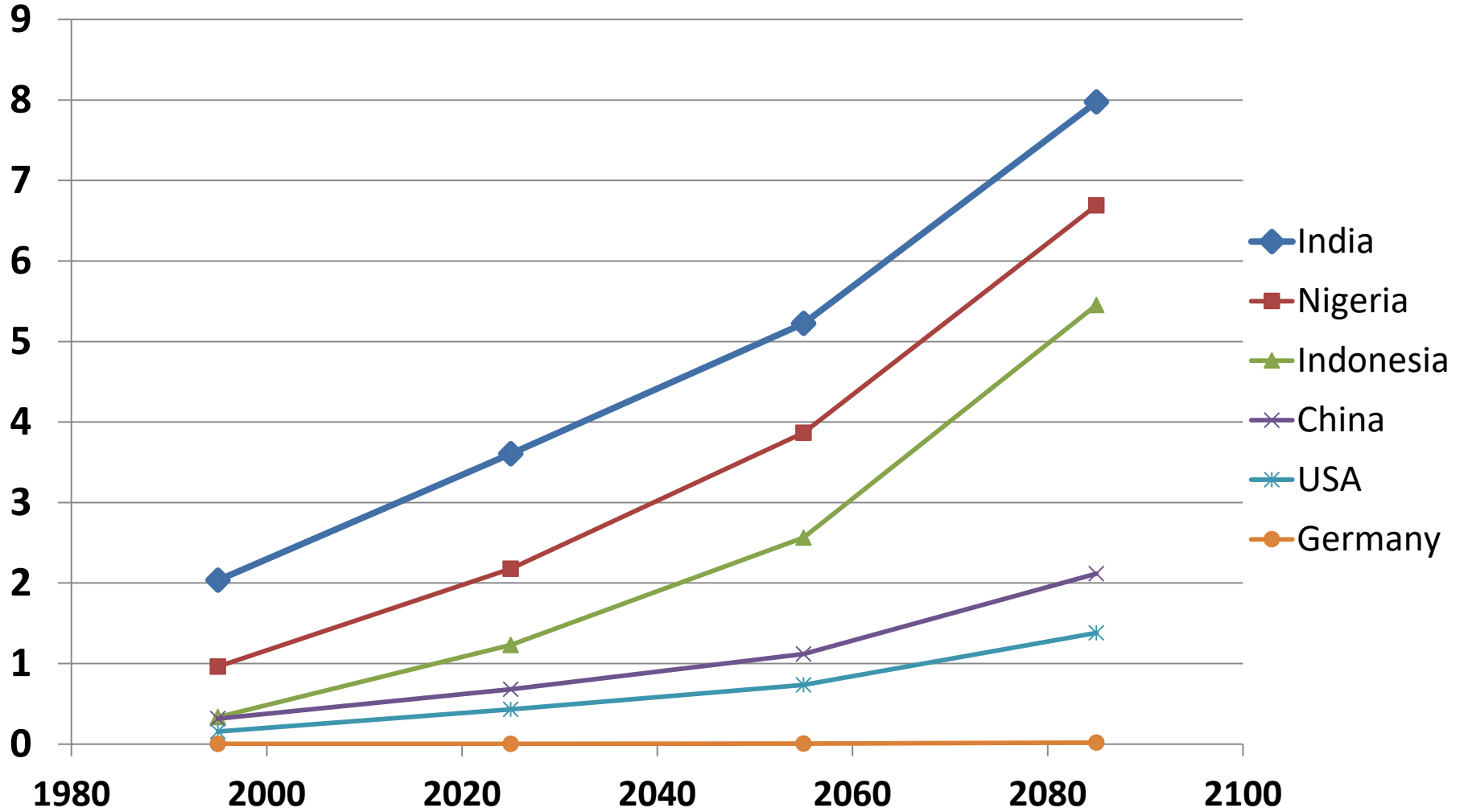
# New model for Current productivity loss: % annual daylight work hours lost; (1995, HadGEM2 model, 400W).



# Future productivity loss: % annual daylight work hours lost; (2085, RCP8.5, GTC = 4.0C, BAU, HadGEM2, 400W).



# % Percent daylight work hours lost in large countries, RCP6.0, HadGEM/GFDL, 300W

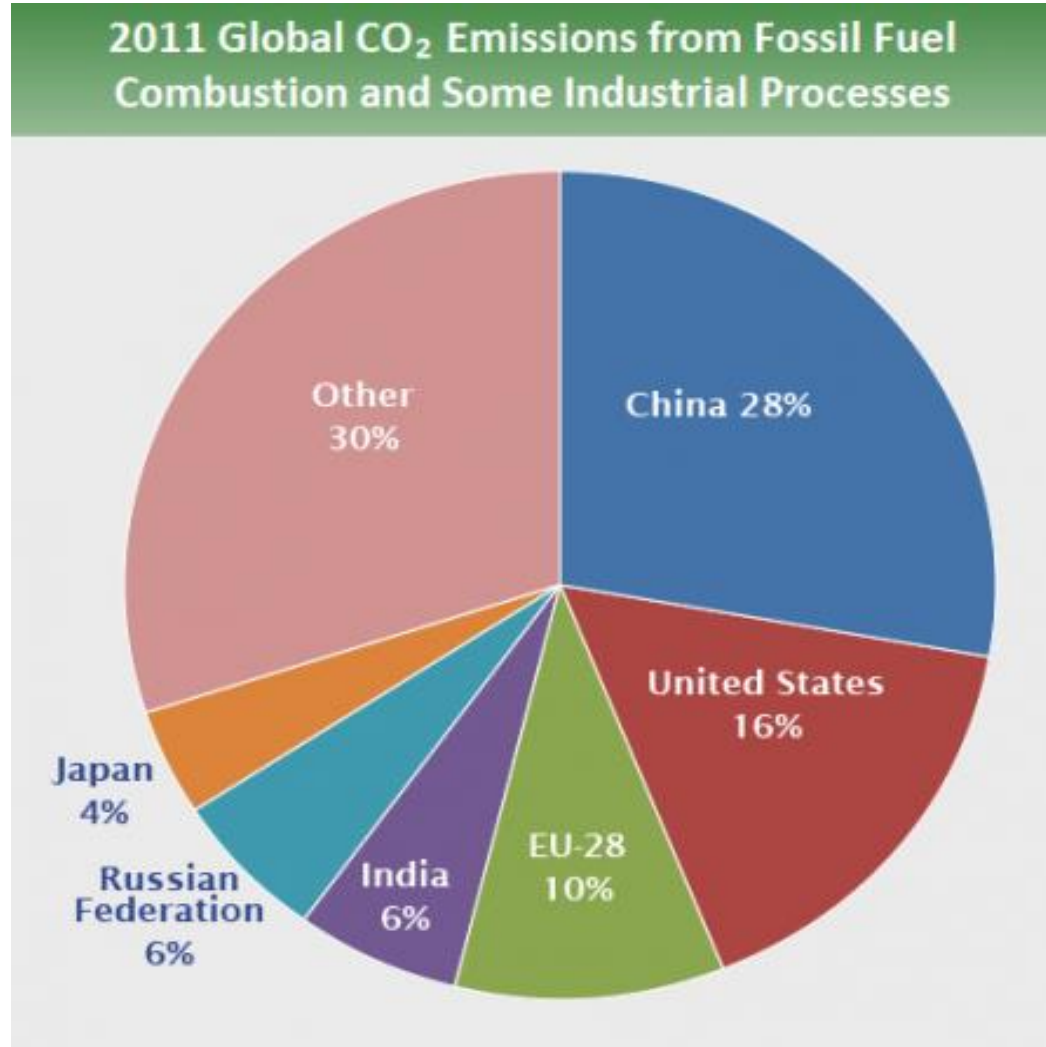




# Work capacity loss and related GDP loss; RCP8.5, mean of HadGEM and GFDL models; workforce changed

	Fraction of daylight hours lost			Billion USD PPP lost/year		
	1995	2025	2055	1995	2025	2055
<b>Australia</b>	<b>0.0%</b>	<b>0.1%</b>	<b>0.1%</b>	<b>0.05</b>	<b>0.46</b>	<b>1.94</b>
<b>France</b>	<b>0.002%</b>	<b>0.007%</b>	<b>0.018%</b>	<b>0.01</b>	<b>0.13</b>	<b>0.72</b>
<b>USA</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.4%</b>	<b>2.3</b>	<b>20</b>	<b>112</b>
<b>Bangladesh</b>	4.3%	5.9%	9.1%	2.7	33	190
<b>Brazil</b>	0.3%	0.5%	0.9%	2.1	12	54
<b>China</b>	1.7%	2.2%	3.2%	18	<b>401</b>	<b>1893</b>
<b>Ghana</b>	2.5%	4.1%	7.0%	0.3	4.6	32
<b>India</b>	3.8%	5.1%	7.5%	27	<b>426</b>	<b>2521</b>
<b>Philippines</b>	2.1%	2.4%	3.3%	2.1	17	93

# National Greenhouse gas emissions




EU countries < 1% each, less than % of China emissions;

**What research has greatest impact on global emissions ?**

# ClimateCHIP output for future in Toscana

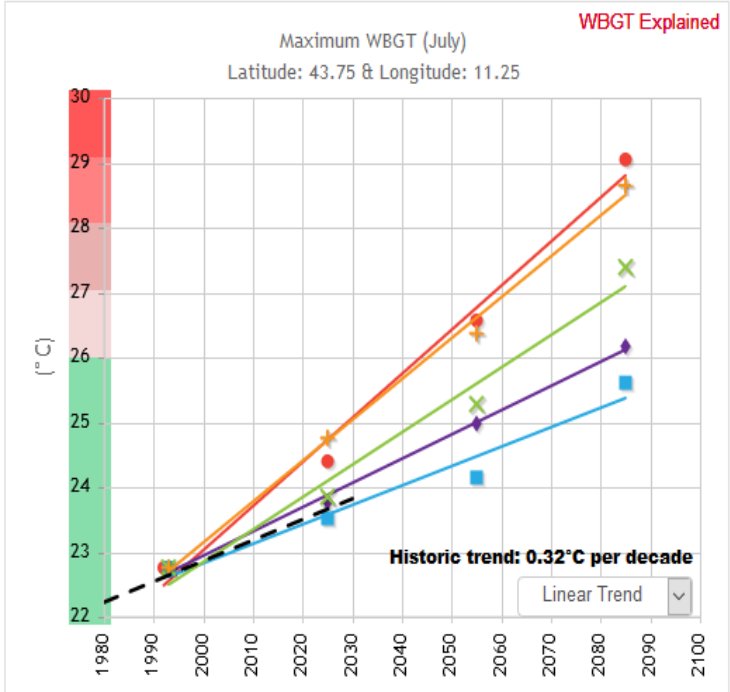
www.climatechip.org/your-area-tomorrow

Italy Search 43.75 11.25 Maximum WBGT July Celsius



Maximum WBGT (July)  
Latitude: 43.75 & Longitude: 11.25

WBGT Explained



Year	HadGem	NORES	GFDL	IPCM	MIROC
1980	22.5	22.5	22.5	22.5	22.5
1990	22.8	22.8	22.8	22.8	22.8
2020	24.5	24.5	24.5	24.5	24.5
2030	25.5	25.5	25.5	25.5	25.5
2050	27.0	27.0	27.0	27.0	27.0
2060	28.0	28.0	28.0	28.0	28.0
2080	29.5	29.5	29.5	29.5	29.5
2090	30.0	30.0	30.0	30.0	30.0

Historic trend: 0.32°C per decade

Linear Trend

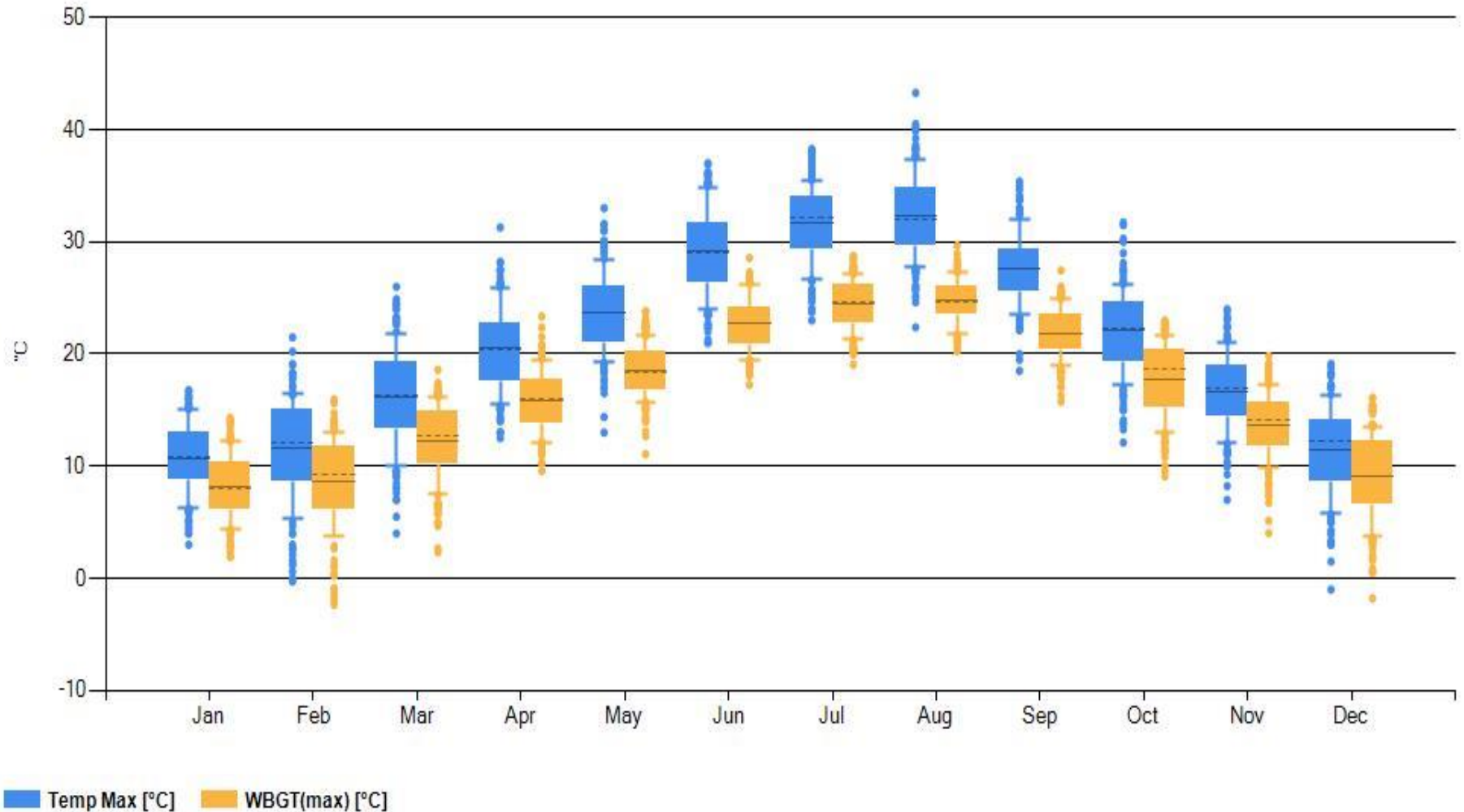
HadGem NORES GFDL IPCM MIROC

RCP 6.0

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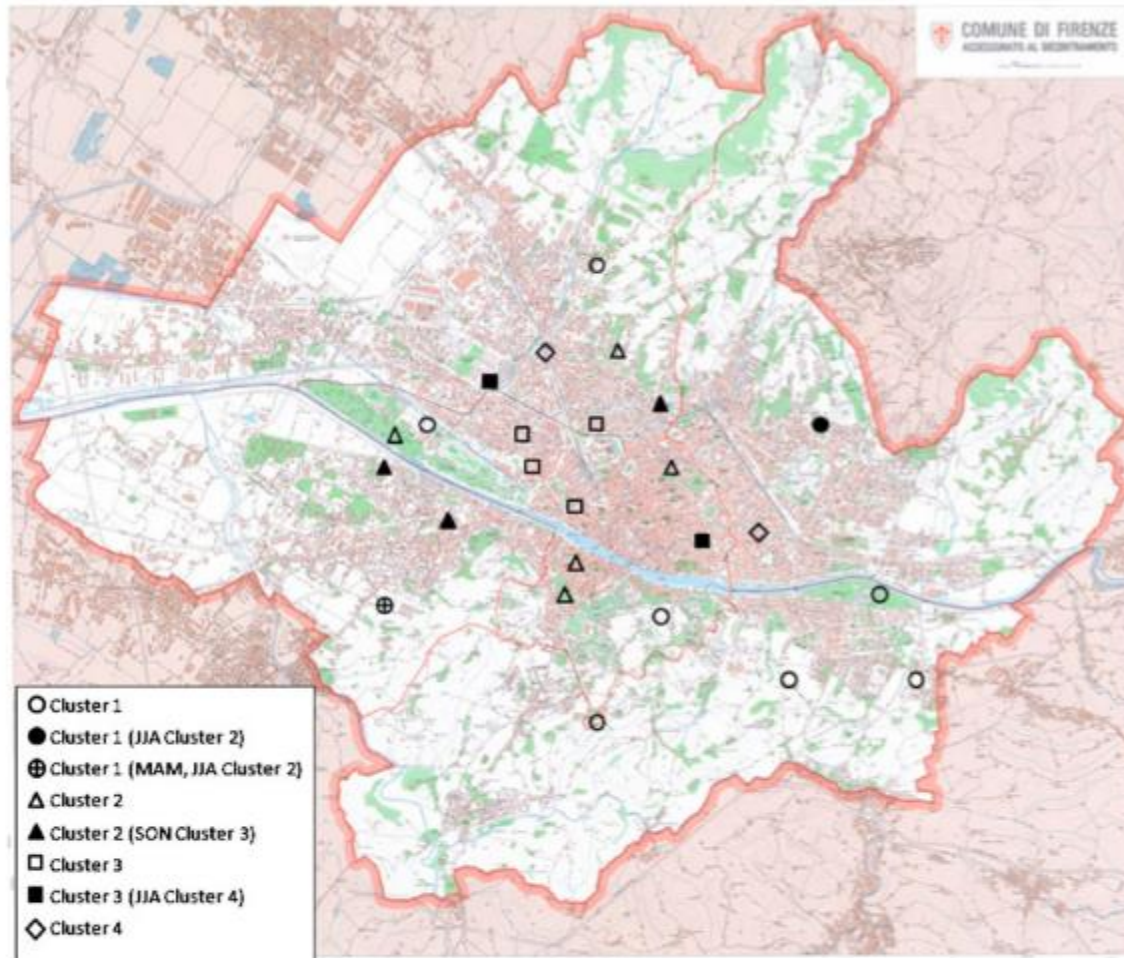
# Hothaps-Soft, monthly average Temp and WBGT

FIRENZE/PERETOLA 2010 - 2014



# Heat mapping potential in Florence

(Petralli et al., 2011)

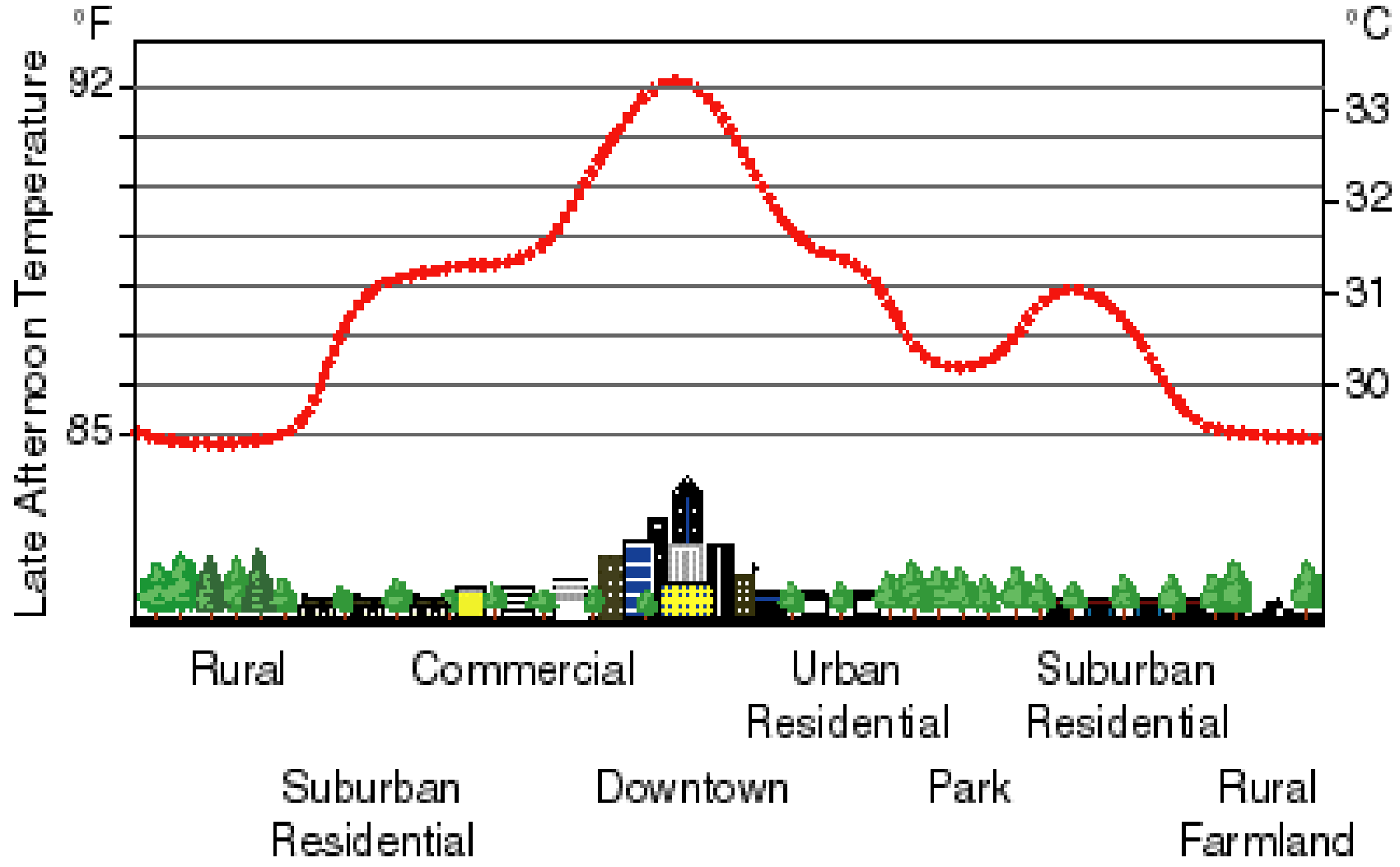


**Fig. 1** Florence municipality map and cluster classification of the 25 air temperature sensors. *Empty circle*—stations classified in cluster 1 in all seasons; *filled circle*—stations classified in cluster 1 in all seasons except in JJA which are classified in cluster number 2; *crossed circle*—

classified in cluster 2 in all seasons except in SON which are classified in cluster number 3; *empty box*—stations classified in cluster 3 in all seasons; *filled box*—stations classified in cluster 3 in all seasons except in JJA which are classified in cluster number 4; *empty diamond*—

# Urbanisation, Added heat exposure

## Sketch of an Urban Heat-Island Profile



→ Increased use of air con adds to local heat exposure

# Potential expanded Research collaboration

- Further studies of heat exposure and effects in Tuscany workplaces, and test different cooling methods
- Quantify risk levels for working people using heat maps from Univ Firenze studies ---- estimate future climate trends and risks
- Analyze Urban Heat Island effect using several heat stress indices
- Use Tuscany study experiences to Quantify health and productivity risks at population level in tropical countries (use existing links to partners in, for instance, China, India, Thailand, Ethiopia, Panama); *Vulnerability mapping as a way to inspire policy and action*
- Economic impacts of the productivity loss or workplace health effects (focus on large GHG emission countries)

Our only home is this lonely planet .....



*Environmental Heat is an underestimated future risk;*

*Inter-disciplinary cooperation will broaden evidence base for development of policies and actions*

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