

From climate assessment to climate services

MARTIN VISBECK

is at the Leibniz Institut für Meereswissenschaften (IFM-GEOMAR), Kiel, Germany.
e-mail: mvisbeck@ifm-geomar.de

The Intergovernmental Panel for Climate Change has convinced the public that climate change is real. To tackle it, the panel needs complementary climate services that provide continuous climate information for all regions and the globe.

Last Friday, I had to take off my shoes and socks and wade down the inundated jetty to board the ferry across Kiel Fjord on my way to work. The experience prompted a discussion about sea level rise among my fellow ferry passengers — an architect couple who own a house prone to flooding right on the beach, a lawyer who works for a regional bank and a scientist from the Institute of the World Economy. Should we expect to get wet feet more often in a world of global warming? The others turned to me, the oceanographer at hand, for an evaluation of the day's high waters and information on future sea-level scenarios for the Baltic Sea.

The science of climate change is assessed by the Intergovernmental Panel of Climate Change (IPCC) — the body of 2,500 scientists that won the 2007 Nobel Peace Prize for distilling the scientific climate literature into authoritative reports. The panel's latest report includes a section on sea level rise, but it is not helpful in placing an event as regional and short-lived as day-long high sea levels in the Western Baltic in the broader context of climate change.

Using all the publicly accessible local information, I failed to gain a complete picture of the recurrence of such day-long events in the past because the available monthly averages smooth them out. Nor could I say much about the future of single-day high waters in Kiel on the basis of information from the IPCC report. Yet it is the future risk of such regional and often short-lived events that policy makers and, ultimately, the public are interested in.

Of course, the purpose of the IPCC was never to elucidate regional short-lived blips in the weather. Its origin lies in

the recognition of the necessity to keep a close eye on a global climate that was suspected to be changing. In February 1979, the World Meteorological Organization sponsored the First World Climate Conference in Geneva, marking the beginning of international interest in the subject of climate change.

About ten years later, at the Second World Climate Conference in 1988, the IPCC was founded to assess and synthesize scientific information about human-induced climate change, its impacts, and options for adaptation and mitigation. To do this, the panel assesses both established and new areas of climate change research based on peer-reviewed publications, highlighting future research needs and also reflecting consensus. Four assessment reports have been issued since, and in the process, the key conclusions have moved on.

The first report in 1990 suggested that the warming of 0.3 to 0.6°C over the twentieth century is broadly consistent with predictions of climate models, but is also of the same magnitude as natural climate variability. The attribution of the warming to human or natural causes was therefore not clear. By 2007, the IPCC stated, somewhat tortuously, that most (>50%) of the observed increase in globally averaged temperatures since the mid-twentieth century is very likely (confidence level >90%) to be due to the observed increase in anthropogenic greenhouse-gas concentrations and that the probability that this warming is caused by natural climatic processes alone is less than 5%. In essence, we are almost certain that human action has caused climate warming since 1950.

Natural climate variability will make unequivocal detection of the anthropogenic

greenhouse effect unlikely for another decade or more, but the tightening of the uncertainty is becoming smaller and smaller, and perhaps less relevant, between successive reports. Given the enormous effort it takes the scientific community to produce the assessments, compared with the benefits from covering the turnover in scientific knowledge, a comprehensive review every ten years seems ample.

But who, then, is going to answer the multitude of questions arising from regional and episodic weather and ocean anomalies? For example, will the recent sustained drought in southwestern North America continue? For how long will the fast sea-level rise in the northwestern subtropical Pacific carry on? Can the record-low summer sea-ice cover in the Arctic recover during the next decade? Is the thermohaline ocean circulation changing already and how much CO₂ did the ocean sequester during the last five years? Even the current frequency of IPCC assessments every 5–6 years is insufficient to address any of these issues.

Decision makers need much more frequent past and present climate assessments and future projections for their own region — at least annually. The projections need to cover the coming decades and to be calculated for a number of likely trajectories of atmospheric CO₂ levels, to give a range of possible future scenarios. This seems beyond a reasonable charge to the IPCC.

In recognition of this gap, a growing number of countries have expanded the mandates of their (weather) services to provide continuous climate change information, to complement the IPCC process. For example, the Netherlands have launched a 'klimaatportaal' that makes all climate information available at one site.

Several other countries are reorganizing their institutions to provide climate services that bridge the gap between local weather and global climate change information.

Right now these regional-based climate information services are being established mainly in the developed world. However, in the times of a global economy, all areas of the globe need to have adequate monitoring networks and up-to-date assessment and forecasting capability that gives public and private decision makers worldwide the best possible information on likely climatic developments from months to many decades.

Climate services will help with adaptation to climate change and its mitigation. The past political focus on mitigation has suggested that curbing emissions is the only way to avoid disastrous climate change. But the interest in a full evaluation of both adaptation and mitigation measures is growing, partly owing to the realization that, no matter which mitigation strategies we introduce, the climate will be changing over the next few decades — because of the greenhouse gases that are already out there, but also because of natural climate variability. On longer timescales, the amount of mitigation achieved will dictate the magnitude of adaptation that is still required.

The climate services must base their continuous assessments on a set of documented practices evaluated by scientific review. Data from global observing systems form the basis for statistical and numerical procedures which provide a near real-time analysis of the current climatic state, and a perspective on the past and future. A regional climate service should be a 'one-stop shop' for climate information.

The climate services would also allow the verification of governments' self-reported statements of annual global carbon mobilization, reflecting the difference between carbon emissions and carbon sequestration (due, for example, to land use change) in a particular country or region. Without internationally coordinated checking procedures focusing on regional terrestrial carbon budgets, global carbon credits for land use changes cannot be traded in a meaningful way. Such a carbon mobilization information system would use global atmospheric and oceanic climate and carbon information, feed them into models and return terrestrial budgets on subcontinental scales.

A reformed IPCC process needs to embrace the emerging regional climate services. Its decadal assessments should include an evaluation of the procedures used by these newly established institutions and recommend best practices for continuously providing regional climate information for



Flooded docks in Mönkeberg, Germany during a storm surge of 1.3 m elevation. These extreme day-long flooding events in the Baltic are associated with seiches — standing waves in a partially enclosed body of water.

policy makers. The refinement of scenarios for future greenhouse-gas emissions has largely been taken out of the IPCC's remit already, so that the large climate modelling centres can update their future climate projections more frequently. The climate services would then use such multi-model ensembles to calculate likely regional impacts.

Although climate change is a global issue, almost all impacts occur at a regional level. In many cases, long-term trends will remain small when compared with decadal and interannual variability, although their influence will grow with time. Taking changes in atmospheric greenhouse-gas concentrations into account has already been shown to bring a measurable increase in seasonal forecasting skill, and is therefore now standard practice for forecasts of seasonal to interannual climate variability made by the European Centre for Medium Range Weather Forecasting.

One might be tempted to look to the World Meteorological Organization for

wisdom as they prepare for the Third World Climate Conference in October of 2009. "Predicting weather and climate for a changing world" was discussed as a title, but this promising proposal had its wings clipped to exclude medium to long-term assessment. "Climate prediction for decision-making: focusing on seasonal to interannual time-scales" is now the — somewhat narrower — working title. I would argue that the scope of emerging climate services needs to take into account the users' requirements, which extend beyond the seasonal to interannual timescale as well.

If we fully embrace past assessment and ongoing future projections of regional climate change as the task of integrated climate services, the IPCC can be relieved of the duty of providing up-to-date assessments of climate change. This would allow the panel to move to the decadal assessments that best suit its primary task: reviewing emerging scientific knowledge and best practices to evaluate global climate change.