9 September 2016

Submission to UNFCCC

Effects of climate change on health and productivity in the workplace

(produced in a rush)

Name/s of institution(s) and any collaborating partner(s)

Health and Environment International Trust (HEIT), Mapua, New Zealand, also operating as Ruby Coast Research Center, Mapua, New Zealand,.......... email kjellstromt@yahoo.com

Primary current collaborator:

1. Center for Environmental Technology Research and Innovation (CETRI), Limassol, Cyprus

Other main collaborators:

2. London School of Hygiene and Tropical Medicine, London, United Kingdom
3. University of East Anglia (Climate Research Unit), Norwich, United Kingdom
4. University of Copenhagen, Denmark (+ other European institutions working in HEAT-SHIELD)
5. University of Wisconsin, Madison, WI, USA
6. University of Lund, Sweden

.... also additional collaborating emerging partners in India, China, Cambodia, Ethiopia, Costa Rica, USA, Australia, New Zealand and international agencies, e.g. UNDP, WHO, IOM, ILO.

Country/Countries of focus (if global, please specify)

Global analysis with a system set up for analysis for any country. Regional analysis for Europe and parts of Europe in one major project (HEAT-SHIELD), and specific country studies in Cambodia, India, Ethiopia, and Costa Rica (and more countries to be added).

Key focus of the collaborative work by this institution

The focus is on using climate change model outputs (from other institutions) to calculate heat stress levels by month and the <u>impacts on health and productivity of working people</u> and the social and economic consequences.

The results when expressed on country basis can become a <u>powerful new incentive for decision-makers to develop stronger policies for climate change mitigation</u>. Annual national losses of many billion USD due to increasing workplace heat unless further mitigation is applied can encourage renewed actions on green-house gas emission reductions in order to reach the maximum 2 degree C global temperature increase this century.

In addition, protection against workplace heat effects (adaptation) already in current conditions will <u>improve health and productivity in the near future.</u>

Relevant activities on the thematic area (and any of the related topics mentioned in the call)

Aims

The overall aims of this climate change related activities of this institution are to produce evidence and projections about the particular effects on working people of climate change related heat increase and the social and economic consequences, and to communicate the results to decision-makers to provide a broadened base for climate change adaptation and mitigation decisions.

Background and setting for the activities

The work started in 2000 when the Institution Director (Tord Kjellstrom) was Professor of Environmental Health at the University of Auckland, New Zealand. It continued as an extension of academic activities when he worked at the Australian National University, and The Swedish National Institute of Public Health. After this he worked as a consultant researcher for a number of universities until the current institutional arrangements were created in 2008. Currently he is primarily linked to CETRI, but has other consultancy activities in progress. He has been an environmental and occupational health researcher and teacher for 40 years, and from 1985 to 1997 worked at WHO in Geneva. During the last years he was Director of the Office of Global and Integrated Environmental Health with responsibility for the initial activities at WHO on climate change and health.

The collaboration with CETRI is a new endeavor, which will make it possible to integrate more of the analysis of local mitigation and adaptation options for different industries into the activities.

The ongoing climate change work has generally been funded via small consultancy grants from government agencies and health research foundations, and these are used for costs associated with the Institutions team work, which includes four experts in the areas of climate science, data analysis, environmental health and physiology.

When the issue of heat impacts on labour productivity was first raised in 2000, it was clear that the physiological mechanism behind this effect was well known and that the social and economic consequences could be assigned to the area of "health effects" of climate change. It has since appeared that many health scientists consider these indirect effects as outside of the health domain, while economists have avoided to link their analysis to the physiological/biomedical mechanisms. This is very unfortunate, as it has delayed international understanding of the importance of this type of effect. The IPCC Working Group 2 report in 2014 has in the Human Health chapter for the first time in an international assessment of health impacts of climate change highlighted these productivity effects.

Our ongoing activities will further improve the methodologies and make the country-based quantitative impact analysis more precise, and hopefully contribute to decisions on the necessary additional mitigation measures, as well as protect workers via adaptation in the near future.

Specific activities
Several major activities are currently being carried out, based on the specific climate change analysis for work situation heat stress and associated effects on occupational health and productivity. Our work to date has been presented in more than 50 publications (see Appendix), many in major scientific journals.

The current activities include:
A. Major input into the EU funded HEAT-SHIELD project, which aims at protecting working people from excessive workplace heat in conjunction with climate change
B. Development and application of analysis methods and reporting of occupational health and productivity impacts of climate change related heat at national, regional and global level
C. Quantification of social and economic impacts of workplace heat exposures at country level
D. Establishment of heat exposure thresholds for "Habitability" in different parts of the planet, and assessment of number of people affected currently and in the future due to climate change
E. Field studies of heat impacts in current workplaces in different industries and countries
F. Hothaps-Soft database and software with local information from weather stations focusing on heat
G.Website ClimateCHIP.org with grid cell based climate information focusing on heat

For each activity, a description including:
- Research, analyses, tools, methods or approaches (that have been used or developed), etc.
- Key results (including both quantitative and qualitative evidence)
- Outputs of the activity (e.g. papers, publications, policies, etc.)
- Potential challenges met when undertaking the activity, and how those have been overcome
- Planned next steps (as appropriate)

I think this level of detail is far too ambitious in the case of this institution, so I will only present relatively short summary stories about each activity and am willing to provide more information to UNFCCC if it is considered necessary.

The " **Relevant pictures/graphics"** section below will include examples of the ongoing and recent results from our activities.

Activity A, HEAT-SHIELD
This is an activity that started in 2016 and is still at an early stage (a separate submission to UNFCCC is planned by a coordinating institution). The activity involves 20 institutions around Europe. Initially, methods to quantify workplace heat stress and demonstrations of impacts will be developed. Heat warning systems for workplaces will be developed including links to routine weather forecasting and longer-term climate projections. Specific heat protection methods will be identified. Eventually the conclusions and recommendations will be communicated and promoted among workplaces in all of Europe. The first report on "Choosing an occupational heat stress index" was just completed within the CETRI linked work, and it recommended the use of WBGT (Wet Bulb Globe Temperature) as the primary index in studies and warnings systems in Europe. This index was developed for occupational health and is familiar to most professionals in that field, but it will require some testing and fine-tuning in relation to climate change impact analysis. Field studies of heat impacts in work situations will be carried out in 2016 and 2017 and a series of publications are planned. It is too early to analyse challenges and new lessons learned.

Activity B. Occupational health and productivity analysis methods, and output tests
The published work to date has presented analysis methods for heat exposure and heat stress, and continues to assess whether existing heat stress indices, such as WBGT, need tweaking to even better represent the health and productivity effect risks. The global and regional analysis methods have been updated and the most recent methods paper (Kjellstrom et al., 2016, in press) will provide all information necessary for the wider use of the methods. The methods will be tested and validated in the HEAT-SHIELD project as well as in the other applications of heat risk assessments that we carry out. This activity also includes quality assessment of the input climate data whether they are sourced from weather stations or grid cells. Obvious anomalies will be discussed with the data producing institution. Our outputs are increasingly in the form of maps using the 67,000 0.5 x 0.5 degree grid cell data. We have also established a database of population data in four age groups (0-4, 5-14, 15-64, 65+) for each grid cell from 1980 to 2099. This makes it possible to calculate the quantitative labour output loss, due to heat related productivity loss, for each grid cell and for combination of grid cells representing countries or regions. We can use the 15-64 year age group numbers to quantify the actual impacts at population level.

Activity C. Quantification at country level
This activity takes the grid cell based data to calculate for any country the impacts of the different RCPs, and the range of impacts for different models. The work is at an early stage, but it shows great promise in demonstrating this climate change impact area in a robust and interpretable way.

The first ever tentative analysis of the economic impacts of heat related labour productivity loss as a result of climate change was published by the Climate Vulnerable Forum (CVF) in 2012 (report: Climate Vulnerability Monitor 2012). It used our first published method for such impact analysis, and now we have improved this method, but not yet had the resources to carry out systematic analysis for major countries. It can be done, but we are seeking funding support to make it happen soon.

We have published a paper (Kjellstrom, 2015) with a number of examples from the Climate Vulnerability Monitor 2012, and the economic losses at country level are substantial. For example, the Philippines was estimated to lose 85 billion USD each year already by the 2030s using the previous IPCC scenario approach. We have now made a tentative update based on heat increase, population growth in the working age range, and likely workforce distribution into jobs with different heat exposure and work intensity. The new estimates based on the new IPCC models and RCP alternatives are emerging, and for the Philippines the losses by the 2050s may be 76 billion USD for RCP2.6 and 130 billion USD for RCP8.5. These are annual losses and even a very small percentage reduction of the losses via well chosen adaptation methods can save billions of USD. The lack of further analysis of this issue brought up by the CVF is astounding, as the potential benefits are so large. Mitigation policies will also be influenced by such analysis. During 2017 we could produce Climate Change Health and Productivity impact profiles for most countries using already available data in our databases, if our fund raising efforts bear fruit.

Activity D. Heat exposure thresholds for Habitability
An ongoing project is analysing the issue of Habitability, and how many people may be affected by their home area becoming so hot that it is impossible or very unhealthy to keep living there. The definition of habitability is still under review and the plan is to include labour productivity loss as a key element of lack of habitability. Tentative analysis shows that currently there are few areas that are so hot during long periods each year that from a physiological viewpoint it would be dangerous to live there. However, using the available physiological understanding, and analysis of labour productivity loss, it can be estimated that by the end of this century grid cell areas that currently have several hundred million inhabitants may become so hot that people cannot live there. The potential impact on climate related migration pressure is obvious. It is expected that by the middle of 2017 we will have a robust analysis of this issue presented.

Activity E. Field studies of impacts in different industries and countries
Several studies (Tawatsupa et al.) have been carried out on selected groups of a very large cohort of adults in Thailand (more than 80,000 in a national questionnaire study and database) showing the reported negative effects of heat at work. In Australia a national survey was carried out (Zander et al., 2015) and productivity was lost as heat got worse. A study in East Bengal, India (Sahu et al., 2013) was able to quantify the relationship between hourly heat exposure level (WBGT) and hourly productivity in teams of 10-15 workers. The exposure-response relationship is shown in the "relevant graphics" below.

Currently studies are carried out in a garment factory in Cambodia and in a vineyard in Cyprus. A large study in Australia is being analyzed, and studies in South India carried out by collaborators are in progress. Further opportunities for studies are sought out.

Activity F. Weather station data and heat analysis software; Hothaps-Soft
Daily weather station data on 7 climate variables from more than 18,000 stations from 1980 onwards have been downloaded from the NOAA GSOD database, and each year we update the full database. Many of these stations have intermittent data, or data just for a short period. Appr. 4,000 weather stations in GSOD have more than 90% of the days since 1980 included. These data can be easily accessed via a user friendly software with a number of output options, developed by our team. Both WBGT and the new heat stress index UTCI are included in the outputs, and time trend analysis can be carried out with different mathematical approaches.

This activity is intended to make local studies of ongoing climate change and impacts possible for local scientists without too much effort. We share the database and software freely via our website, ClimateCHIP.org.

Activity G. Website with grid cell based heat and impacts data; ClimateCHIP.org
This activity uses climate data from ISI-MIP (Potsdam Institute) and calculate WBGT and UTCI so that they can be displayed for any of the 67,000 grid cells over land. The idea is to help local government agencies, enterprises, communities, scientists, school teachers and interested individuals to find out about ongoing climate change since 1980, and the projected heat exposure situations until the end of the century.

The website is still at a development stage, as we have not yet had the resources needed to complete the initial set-up and to continually manage the website. In spite of this, the local climate and heat exposure data is already available in a user friendly format. The local data can be donwloaded for further statistical and other analysis.

Good practices and lessons learned (as appropriate)

1. The Hothaps-Soft database/software has been accessed by a large number of scientists, and the website ClimateCHIP.org is increasingly used for climate change information access.

2. The negative connotations for communities and enterprises of the increasing environmental heat levels is finally becoming a issue talked about at environmental and occupational health conferences and mentioned in international assessments.

3. A remaining serious problem is the continuing "silo-mentality" of the different scientific areas involved in this work and particularly the gap between top-down economic analysis (based on macro-economic models) and the bottom-up analysis starting from human workers physiological limitations. The academic culture of competition rather than cooperation, the difficulties in getting funding support for inter-disciplinary work, and the problems of getting such research work published in high quality journals (as reviewers tend to be parochial for their field), makes progress on assembly of evidence on this climate change challenge slow and difficult.

4. The extraordinary lack of action on funding more analysis of the actual economic losses that may be caused by increasing heat, as the funds required dwarf the benefits from even a small fraction improvement. As the economic cost may be great, and the argument for mitigation of climate change gets substantially strengthened by knowing the costs, one would assume that rapid robust support for the needed inter-disciplinary work would have emerged. **The World Bank and its various national Trust Funds would seem a logical source of funds**, but as far as I know this has not happened yet.

5. Our institution is willing to continue and complete our current work, and compare the impacts of different Global Temperature Changes (1.5, 2, 2.7 or 4 degr C) on the social and economic impacts in any country. In this work we would involve our current collaborators, as appropriate, and add new cooperating links as needed or requested.

Relevant hyperlinks, including to information sources

www.ClimateCHIP.org, but it needs updating ...... we have not had the time/resources to complete the work on the website yet.

Contact details for further information

Our email contact address is: kjellstromt@yahoo,com

Relevant pictures/graphics

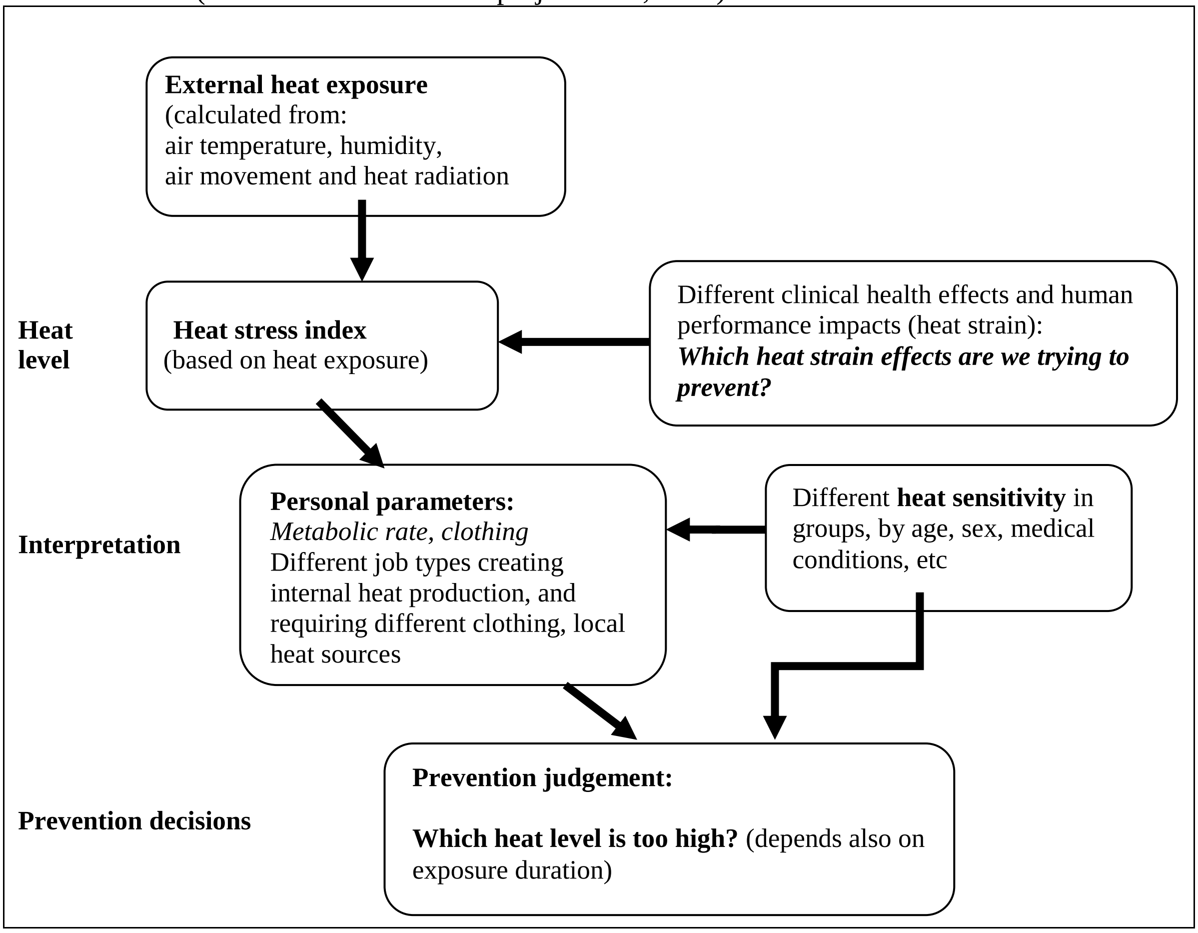
(references in the Appendix)

The conceptual framework for climate change related heat effects on labour productivity is an important part of analysis/research planning and project design. The following framework was developed for the HEAT-SHIELD project (Figure 1).

The figure highlights the distinction between "heat exposure" (which is calculated from environmental factors), "heat stress" (which incorporates the physiological mechanisms behind health and productivity effects), and "heat health effects, or heat strain" (which is describing the actual health effects that will or may occur). Our activities make use of these different concepts and uses the human physiology knowledge in calculations of future labour and economy impacts. This adds important explanatory material to the economic analysis, which has not been used in any of the reports on climate change impacts on economic factors.

Figure 1. Schematic Heat Stress Index and interpretation fundamentals

(source: HEAT-SHIELD project team, 2016)



Workplaces affected by excessive heat exposure on the workers exist both in high income countries (e.g. Europe, USA, Japan, Australia) and in low/middle income countries. The main areas affected now and in the future are in tropical or sub-tropical latitudes. Work outdoors in strong sunlight often creates the highest heat stress, including much agricultural work (Figure 2), construction work, and work in local community services (such as rubbish collection). Heat effects can in some such situations be avoided by not working during the hottest hours or by scheduling work to night time or cooler parts of the year. Night time work is not possible for poor people who do not have access to artificial light on the work site. Many factories in hot low/middle income countries have no air cooling (Figure 2) and the workers health and productivity are at risk.

Figure 2. Some workplaces have excessive heat exposures during several months each year. (source: UNDP, 2016)

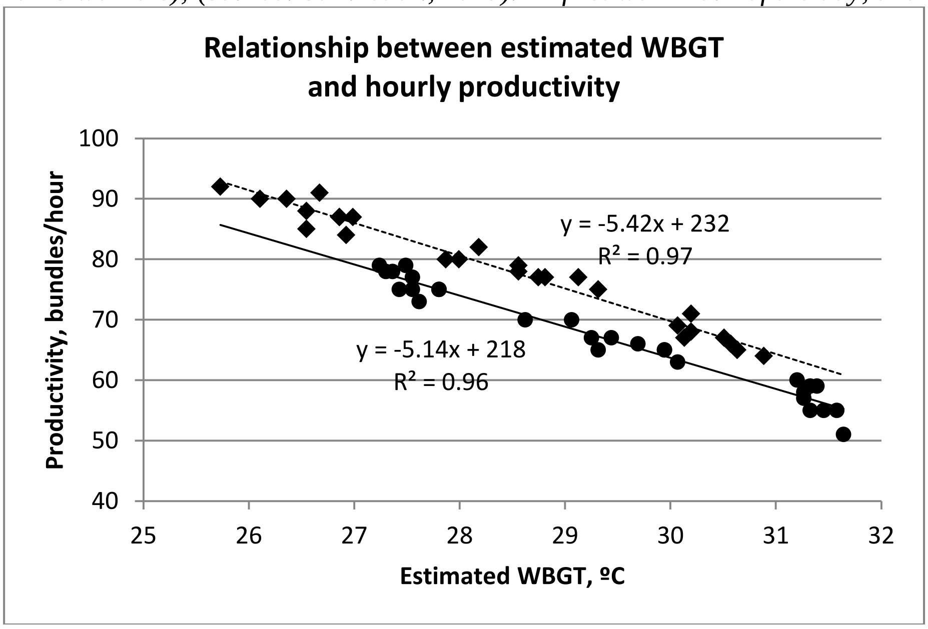
Sugar cane cutting by hand in Nicaragua, 2003
(T.Kjellstrom photos)

This work and other heavy labour agricultural activities in many tropical areas have to be carried out during the hottest season each year. Solar heat radiation adds substantially to the ambient air heat. Heat stress and heavy work, as well as high exposures to agricultural chemicals, create injuries, clinical health risks and daily productivity losses. Many of these workers are paid by production output, so heat causes longer workdays or reduced daily income.

Shoe manufacture in Haiphong, Viet Nam, 2002
(T.Kjellstrom photos)

Factories in low and middle income countries that produce consumer goods, many of which are destined for consumption by high income countries, seldom have air conditioning or other effective cooling and ventilation systems.
Heat stress and the same daily production targets in all parts of the year means that the workers have to work longer each day in the hot season than in cool season; but the salaries are the same.

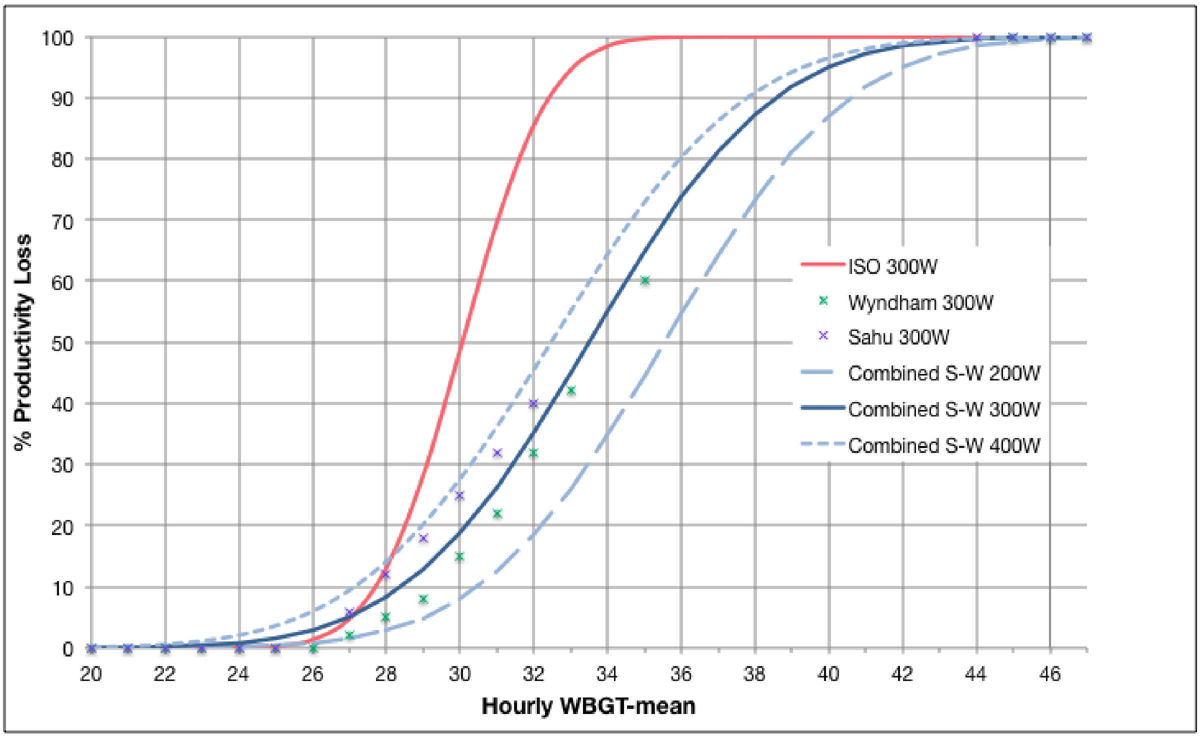
Figure 3: Reduced labour productivity due to heat
Bundles of rice harvested per hour (productivity) at different environmental heat levels (WBGT). Regression lines and equations and correlation coefficients shown. (Each point is a group average of 10-18 workers); (source: Sahu et al., 2013). ◆ *first work hour of the day, and* ● *fifth work hour.*



A key aim of our field studies is to collect more evidence about the actual productivity loss due to heat exposure in different types of work and different countries. One study in India (Figure 3) demonstrated a one third loss agricultural work as the heat exposure level increased 5 degr. C.

These data from Sahu et al., (2013) and the only other available workplace data on productivity loss due to heat (Wyndham, 1969, a reference in many of our reports) were combined into a cumulative Gaussian distribution curve to be used as a exposure-response relationship in climate change impact analysis (Figure 4). The impacts of heat on an individual worker, an enterprise or a larger community (or country) can be estimated with these relationships. It is seen that the international standard (ISO) for the percent of a work hour that workers need to rest to avoid body temperature rising too high is more strict than what happens for the average workers (the fitted curves). This is logical as the standard is designed to protect even the more heat sensitive workers, and not just the average worker.

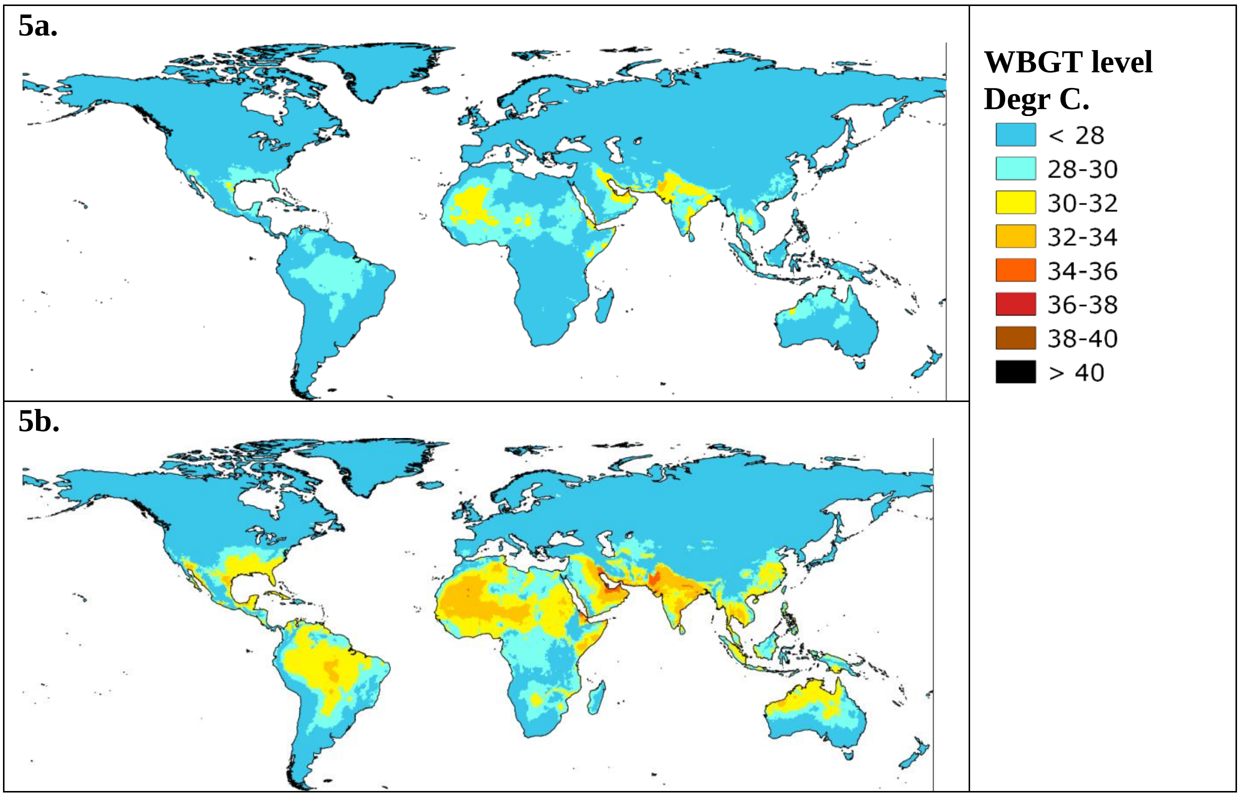
Figure 4. Exposure-response relationships (risk functions) for workplace heat and labour productivity. "Combined" based on Wyndham and Sahu studies (Kjellstrom, et al., 2016, in press)



Our activities include estimating and mapping heat levels using the index WBGT (Wet Bulb Globe Temperature) based on climate modelling carried out by internationally accepted models in experienced institutions. We calculate 30-year averages for 67,000 0.5 x 0.5 degree grid cells over land. The current levels (Figure 5a) are based on Climate Research Unit (CRU at UEA, Norwich, UK) estimates, and the future levels (Figure 5b) are based on results from ISI-MIP at Potsdam Institute, Germany. Figure 5b is just one example. We can calculate for any RCP and any model. IN order to simplify interpretation we use the models HadGEM and GFDL as the main data input models, and their mid-point as a potential average for all models. HadGEM produces global change estimates at the 95-percentile of all IPCC models and GFDL produces results at the 5-percentile level. Thus, the results present a reasonable range of what may be the best future projection.

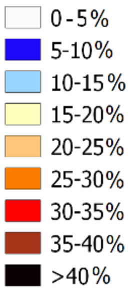
Figure 5a. Monthly WBGTmean, average 1981-2010, hottest month, CRU

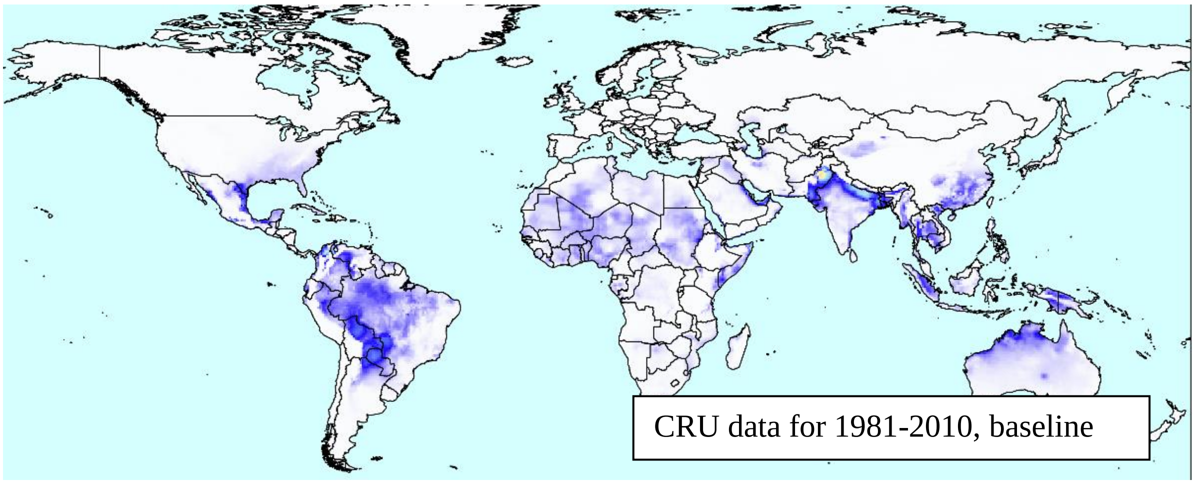
Figure 5b. WBGTmean, hottest Month, monthly average, Two models mid-point (HadGEM2/GFDL), RCP6.0, ISI-MIP, 2085 (2071-2099)

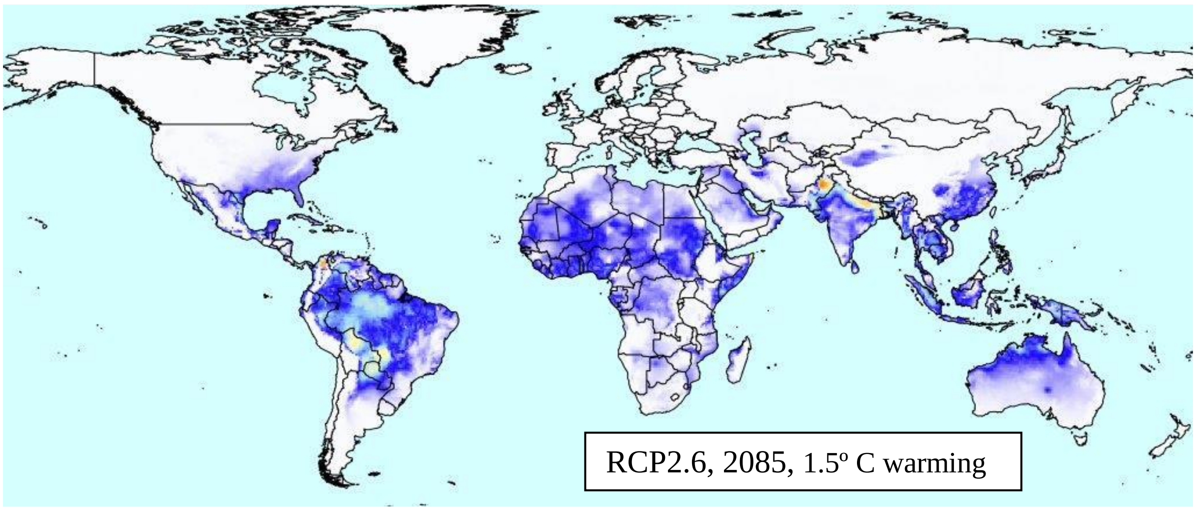


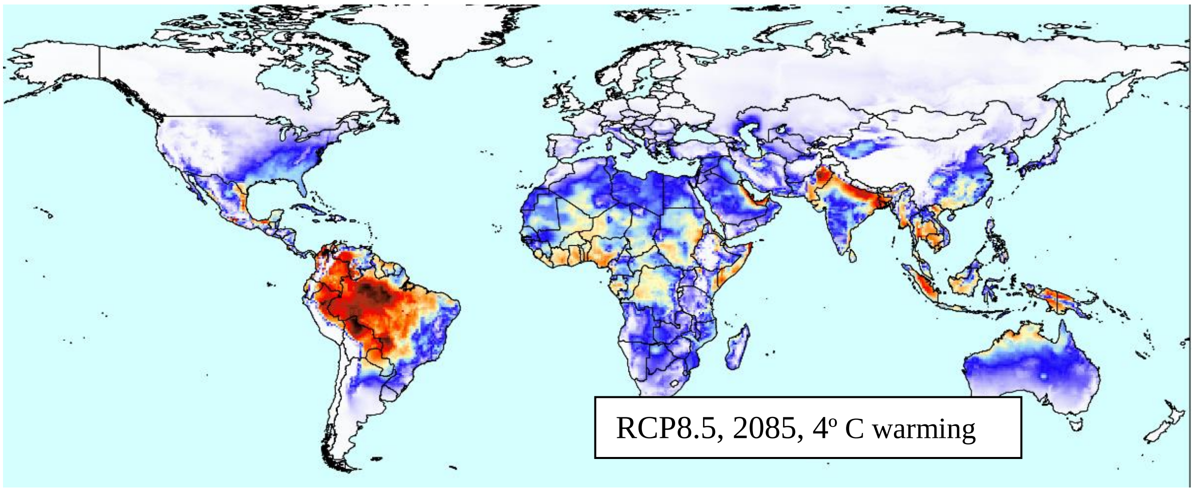
Using the risk functions in Figure 4 and the climate projects data for WBGT we can now calculate the labour productivity loss in each grid cell and produce maps like in Figure 6.

Figure 6. Workplace heat health risks and loss of labour productivity due to heat.
The percentages refer to potential annual daylight hours when health and productivity problems due to heat start occurring for moderate work and labour productivity falls as workers slow down or take more rest. The percentage productivity loss for moderate work (300W) is shown in the colour scheme below and is used in the maps (Kjellstrom et al., to be published)









These types of data can also be summarized for countries using the relevant grid cells (Table 1).

Table 1. Regional and country level losses of labour productivity
These are preliminary and indicative results for a selection of countries based on model data by IPCC analysis. Updated analysis will be produced in 2016. The 2015 numbers in the table range from a linear extrapolation of trends since 1980, and interpolation point between 1995 and 2025. Each year point is a 30-year average estimate around that year. The data apply to work in the shade at moderate work intensity (300W). The RCP6.0 model outputs fit well with the national mitigation policies presented at COP21. (two-decimal numbers do not imply this level of precision in the results)

Country	Working age population	Potential annual daylight work hours lost for work at 300W, %; based on RCP6.0, average of HadGEM2 and GFDL models; 2015 numbers range for two estimates.				
Asia and the Pacific	**2015, millions**	**1995, CRU**	**2015**	**2025**	**2055**	**2085**
Bangladesh	98.65	1.06	1.4 - 2.0	2.53	4.61	8.56
Cambodia	9.51	1.82	2.2 - 3.4	4.24	6.54	10.93
China	892.11	0.32	0.33 - 0.56	0.68	1.12	2.12
India	817.16	2.04	2.6 - 3.1	3.61	5.22	7.98
Indonesia	164.23	0.33	0.42 - 0.93	1.23	2.56	5.45
Kiribati	0.06	0.59	0.75 - 1.5	1.95	4.31	8.66
Maldives	0.12	0.42	0.59 - 1.4	1.90	4.52	9.17
Nepal	19.7	0.61	0.88 - 1.1	1.27	1.98	3.38
Pakistan	109.88	3.73	4.1 - 4.7	5.22	7.00	9.97
Philippines	61.92	0.32	0.33 - 0.79	1.03	2.07	4.41
Vietnam	60.55	0.80	0.78 - 1.7	2.08	3.44	6.31
Africa						
Burkina Faso	10.25	1.90	2.8 - 3.0	3.56	5.59	9.17
Ethiopia	51.55	0.14	0.19 - 0.24	0.28	0.43	0.72
Ghana	17.34	0.64	1.1 - 1.4	1.71	3.49	6.75
Kenya	29.57	0.05	0.09 - 0.13	0.17	0.32	0.63
Morocco	21.02	0.01	0.03 - 0.03	0.04	0.08	0.22
Nigeria	109.4	0.96	1.6 - 1.8	2.18	3.86	6.69
Tanzania	33.57	0.04	0.08 - 0.11	0.15	0.35	0.83
Tunisia	6.89	0.29	0.65 - 0.56	0.69	1.14	2.15
Americas						
Barbados	0.18	0.05	0.13 - 0.25	0.34	0.78	2.96
Colombia	30.48	0.21	0.32 - 0.49	0.63	1.22	2.41
Costa Rica	3.14	0.28	0.33 - 0.53	0.65	1.19	2.23
Honduras	5.3	0.07	0.11 - 0.24	0.32	0.67	1.51
Mexico	74.94	0.33	0.50 - 0.57	0.69	1.15	2.03
USA	208.12	0.15	0.26 - 0.34	0.43	0.73	1.38
Europe						
France	40.56	0.00	0.00 - 0.00	0.00	0.01	0.04
Germany	52.17	0.00	0.00 - 0.00	0.00	0.00	0.02
Greece	7.38	0.00	0.02 - 0.02	0.02	0.06	0.24
Spain	30.69	0.01	0.03 - 0.03	0.04	0.08	0.25
Switzerland	3.56	0.00	0.00 - 0.00	0.00	0.00	0.01

Appendix

List of our publications related to this specific topic in chronological order:

Peer reviewed articles (some recent articles to be added)

1. Kjellstrom, T. (2000) Climate change, heat exposure and labour productivity. Proc. ISEE 2000, 12th Conference of the International Society for Environmental Epidemiology, Buffalo, USA, August, 2000.

Epidemiology, 11, S144. http://www.epidem.com/pt/re/epidemiology/ ***...... this is the first time the topic of heat effects on working people is brought up in conjunction with climate change***

2. Friel S , Marmot M, McMichael AJ, Kjellstrom T, Vågerö D. (2008) Global health equity and climate stabilisation - need for a common agenda. *The Lancet*, 2008; 372: 1677-1683.

3. Kjellstrom T and Weaver HJ. (2009) Climate Change and Health -- impacts, vulnerability, adaptation and mitigation. *NSW Publ Health Bulletin*, 20, 5-9

4. Kjellstrom T. (2009) Climate change, direct heat exposure, health and well-being in low and middle income countries. *Global Health Action*, 2, 2009.

5. Kjellstrom T, Kovats S, Lloyd SJ, Holt T, Tol RSJ. (2009) The direct impact of climate change on regional labour productivity. *Int Archives of Environmental & Occupational Health*, 2009, 64, 217-227 (on website: http://ensembles-eu.metoffice.com/docs/kjellstrom_2009_prod_paper.pdf).... ***this is the first quantitative estimate of labour productivity loss at regional level.***

6. Kjellstrom T, Holmer I, Lemke B. (2009) Workplace heat stress, health and productivity – an increasing challenge for low and middle income countries during climate change. *Global Health Action* 2009 (on website: www.globalhealthaction.net). DOI 10.3402/gha.v2i0.2047.

7. Kjellstrom T, Gabrysch S, Lemke B, Dear K. (2009) The "Hothaps" program for assessment of climate change impacts on occupational health and productivity: An invitation to carry out field studies. *Global Health Action* 2009 (on website: www.globalhealthaction.net). DOI 10.3402/gha.v2i0.2082.

8. Kjellstrom T, Butler A-J, Lucas R, Bonita R. (2010) Public health impact of global heating due to climate change – potential effects on chronic non-communicable diseases. *International Journal of Public Health* 2010, 55, 97-103. DOI: 10.1007/s00038-009-0090-2.

9. Berry HL, Bowen K, Kjellstrom T. (2010) Climate change and mental health: a causal pathways framework. *Int J Public Health*, 55, 123-132, DOI: 10.1007/s00038-009-0112-0

10. Tawatsupa B, Lim L, Kjellstrom T, Seubsman S, Sleigh A, (2010) Thai Cohort Study Team. The association between overall health, psychological stress and occupational heat stress among a large national cohort of 40,913 Thai workers. *Global Health Action 2010, **3:** 5034 - DOI: 10.3402/gha.v3i0.5034*

11. Nilsson M, Kjellstrom T. (2010) Invited editorial: climate change impacts on working people: how to develop prevention policies. *Global Health Action*, 2010, vol 3 (DOI: 10.3402/gha.v3i0.5774)

12. Hyatt O, Lemke B, Kjellstrom T. (2010) Regional maps of occupational heat exposure: past, present and potential future. *Global Health Action*. 2010 Nov 29;3.(DOI: 10.3402/gha.v3i0.5715)

13. Dapi LN, Rocklov J, Nguefack-Tsague G, Tetanye E, Kjellstrom T. (2010) Heat impact on school children in Cameroon, Africa: potential health threat from climate change. *Global Health Action*, 2010, 3 (DOI: 10.3402/gha.v3i0.5610)

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