

# Projections of global labour productivity and supply under climate change

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# Introduction

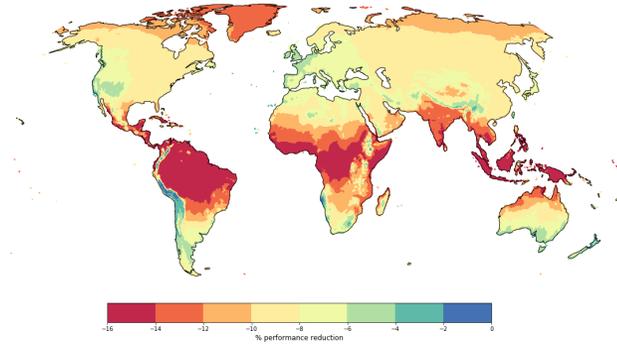
- Labour productivity (effectivity during worktime) and labour supply (working hours) are directly reduced by increasing temperatures
- Proximal behavioural adjustments and the ultimate realized welfare impacts depend on the worker's local context
- Most of the existing response functions are based on either a few observations (e.g. Sahu et al., 2013) or tend to be location specific
- We provide a model intercomparison of 5 existing models on labour productivity and introduce a novel approach to capturing temperature effects on labour supply
- We arrive at a more comprehensive understanding of climate change impacts on labour (supply and productivity combined)

# Methods

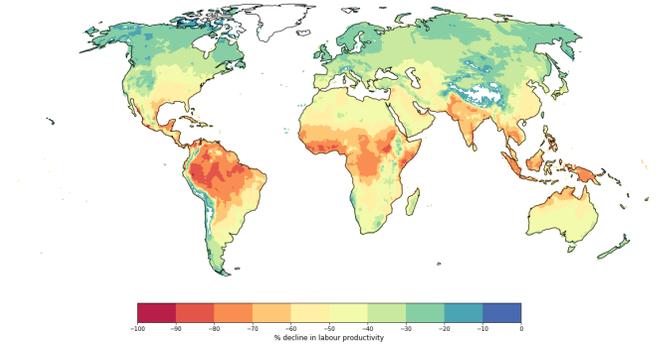
1. Compare 5 existing impact models from Gosling et al. (2018) on labour productivity using ISIMIP data
2. Apply new model by Dasgupta (2020) on labour supply using ISIMIP data
3. Combine analyses (1. and 2.) and estimate combined climate change impacts on labour (productivity and supply)
4. Provide impacts and damage functions to CGE models and Integrated Assessment Models

# 1. Model intercomparison on labour productivity

Pilcher et al. (2002)



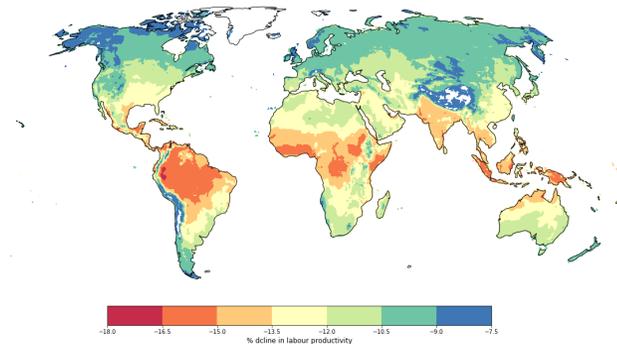
Sahu et al. (2013)



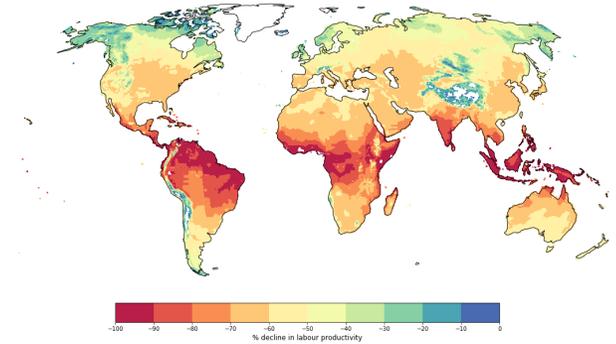
5 impact models  
describing the impacts  
of WBGT on labour  
productivity  
(for indoor and  
outdoor work)

From Gosling et al. (2018)

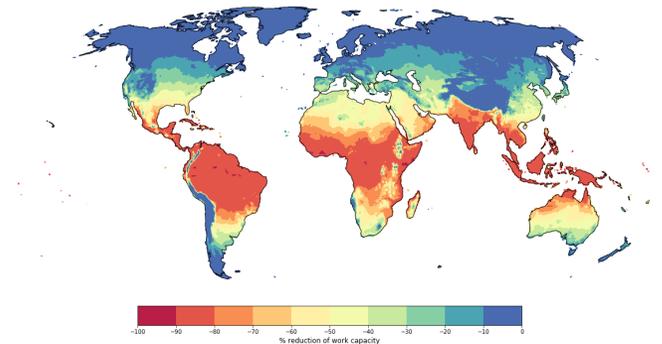
Li et al. (2016)



Dunne et al. (2013)

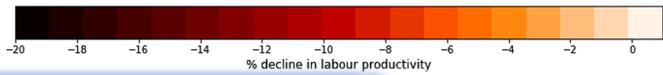
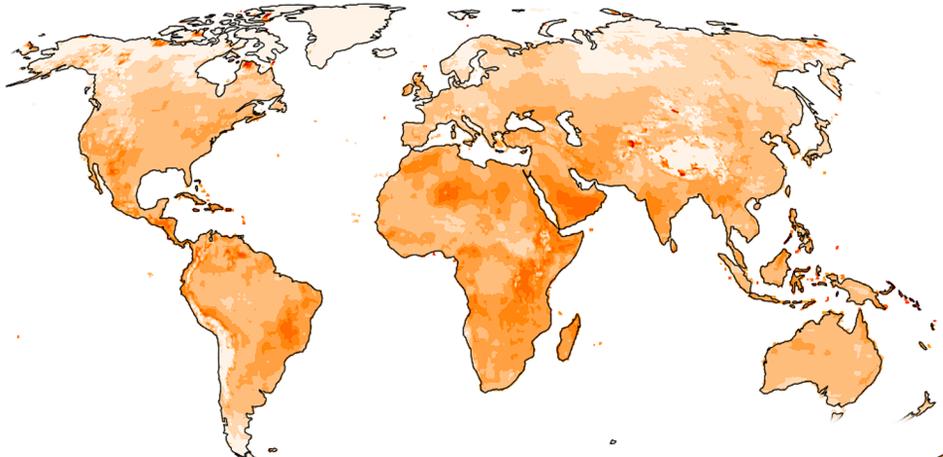


Kjellstrom et al. (2014)

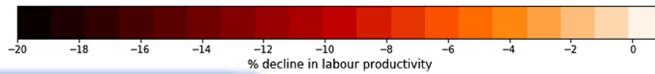
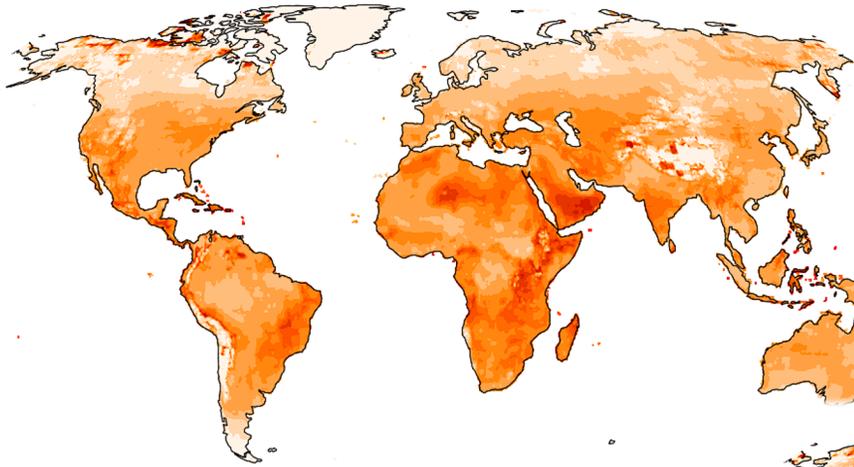


# Summary of all 5 models (labour productivity) at 1.5, 2 and 3°C of global warming

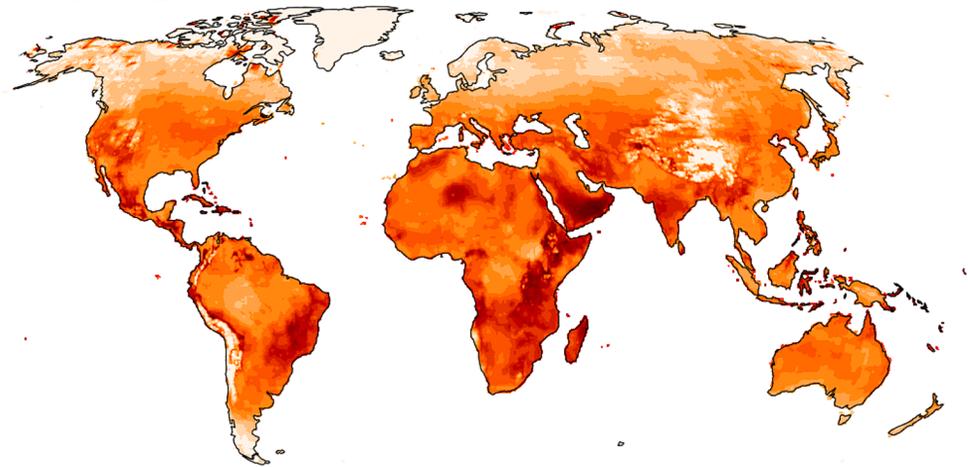
Compared to 1986 – 2005 for  
outdoor conditions  
(mean over GFDL-ESM2M and IPSL-CM5A-LR)



Decline in labour productivity under 1.5°C of global warming

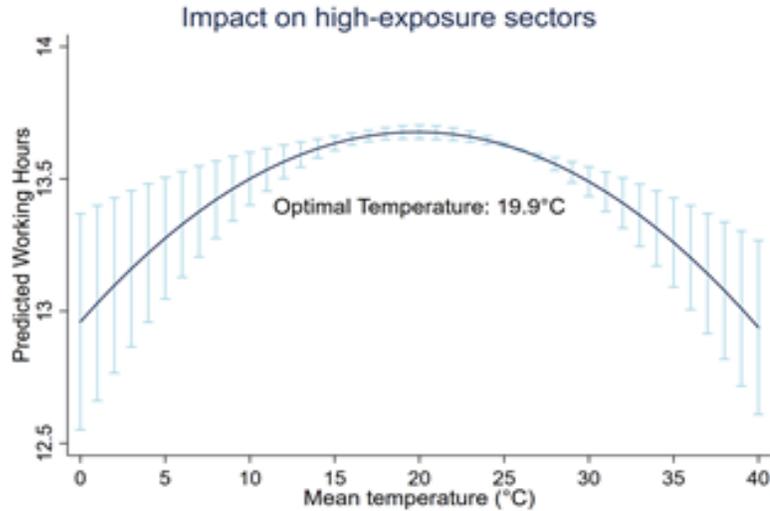


Decline in labour productivity under 2°C of global warming

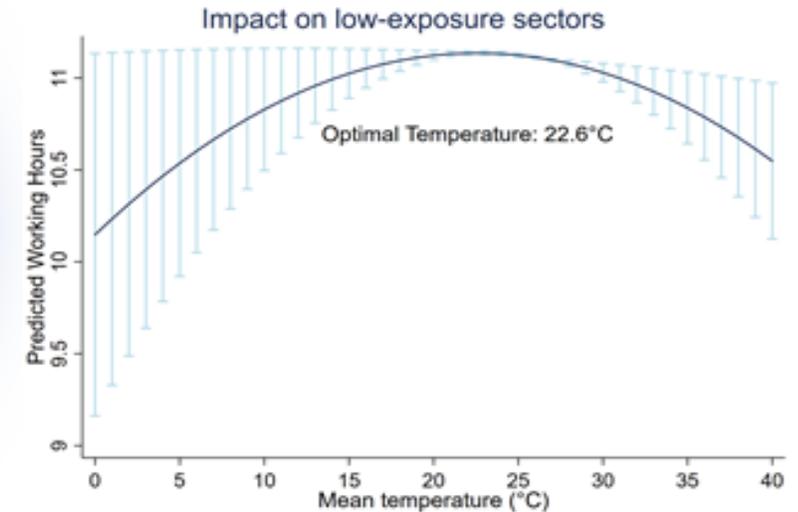


Decline in labour productivity under 3°C of global warming

## 2. Labour Supply (a new model by Dasgupta, 2020)



An empirically based exposure-response function describing the relationship between mean temperature and labour supply (for high- and low-exposure sectors)



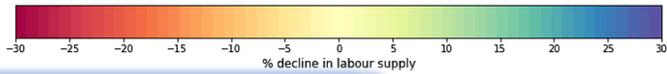
*“The dataset comprises more than three-hundred micros-surveys including labour force surveys, censuses, and household income and expenditure surveys.*

*The raw dataset consists of more 400 million observations from eighty-nine countries, of which fifty-six million observations are on the number of hours worked per week.*

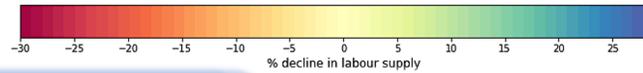
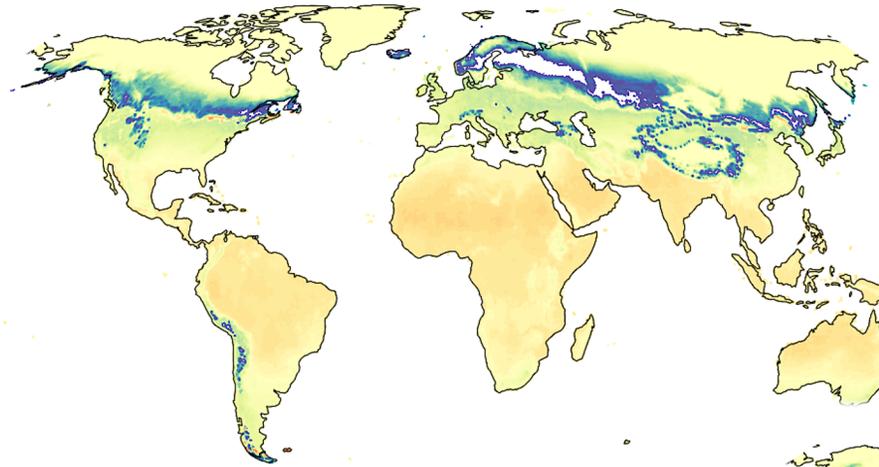
*The data is geo-referenced at the second administrative level, which allows us to use the individual weights from the surveys to aggregate the data to the region-year level, as a result the data is representative at the sub-national level.” (Dasgupta, 2020)*

# Climate change impacts on labour supply at 1.5, 2, and 3°C of global warming

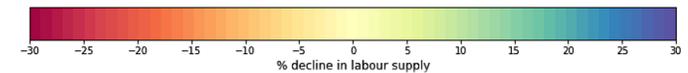
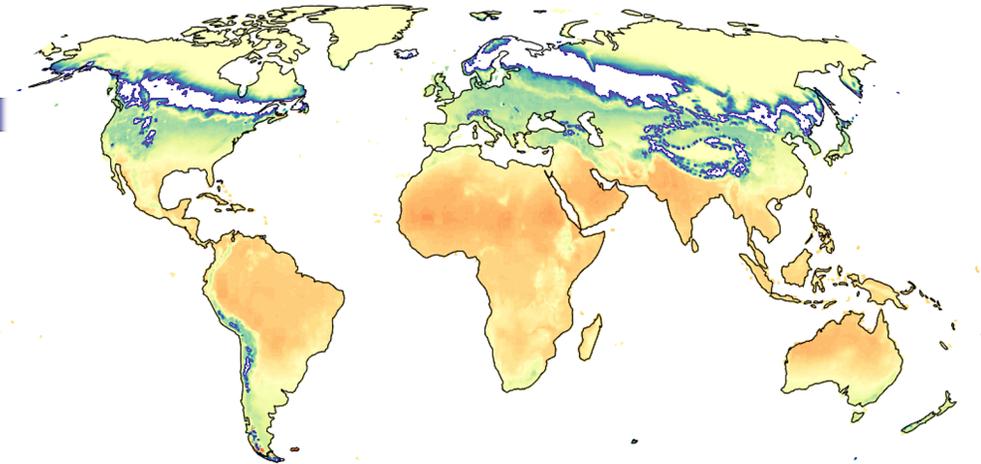
Compared to 1986 – 2005 for outdoor conditions  
(mean over GFDL-ESM2M and IPSL-CM5A-LR)



Decline in labour supply under 1.5°C of global warming

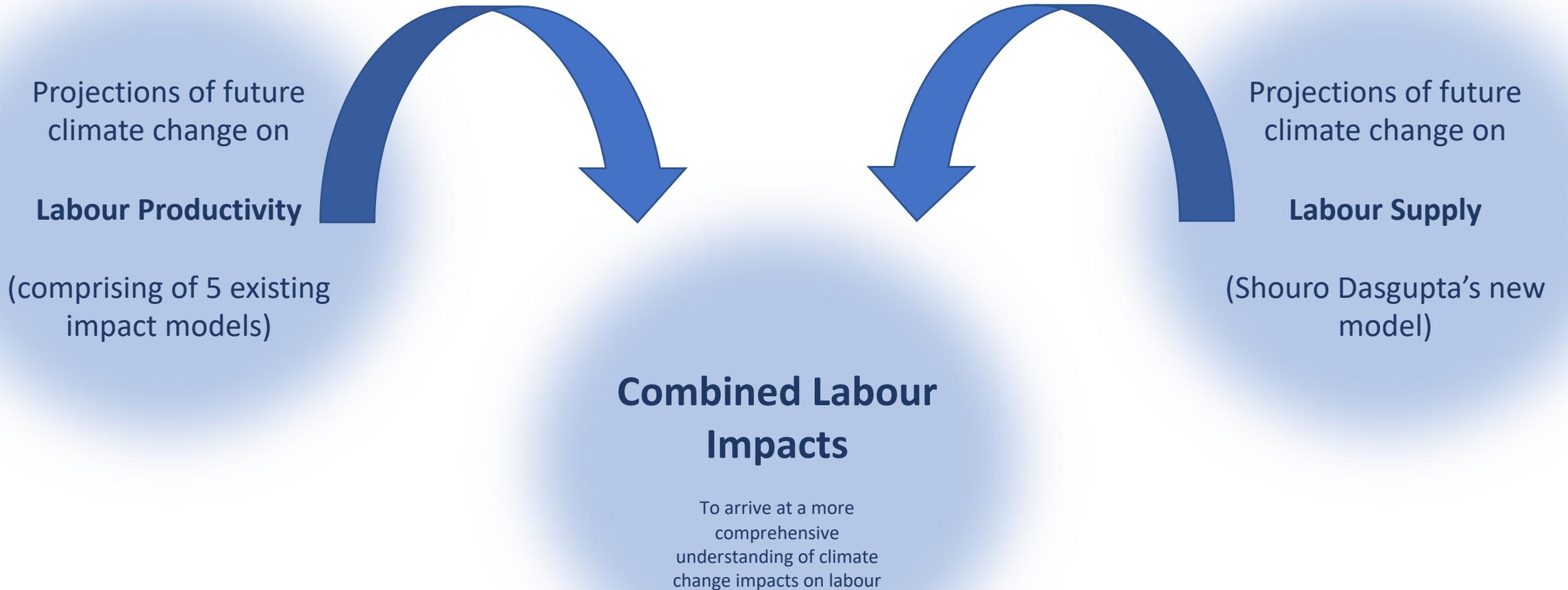


Decline in labour supply under 2°C of global warming



Decline in labour supply under 3°C of global warming

# 3. Combined Labour Impacts

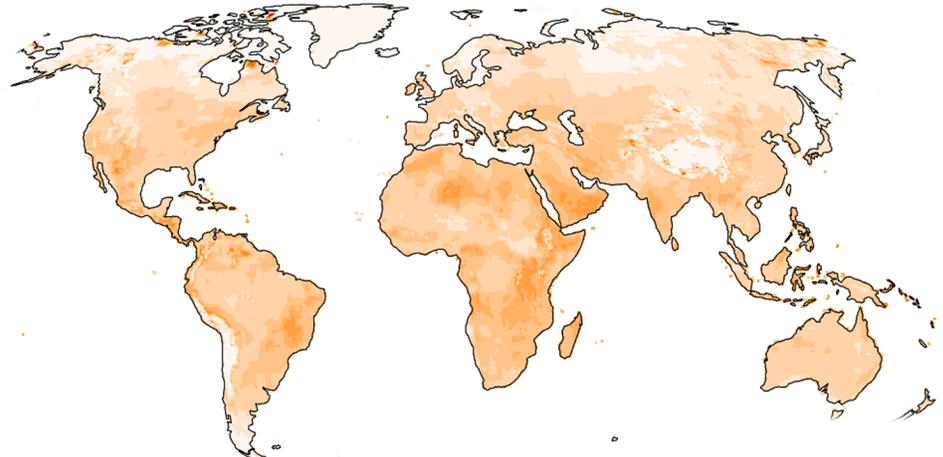


$$\text{Combined Labour Impacts} = (100\% + \text{Labour Supply}) * \text{Labour Productivity}$$

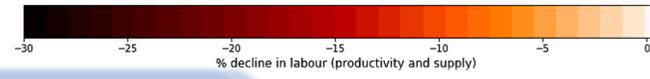
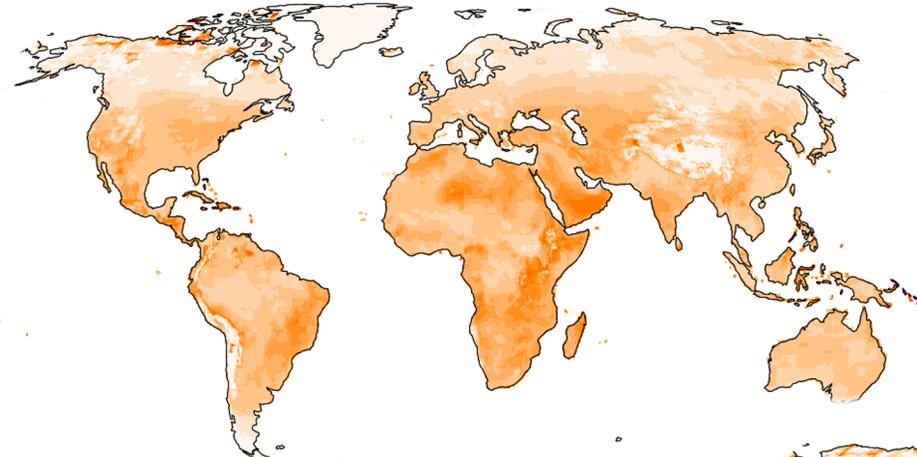


# Combined labour impacts (productivity and supply) at 1.5, 2, and 3°C of global warming

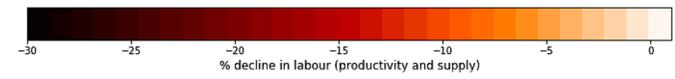
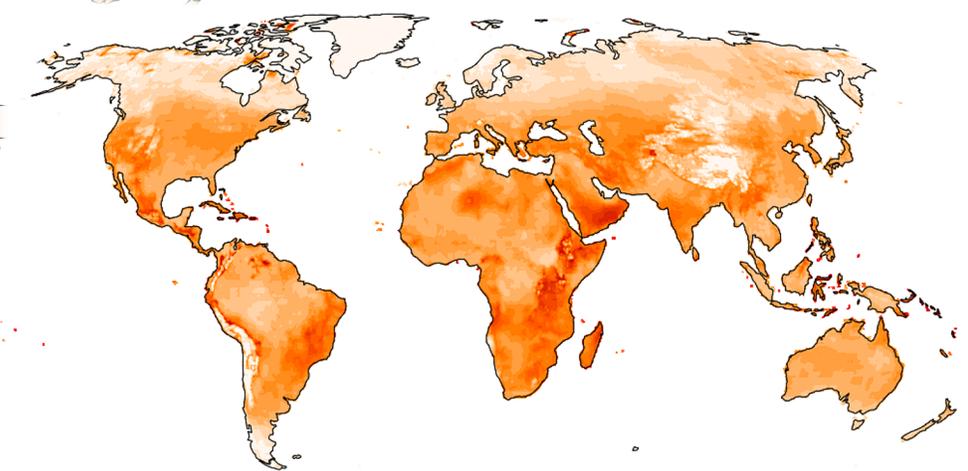
Compared to 1986 – 2005 for  
outdoor conditions  
(mean over GFDL-ESM2M and IPSL-CM5A-LR)



Decline in labour under **1.5°C** of global warming



Decline in labour under **2°C** of global warming



Decline in labour under **3°C** of global warming

# Outlook:

- Labour productivity and supply (and thus the combination of both) will reduce under future climate change
- Especially those countries that have limited adaptive capacity will be impacted the most
- Future work will include capturing scenarios for sectoral adaptive capacity in the labour sector
- Results will be applied to various macro models for economic damage assessments
  - Impacts for CGE models
  - Damage functions for Integrated Assessment Models

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THANK YOU!



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