



# **WORLD CLIMATE PROGRAMME**

## **WORLD CLIMATE APPLICATIONS AND SERVICES PROGRAMME**

**REPORT OF THE MEETING OF THE COMMISSION FOR CLIMATOLOGY  
EXPERT TEAM ON CLIMATE AND HEALTH**

**(London, United Kingdom, 20 – 22 November 2006)**

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The **World Climate Programme (WCP)** implemented by WMO in conjunction with other international organizations consists of the following major components:

- World Climate Data and Monitoring Programme (WCDMP)
- World Climate Applications and Services Programme (WCASP)
- World Climate Impact Assessment and Response Strategies Programme (WCIRP)
- Coordination activities within the Climate Agenda (CCA)
- World Climate Research Programme (WCRP)
- Intergovernmental Panel on Climate Change (IPCC)
- Global Climate Observing System (GCOS)

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## 1. Opening of the Meeting

The Commission for Climatology Expert Team (ET) on Climate and Health (CCI ET 4.1) met from 20 – 22 November 2006 at King's College London, London, UK. ET members, invited experts and observers reviewed progress of ongoing climate and health activities that were initiated under CCI-XIII (2001) and discussed the future work of the Team. The WMO Secretariat, the president of the Commission for Climatology and the ET lead expert, Prof. Glenn McGregor, delivered opening and welcoming remarks, and provided an overview of the objectives and anticipated outcomes of the meeting. The main objectives of this session were to learn the expertise and interests of the members of the Expert Team (ET) and key partners; to review the Terms of Reference of the ET; to discuss various scientific issues related to climate and health requiring investigation; to revise and revitalize the project to develop WMO Guidelines on Heat Health Warning Systems (HHWS); and to establish a workplan for 2006-2009 based on SMART goals, and within the broad areas of work outlines in the Terms of Reference. A relevant objective of the meeting was to develop effective partnerships between the ET members and the key partners for information sharing and joint activities.

## 2. Organization of the Meeting

Participants were introduced. The meeting Chairperson, Prof. Glenn McGregor, invited the meeting to consider the provisional agenda, which was adopted with minor changes to accommodate the schedules of the participants. Participants agreed on the organization of the session, including working hours and breaks, and a change of venue for Days 2 and 3. The meeting agreed to develop a list of decisions of and actions from the session that would be approved before the close of session. The final Agenda and List of Participants are included as **Annex 1** and **Annex 2**, respectively.

## 3. Assessment of Global and WMO/CCI Climate and Health Activities

### 3.1 ET and partner interests in climate and health

Each participant provided an overview of their background and work pertinent to the priorities of the Expert Team, including existing areas of partnership and collaboration in climate and health:

- **Pierre Bessemoulin** discussed the development of the French HHWS, biometeorological thresholds, collaboration between Météo-France and the Institut de veille sanitaire (INVS), and the decision-making process in development of HHWS. He reviewed progress made in writing the WMO/WHO Guidelines on HHWS, the workplan for which had been developed in 2004 at an Expert meeting in Freiburg, Germany and noted that considerable work remained to finalize that project.
- **Gerd Jendritzky** discussed the Universal Thermal Climate Index, assessment of the thermal environment of a human being, heat budget models, the Deutscher Wetterdienst Perceived Temperature (PT) model, as well as the EU Cooperation in Science and Technical Development (COST) Action 730 on UTCI and its three Working Groups (on Thermo-physiological modelling and testing, meteorological and environmental data, and applications).
- **Larry Kalkstein** discussed progress in Heat-health Warning System technology in the USA: the System, its effectiveness, intervention and stakeholder identification. He covered air mass types most associated with deadly heat waves, development of

algorithms for calculation of mortality, examples of operational HHWS, results of a recent survey, and plans for development of a Guidebook on excessive heat events.

- **Wing-mo Leung** noted recent studies in Hong Kong, China on the relationship between thermal index and mortality, and on Severe Acute Respiratory Syndrome (SARS) and Avian Influenza (the latter published in the WMO Bulletin Volume 54, No. 4, October 2005). He further noted an evaluation in Hong Kong of the effect of weather on the abundance of dengue fever mosquitoes and the Hong Kong System of warnings for very hot and cold weather for which a Weather Stress Index is used.
- **Paulo Ortiz Bulto** spoke about the IAI project on use of information and climate prediction in human health. This study used climate, epidemiological, ecological and socio-economic data to evaluate the relationships between climate variability and change and epidemiological pattern changes. Climate prediction is used to support proactive adaptation measures in the human health sector. Dr Ortiz Bulto described the development of Early Warnings for various infectious diseases in Cuba, and future needs (for more research, vegetation indices, socio-economic data, etc.).
- **Robin Hicks** noted his background in climate information and monitoring of conditions conducive to outbreak of infectious diseases such as Murray Valley Encephalitis and Ross River Fever, in activities related to thermal stress and thermal comfort and in development of Heat-health plans for Australia. The Bureau (Australia) produces bulletins on Apparent Temperature as a guide for athletes and outdoor workers. Because of recurrent droughts, a pressing recent need in Australia is for information on water supplies and bush fires. Mr Hicks, presently national manager for fire weather and air quality services, is developing mesoscale modelling within the Australian Air Quality Forecasting System, and studies the association of air quality and adverse health effects.
- **Renate Hagedorn** reviewed climate and health applications at ECMWF, including the lead times, and horizontal and vertical resolutions of various forecast systems. The DEMETER model was discussed as an end-to-end system from seasonal prediction, through downscaling to applications models. DEMETER supports the Malaria Early Warning System (MEWS), Tropical Cyclone forecasting, heat wave warning systems and air quality monitoring and prediction.
- **Haleh Kootval** discussed the WMO Public Weather Services programme (PWS) which assists WMO Member countries to deliver reliable and effective weather and related services to the public. PWS is concerned in biometeorology, in such issues as Pollution Standard Index (PSI), UV Index, pollen counts, etc. and have published Guidelines on Biometeorology and Air Quality Forecasts (WMO/TD No. 1184) in 2004. PWS advises National Meteorological Services on dissemination and communication of Warnings, on presentation skills, and on public education and outreach.
- **David Rogers** provided an overview of the impacts of infectious diseases on Africa, and the interconnections between poverty, disease and nutrition, food and water insecurity, climate change and ecosystem conditions. There is considerable potential for development of Early Warning Systems that use climate information, the known climate-disease relationships, and prediction tools, to assist the health sector. He noted the importance of building on existing projects and programmes such as MARES, AMMA, THORPEX, GCOS and previewed a Climate and Health partnership that would also develop new activities such as the GEOSS-WHO effort towards reduction of the risk of meningitis. The climate and health partnership intended to foster education and training, public outreach, health and climate assessments, ecosystems and health research, to support environmental observations and, above all, to mobilize resources.

- **Diarmid Campbell-Lendrum** described the activities of the World Health Organization towards protecting health in a changing climate: risk assessment; awareness raising; vulnerability assessment, adaptation strategies and tools for protection of health. In particular, a GEF project on piloting health adaptation to climate change has been taking place in seven countries, each experiencing different health impacts from climate change. Development of Early Warning Systems and prevention/preparedness measures, use of weather forecasts and seasonal climate prediction, improved surveillance systems etc. are expected to reduce vulnerability. Working with partners like WMO and National Meteorological Services will reduce duplication of effort.
- **Sari Kovats** reviewed aspects of the global burden of disease, as published in the A.J. McMichael (et al) WHO book of 2004 on 'Comparative quantification of health risks: global and regional burden of disease due to selected major risk factors'. Relative risks of diarrhea, inland floods, coastal floods, malaria and dengue fever were noted for West Africa, South and East Africa, North America, Central and South America, and for Southeast Asia. In addition, Sari discussed effectiveness and evaluation of Heat-health Warning Systems; and the differences between efficiency, effectiveness, and efficacy. Effectiveness can be expressed in both quantitative (e.g. reduction of mortality) and qualitative (e.g. effectiveness of lines of communication) terms. It was noted that no HHWS have been fully evaluated. A few studies have looked at effectiveness in reducing population mortality. Some have evaluated process, there have been several simulation exercises and a number of surveys of awareness. It was noted that the public health objectives of HHWS included prevention of heat-related illness and death, but that there were also benefits to specific target groups in leisure and sports industry, for example. Finally, some measures/strategies are known to be more effective than others – fans, for example, may potentially increase heat stress in some environments, but the 'buddy' system where neighbors look out for the vulnerable members of their populations, appears to work well.
- **Franziska Matthies** spoke about the EuroHEAT project for improving public health responses to extreme weather/heat-waves. Amongst the achieved objectives of EuroHEAT were identification of risk factors for health impacts of heat; a web-based climate information decision-making tool; Guidelines on health system responses to health risks of extreme heat; and Guidelines on best practices for prevention and treatment of health impacts of extreme heat (e.g. heat or sun stroke). She noted the need for national heat plans and the flow of information required between the lead agency (department of health), the meteorological office, relevant agencies including hospitals and care facilities, and the media and general public.
- **Glenn McGregor** reviewed the use of seasonal climate forecasts for the health sector, noting that while good forecasts are indeed available in the 5-10 day timescale, this is at the threshold of preparatory and crisis planning. The health sector needs to be able to anticipate events much longer in advance. There are discernable climate and health associations at the intra-seasonal to seasonal timescale, and therefore there is potential for development of long-lead health forecasts (at least in summer). Glenn discussed aspects of the findings of the PHEWE project including mapped results showing convergence of surface temperature hotspots and areas of high sensitivity.

### 3.2 Review of the Terms of Reference of the ET, discussion on key priorities

The president of the Commission provided a brief overview of the CCI structure established at the fourteenth session of the Commission for Climatology (CCI-XIV, 3-10 November 2005, Beijing), which includes the President, Vice President, regional Members, rapporteurs and

four Open Programme Area Groups (OPAGs), each of which has a number of Expert Teams (ETs). The ET on Climate and Health is within OPAG 4 on Applications and Services, which is led by Dr Wenjie Dong of China, and co-chaired by Mr Mohammed Kadi, of ACMAD, Niger. The president introduced the Terms of Reference (ToRs) for the team (see **Annex 3**), which are a broad and extensive set of priorities to guide the work of the ET. He then described the development of a workplan of **Specific, Measurable, Achievable, Realistic and Time-bound (SMART)** goals, based within these broad ToRs, and identified that a priority for consideration in the workplanning would be efforts towards Disaster Prevention and Mitigation, in particular with respect to Heat-Health Warning Systems (HHWS). Mr Bessemoulin noted the possibility to take the HHWS concept into implementation phase, through a number of field tests, demonstration projects, intercomparisons and evaluations.

#### **4. Guidelines on Heat-Health Warning Systems**

##### **4.1 Background on development of HHWS Guidelines**

Two Expert Teams focused on Climate and Health initiated by the thirteenth session of the Commission for Climatology in 2001, namely the ET on Operational Heat-health Warning Systems (HHWS), and the ET on Health-related Climate Indices and their use in Early Warning Systems, met in Freiburg, Germany in April 2004, to discuss the development of Guidelines on HHWS. This meeting developed an outline for these Guidelines, and assigned authors and deadlines. The work was not completed within the thirteenth intersessional period. During CCI-XIV, the two former teams were merged and the membership was considerably changed.

##### **4.2 HHWS Guidelines: revised outline and project decisions**

The new ET 4.1, along with invited experts and partners, reviewed and revised the original outline for the Guidelines on HHWS, and re-distributed the assignments to new ET members and partners. The revised outline for the Guidelines on HHWS, with deadlines and identification of section authors, is attached as **Annex 4**. In addition, the participants agreed that the Guidelines will not deal with cold waves; the co-publishers will be WHO and WMO (to be listed on the front cover); the authors, contributing authors, review committee (which should cover the major stakeholders such as IFRC) will be listed on the inside front cover and/or facing page. The participants committed to the development of a first draft to be available for distribution to WMO members during its 15th Congress (May 2007). Glenn McGregor agreed to be the champion of the process and to encourage the writers to deliver on time. It was noted that WHO and WHO regional office for Europe use the word 'Guidelines' specifically, and that an alternative title may be needed (e.g. Guidance). It was agreed that the Secretariat would consult with WHO on the matter. Finally, it was agreed that the Secretariat would share the results of the WMO DPM/WCP survey on the 2006 heat wave in Europe and North America with WHO Europe and the EuroHEAT project.

##### **4.3 HHWS demonstration and implementation**

The Secretariat noted that in conjunction with the WMO Disaster Prevention and Mitigation Programme, various demonstrations of Early Warning Systems would be considered within WMO's fundraising efforts. The meeting discussed regional field-testing and demonstrations for various HHWS, in China, France, India and other countries, which would build on existing partnerships and enhance synergies with ongoing efforts of partnering agencies including WHO global and regional programmes and the London School of Hygiene and Tropical Medicine. Diarmid Campbell-Lendrum agreed to provide information related to WHO initiatives of the southeast Asian regional office in Delhi (interested in climate and health), the China WHO/UNDP/GEF project, and Sari Kovats similarly offered to share information on

her heat research project in India. Participants agreed to support development of projects on demonstration and implementation of HHWS, should these opportunities be realized.

## 5. Potential Applications of Seasonal Forecasts in Health Planning and Decision-making

Medium to long-range climate forecasts (10-30 day to one season ahead) provide the opportunity to identify in advance the possible occurrence of anomalous climate conditions that may have discernible health impacts. Compared to assessments of the utility of this type of information for other sectors, such as agriculture and water, health has received little attention. The group discussed topics including realistic target health outcomes and regions; the status of seasonal climate forecasting for target countries, including an overview of activities in the area of seasonal prediction of disease outbreaks; data set availability for developing seasonal climate forecasting models, and likely barriers to the uptake of seasonal climate information by the health sector.

The ET decided to investigate development of a position paper on the utility of seasonal prediction in certain health decisions (i.e. the feasibility of seasonal predictions for heat waves and other health-related issues). Partners (e.g. IRI, WHO, ECMWF, etc) would be involved. User-driven requirements for forecasts should be identified to the extent possible (e.g. a 2-month lead time is useful for ordering insecticide, but ensuring staff levels, stockpiling drugs may require a 3-day lead time only). Case studies would be useful to demonstrate what forecasts are beneficial in what decisions.

As a precursor to such a study, the ET decided to establish an on-line virtual document library and bibliography, and noted that there are quite a few research papers, information notes and presentations to draw on. Relevant sources of information include:

- The WHO publication on infectious disease:  
<http://www.who.int/globalchange/publications/infectdiseases/en/index.html>
- a short review on seasonal climate forecasting with a tropical focus:  
<http://www.cru.uea.ac.uk/tiempo/portal/archive/issue33/t33a3.htm>
- some information on Malaria Early Warning Systems:  
<http://iri.columbia.edu/impact/project/MalariaEarlyWarn/>  
<http://www.cru.uea.ac.uk/tiempo/portal/archive/issue33/t33a3.htm>
- M. Thomson et al, (2005) Am. J. Trop.Med.Hyg. (malaria index)
- M Thomson PowerPoint presentation at the LWVCV Conference available at:  
<http://www.livingwithclimate.fi/linked/en/Thomson.pdf>

The ET agreed to develop and post a list of all Weather Services and centres and agencies that do seasonal prediction (including Global Producing Centres (GPCs), Regional Specialized Meteorological Centres (RSMCs), Regional Climate Centres (RCCs) and National Meteorological Centres (NMCs)). This effort will identify what they predict (what are their outputs: temperature, precipitation, etc.) for purposes of evaluating the utility of seasonal prediction for health applications. Lead times, temporal and spatial resolution would be of special interest. WMO World Weather Watch and Hydrology programmes will be asked to provide input.

## **6. Strategies for Assessing Attribution of Observed Health Trends to Observed Climate Change**

The majority of the climate science community now accepts that anthropogenic activity over the last century has had a discernible impact on global climate. However what is less clear is how observed climate change may have had an impact on trends in the global burden of disease. Recently one estimate (Patz JA, Campbell-Lendrum D, Holloway T, Foley JA. (2005): Impact of regional climate change on human health. *Nature* 438, 310-317. doi:10.1038/nature04188), based on standard epidemiological approaches, has put the annual toll attributable to climate change over the past 30 years at over 150,000 lives. The meeting discussed the current methods used for assessing the contribution of climate to the global burden of disease from a climate perspective and assessed whether climate change and health experiments could be designed to shed light on the association between trends in observed climate and a variety of health outcomes.

The ET recognized the difficulties associated with assessing attribution of observed health trends to observed climate change, and noted that long-term trends in the incidence of specific disease are affected by the health field's improvements on medicines and methods, etc – i.e. underlying conditions are changing, and this affects the observed trends. Calculating the burden of disease at national scales would be a very difficult exercise. The ET decided not to pursue this as a high priority during the fourteenth intersessional period (2005-2009) but agreed that it would review the Patz et al publication for consideration for the subsequent period. Diarmid Campbell-Lendrum agreed to provide the ET with the paper.

## **7. Uncertainties Associated with Climate Change Health Impact Assessments**

In applying and interpreting climate change scenarios for health impact assessment, the inherent uncertainty in the scenarios needs to be acknowledged. Sources of uncertainty are the climate models themselves (model physics), assumptions about future levels of Greenhouse Gas emissions (influenced by global fossil fuel consumption, economic and population growth rates) and the robustness of the climate health transfer functions forced by variables derived from climate change experiments. Notwithstanding these concerns, many climate change health impact assessments use the output from climate change experiments unquestioningly.

The meeting discussed the potential sources of uncertainty in climate change related health impact assessments, and considered formulating a position paper on this topic for distribution to the climate impacts community. The ET agreed that uncertainty with respect to climate change health impacts assessments was an important cross discipline matter for WMO and WHO, and that for health projections, the key limitation would be uncertainty related to precipitation (substantially greater problem than uncertainty for temperature). As to developing methodologies for quantifying that uncertainty, the ET decided to discuss what details of the science would be most relevant in health sector decisions on the ground with colleagues at WHO (facilitated by Diarmid Campbell-Lendrum).

## **8. Development of Climate/Health Outreach Materials**

Although climate has both direct and indirect impacts on a range of human activities, its role as a health stressor remains poorly understood not only by many in the broad health science community but also by the public in general. This is of concern because a prerequisite for a society prepared for the vagaries of climate is a good understanding of the role that climate plays in determining health outcomes at a variety of spatial and temporal scales. Outreach therefore has an important role to play in the "climate education" of society from the political to individual level. Participants discussed progress and issues related to development and publishing of a booklet on

heatwaves, a project initiated in the thirteenth intersessional period. It was agreed that the materials collected to date were not ready for publication without considerable additional effort, and the group agreed not to pursue that project. However, once the Guidelines on Heat-health Warning Systems are in peer review, the ET will develop some joint WMO/WHO factsheets on climate change and health (update and co-publish the WHO original), and on climate variability and extremes and health (new), explaining the difference between CC and CV in both.

Participants were apprised of the work in progress by the CCI Expert Team on El Niño and La Niña, to develop a '0' order atlas of El Niño impacts. Impacts of El Niño and La Niña on health have been the subject of research and a number of papers exist that would be of great benefit to the Atlas content (e.g. Sari Kovats, 2 papers in Lancet, and Bouma publications on infectious disease and El Niño). The ET agreed therefore to provide these references to ET 3.3 for its work.

## 9. Establishment of a Workplan (2006-2009)

The meeting summarized the requirements for completion of any outstanding work from the thirteenth intersessional period of the Commission for Climatology, and established a Workplan with SMART goals, along with assignments of tasks and deadlines, for those and any new work to be undertaken. It was noted that work to be reported to the fifteenth session of the Commission (2009) must be completed by April 2009, and that this present meeting is the only one scheduled in the fourteenth inter-sessional period for the Commission (i.e. 2005-2009). However projects related to demonstration and implementation of HHWS might present additional opportunities for meetings. Teleconferences can be arranged, as needed.

The group agreed on a number of specific deliverables, summarized in Table 1:

**Table 1: The 2005-2009 Workplan for ET 4.1 on Climate and Health:**

No.	Task	Responsible	Due Date
1	<b>ET4.1 Number 1 priority:</b> Develop, publish and disseminate the HHWS Guidelines	<i>Content:</i> <b>Glenn McGregor</b> (lead); ET and partners;  <i>Peer Review:</i> <b>WMO &amp; WHO Secretariats</b>  <i>Publication:</i> <b>Secretariat</b>	Estimated at December 2007*, with a draft to WMO Members for Cg-XV, May 2007
2	Develop a Guidelines on UTCI	<i>Content:</i> <b>Gerd Jendritzky</b>  <i>Publication:</i> <b>Secretariat</b>	May 2009
3	Develop and maintain an online virtual document library and bibliography on health/climate issues	<i>Web site:</i> <b>Secretariat</b>  <i>Content:</i> <b>Paulo Otriz Bulto</b> for seasonal prediction for infectious diseases and other health outcomes; <b>Ulisses Confalonieri</b> for climate, climate change and health; <b>Glenn McGregor</b> for attribution of observed health trends to observed climate change; <b>Glenn McGregor, Sari Kovats, Simon Gosling and Stephen Schneider</b> for uncertainties associated with climate change health impact assessments	April 2009

4	Develop and post a list of producers of seasonal predictions, including RSMCs, GPCs, RCCs, NMCs	<i>Content:</i> <b>Robin Hicks</b> , with WCP, WWW and HWR  <i>Web site:</i> <b>Secretariat</b>	May 2007
5	<b>ET4.1 Number 2 priority:</b> Review and assess the utility for health applications of seasonal prediction products developed by various NMHSs, centres and agencies	<b>ET 4.1, WHO experts, in consultation with ET 3.1</b>	December 2007
6	Develop a survey paper on seasonal prediction for infectious diseases and other health outcomes	<b>Paolo Ortiz Bulto, Glenn McGregor and Diarmid Campbell-Lendrum</b>	June 2008
7	Provide information to CCI ET 3.3 on ENSO-related health impacts for the CCI ENSO impacts atlas project (e.g. Sari Kovats papers in Lancet, and Bourma paper on infectious disease and El Niño)	<b>Secretariat</b>	April 2007
8	Develop and post joint WMOWHO factsheets on climate change and health (update WHO original), climate variability and extremes and health (new)	<i>Content:</i> <b>Wing-Mo Leung, Diarmid Campbell-Lendrum and Bettina Menne</b> with support from PWS, WCP and DPM  <i>Web site:</i> <b>Secretariat</b>	April 2009
9	Develop a fact sheet on climate and fire health impacts, in relation to natural fires related to seasonal dry spells	<b>Robin Hicks</b>	May 2008

**\*Note that the due date for this deliverable depends on availability of various authors (all volunteers) and on the time required to comply with the peer review processes of both WMO and WHO.**

## 10. Review and Approval of Decisions and Actions

The meeting reviewed and approved the decisions and actions from the session, for both the text of the report, and as embedded in the Workplan and the revised outline of the Guidelines on HHWS.

## 11. Other Business

There were no additional issues raised.

## 12. Closure of the Meeting

The meeting ended at 16h00 on Wednesday, 22 November 2006. The Chairman, Prof. McGregor, and the Secretariat, warmly thanked the participants for their enthusiastic commitments to the tasks ahead.

**AGENDA**

1. OPENING OF THE MEETING
  2. ORGANIZATION OF THE MEETING
  3. ASSESSMENT OF GLOBAL AND WMO/CCI CLIMATE AND HEALTH ACTIVITIES
  4. GUIDELINES ON HEAT-HEALTH WARNING SYSTEMS
  5. POTENTIAL APPLICATIONS OF SEASONAL FORECASTS IN HEALTH PLANNING AND DECISION MAKING
  6. STRATEGIES FOR ASSESSING ATTRIBUTION OF OBSERVED HEALTH TRENDS TO OBSERVED CLIMATE CHANGE
  7. UNCERTAINTIES ASSOCIATED WITH CLIMATE CHANGE HEALTH IMPACTS ASSESSMENTS
  8. DEVELOPMENT OF CLIMATE/HEALTH OUTREACH MATERIALS
  9. ESTABLISHMENT OF A WORKPLAN (2006-2009)
  10. REVIEW AND APPROVAL OF DECISIONS AND ACTIONS
  11. OTHER BUSINESS
  12. CLOSURE OF THE MEETING
-

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### Terms of Reference (ToRs) for the CCI Expert Team on Climate and Health (ET 4.1)

[http://www.wmo.int/web/wcp/ccl/opags/opag4/ET4.1/ET4.1\\_Members\\_ToRs.htm](http://www.wmo.int/web/wcp/ccl/opags/opag4/ET4.1/ET4.1_Members_ToRs.htm)

Note that in the General Summary Text of the proceedings of the fourteenth session of the Commission for Climatology (3-10 November 2005, Beijing China) it is noted (item 11.2.6(g)) that the Terms of Reference are broad, long-term goals that constitute a framework to guide the work of the Expert Team (ET), and that each ET will set workplans with **Specific, Measurable, Achievable, Realistic and Time-bound (SMART)** goals consistent with that framework (see 4.1.3 below)

- (a) To improve the knowledge of relationships between environmental factors (meteorological parameters, air pollution, housing, ...) and reactions of the human organism;
- (b) To complete and distribute the WMO/WHO Guidelines on Heat-health Warning Systems and health-related assessments of the thermal environment which will include procedures that could be used worldwide by both climate and health specialists to develop and operate heat/health and cold-spell/health warning systems, and to make recommendations on regional workshops for implementation of the new procedures;
- (c) To recommend further actions to make health-related warning systems a fully integrated part of CLIPS operations, Climate Watch and Disaster Prevention and Mitigation (DPM) systems;
- (d) To identify the needs of the health sector for climate information including monthly to seasonal predictions (for planning and in early warning systems) and considerations of climate change, particularly focusing on climate information relevant to increased risks of infectious diseases (e.g. Yellow Fever, Cholera, West Nile Fever, Malaria, Dengue Fever, Influenza, meningitis and possibly Severe Acute Respiratory Syndrome (SARS) and Avian Influenza);
- (e) To consider possible coincidences between temperature extremes and air quality extremes in the different climate regions, and to study health effects of these multiple stress events;
- (f) To develop, in partnership with NMHS climate services programmes, the WMO Regional Associations and relevant partners in the health sector, useful and understandable tailored climate products for application to health, including specific attention to high latitudes (role of climate variability and change on health of people and in communities in Polar Regions);
- (g) To identify the international and national groups (e.g. the World Health Organization, the International Society of Biometeorology, the International Association of Urban Climatology, and including programmes within NMHSs and in WMO such as Public Weather Services on biometeorology, and the AREP GURME project) with active programmes in climate and health, to gather information on their areas of interest and expertise, and then to investigate potential synergies and projects with these groups;
- (h) To incorporate the WMO cross-cutting themes (on Disaster Prevention and Mitigation, Space/GEO and Least Developed Countries) into planning and activities of the ET, and to collaborate as needed with experts (across all related disciplines) in other CCI ETs, in ETs of other WMO Technical Commissions, and in relevant external Organizations;
- (i) To provide guidance on, and make recommendations for, the design and conduct of specific demonstration and pilot projects, including the calculation of cost/benefits and value of climate predictions from the user point of view;
- (j) To explore, document and make recommendations for addressing the needs for capacity building in each region, pertinent to this topic;
- (k) To submit reports in accordance with timetables established by the OPAG chair and/or Management Group.

**Guidelines for Heat/Health Warning Systems – Outline  
(revised 22.11.2006)**

**Preface – to cover potential users or stakeholders and the development partners  
(WMO/CCI, WHO)**

**1. Introduction (Glenn McGregor and WHO)**

- Describe the goal to optimize the relationship between health, meteorological and other agencies,
- Clarify terminology.

**2. What is a HHWS? (Larry Kalkstein and others)**

- End to end process,
- Dissemination to stakeholders and public
  - i. levels of warnings [warning nomenclature]... – preparedness/alert vs disaster, vs moderate]
  - ii. Use chapter 7 PWS Guide for wording on stakeholders...interagency
- Policy, legal and resource implications of HHWSs

**3. Heat as a health problem: impact of heat on human health  
(Bettina Menne, Gerd Jendritzky, with Dr Bouchama? and others – Paola Mitchelozzi, Kris Ebi)**

- What is heat? (Ways of describing heat and hot weather impact on humans (to include general principles of these methods for describing heat):
  - Simple meteorological or biometeorological indices (e.g. Ta, AT, NET, etc)
  - Human energy balance based indices; heat budget models
  - Air mass approaches
- Physiology
- Symptoms of heat illness
- Who dies in a heatwave (international),
- Environmental factors - indoor vs outdoor temp
- Factors of heatwaves that are dangerous – early season, rapid onset, T

**4. Heat/Health Warnings (Christina Koppe and Scott Sheridan, Pete Chatman, INVS) – Larry Kalkstein would make the first approach to CK, SS and PC**

- Methodological approaches: where its used; nomenclature; description of the systems (overview in general terms of how the system works; caveats and assumptions, data requirements – no value judgements)
- Levels of warnings, lead times [3-5 days?]. ensemble predictions, probabilistic warnings.
- criteria for issuing and ending warnings;
- Integration of heat and Air Quality warnings.

**5. Risk communication; Heat-Health warnings to stakeholders and to the public [Haleh Kootval, and Bettina Menne]**

- Info linked to warnings
- Content- advice on diet, fans. ??? how prescriptive?
- Mass Media – web pages, radios, other?
- Ensuring messages reach target groups.
- References could include Ch 9, PWS Guide, EPA Guidebook, EUROHEAT results, etc)

**6. Intervention strategies (Kris Ebi and David Mills)**

- Actions taken following a warning (based on the level of warning)
- Dissemination to agencies ---Hospitals, social services, local govt agencies, utilities, other agencies
- Address issues related to outreach in terms of active contact, cooling centres -
- References: Sari and Kris' table; EPA Guidelines; EUROHEAT results

**7. Evaluation; Effectiveness (Sari Kovats, Francesca de Donato, J. Tan and W. Leung, Christina Koppe)**

- forecast accuracy
- Evaluation of a health-based forecast indicator [false positives]
- Effectiveness of HHWS in terms of life saved
- Evaluation criteria...
- Process evaluation
- Cost effectiveness
- References could include Chapter 10, Guide to PWS

**8. Development of intraseasonal heat health plans (Robin Hicks, Bettina Menne)**

- Pre- and mid-season awareness raising
- Discuss the range of national Heat plans available, common features, e.g. task forces- elements needed for an effective plan ( see Kovats and Ebi, Bernard and McGeehin)
- Reference to include plan of Philadelphia Health Commissioner, Lawrence Robinson and Plan Canicule of France, Queensland Heat Plan, England Heat Plan and EUROHEAT results.
- 'Governance' of heat as a hazard
- references could include strategies for public education and outreach (PWS)

**9. Longer term initiatives for managing heat (McGregor, Jendritzky)**

- Future development of HHWS (S&T) including possible integration of Air Quality forecasts
- Use of specialized centres in developing regional forecasts e.g. RSMCs, RCCs, etc.
- Seasonal forecasts
- Urban and building design (Sue Grimmond and ET 4.4)
- Climate change could exacerbate, bring heatwaves to new regions (McGregor)