

## Chapter 1:

# Introduction

This report addresses the mitigation of short-lived climate forcers (SLCFs) and the role that it can play in air pollution control and near-term climate protection and in achieving sustainable development goals. The focus is on three SLCFs: methane, tropospheric ozone (in the lower atmosphere) and black carbon, all of which have relatively short atmospheric lifetimes and lead to impacts on human health, crops and ecosystems and whose reduction would limit the rate of increase in global temperature over the next two to four decades. Scientific understanding of the role of SLCFs in near-term climate change has improved dramatically over recent years. It is now possible to examine actions that could mitigate SLCFs and that will also bring immediate benefits for health and crop production and, more broadly, benefits for development.

Air pollution continues to have significant health, ecosystem and crop yield impacts across the globe and is estimated globally to cause 1.97 million premature deaths from exposure to particulate matter indoors and 1.15 million deaths from exposure to outdoor particulate matter each year (WHO, 2009). Most of these health impacts occur in developing countries. These countries, in particular, are concerned with the need to protect public health and the environment in a way that is consistent with their development objectives. The policies and measures discussed in this report could reduce the economic burden of air pollution and its associated negative impact on human health and crop yields, as well as limit the potentially negative changes to climate affecting their regions, particularly those related to rainfall patterns (UNEP/WMO 2011).

Control of anthropogenic emissions of carbon dioxide (CO<sub>2</sub>) and other long-lived greenhouse gases, now and further into this century, is critical and must continue. However, the rate of near-term climate change, and the wide range of associated impacts anticipated over the next two to four decades, is a growing threat that also requires immediate attention.

Why is it important to slow down warming in the near term? First of all, current climate change is already leading

to many undesirable impacts: lakes are building up at the foot of melting glaciers in the Himalayas and other glaciated regions and are threatening to burst and cause floods downstream; warmer temperatures are leading to more frequent heat waves; the melting of land ice in the Arctic is contributing to sea-level rise throughout the world; and shifting climatic zones threaten the existence of some plant and animal species. Slowing the rate of warming would slow down the intensification of these impacts. Secondly, near-term warming is pushing us closer to thresholds that may lead to a further acceleration of climate change. For example, the melting of permafrost in the Arctic is releasing additional quantities of methane into the atmosphere (Christensen *et al.*, 2004), which in turn contributes to enhanced global warming. Another example is the melting of the summer Arctic sea ice which is altering the amount of solar radiation reflected over large areas and is likely to lead to climate change at regional and, perhaps, wider scales. By reducing the rate of warming over the next few decades, some of the processes that are accelerating climate change can be slowed, and perhaps it will be possible to avoid exceeding other thresholds. Finally, slowing down near-term warming will give society and nature more time to adapt to climate change. The faster the speed of change, the less time society has to develop drought-resistant crops, re-cultivate wetlands to protect shorelines, or implement flood protection schemes to cope with more frequent river flooding. The faster the rate of change, the more difficult it is for plants and animals to migrate to more climatically suitable areas, and the less time society has to develop and implement the technologies to control CO<sub>2</sub> emissions. Therefore, there is a need to make rapid progress to limit the speed of warming in the near term and full climate protection can only be achieved by addressing both near- and long-term climate change.

Action to reduce concentrations of SLCFs is substantiated by key scientific assessments that analyse how they influence climate and how they impact human well-being around the globe. The analysis in this report

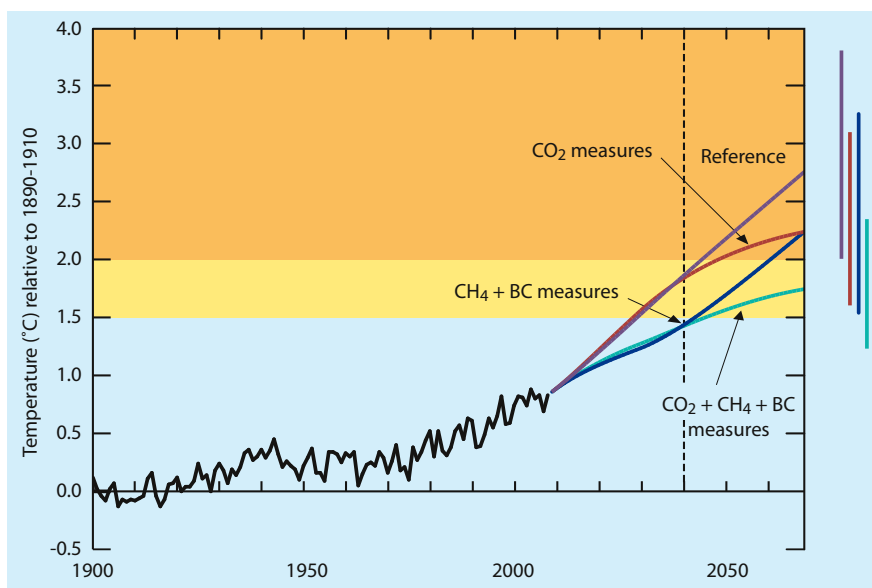
builds upon the *Integrated Assessment of Black Carbon and Tropospheric Ozone* (UNEP/WMO, 2011), and also links to other international assessments and research programmes (HTAP, 2010; Arctic Council, 2011; ABC project: UNEP and C4, 2002, and Ramanathan *et al.*, 2008). In addition, the UNEP/WMO (2011) assessment demonstrated how widespread implementation, worldwide, of a relatively small number of carefully identified measures could achieve multiple goals.

As well as achieving significant health and crop yield benefits, the implementation of identified black carbon and methane measures were shown to significantly slow the rate of near-term climate change. Figure 1.1 illustrates this impact on global temperatures. It also shows that the measures could also increase the chances of remaining below the Cancun Agreement of not exceeding a 2°C increase in global average temperature above pre-industrial levels during the 21<sup>st</sup> century (see the lower line of combined CO<sub>2</sub>+CH<sub>4</sub>+BC measures in Figure 1.1). This figure also illustrates that the major effects of the CO<sub>2</sub> reduction scenario (CO<sub>2</sub> measures in Figure 1.1) on temperature are realised in the longer term whereas the mitigation of SLCFs by black carbon and methane measures slow global warming in the near term.

Recognizing the need to make progress on SLCF reductions, this report examines options for national action, outlining costs and benefits of implementing certain measures and emphasizing the potential facilitating and catalysing roles of regional inter-governmental cooperation and global mechanisms. The main goals of this report are to:

- Identify the benefits of reducing SLCFs, including the global climate benefits of slowing near-term global warming, and the air quality benefits to health and agriculture.
- Identify practical policies and measures, available now, that can effectively reduce SLCFs, in particular emissions of black carbon and the precursors of tropospheric ozone, especially methane.
- Highlight the most effective measures within different regions to reduce SLCF emissions and concentrations and compare the benefits that would offset the implementation costs.
- Review and discuss policies and other actions at the national, regional and global levels that would lead to widespread reductions of SLCFs.

**Figure 1.1:** Observed deviation of temperature to 2009 and projections under various scenarios from the *Integrated Assessment of Black Carbon and Tropospheric Ozone* (UNEP/WMO, 2011). Implementation of the identified black carbon (BC) and methane (CH<sub>4</sub>) measures between 2010 and 2030, together with measures to reduce carbon dioxide (CO<sub>2</sub>) emissions, would improve the chances of keeping the Earth's temperature increase to less than 2°C relative to pre-industrial levels. The uncertainties of the temperature projections in 2070 are shown by the lines on the right hand side<sup>9</sup>



Source: UNEP/WMO, 2011

9. The uncertainty for black carbon on global temperature is greater than for methane, whose impact is relatively well known. It is possible that the impact of black carbon on warming could be around zero, but current knowledge suggests that it is more likely that removing black carbon would provide a net global climate benefit.