IPCC flooded by criticism

Climate body slammed for errors and potential conflicts of interest.

Just over two years after winning the Nobel Peace Prize, the United Nations panel on climate change is undergoing a period of soul-searching.

The Intergovernmental Panel on Climate Change (IPCC) has always been a target for climate-change sceptics. In recent weeks, however, criticism has mounted and the panel admitted to a glaring error in its last comprehensive report, released in 2007, which says that Himalayan glaciers are likely to melt completely by 2035 (see *Nature* **463**, 276–277; 2010). On top of that, its chairman, Rajendra Pachauri, is under pressure to resign because the institute he directs, the Energy and Resources Institute in New Delhi, has ties with companies that could benefit from climate policies.

In response, many climate scientists — including a number already involved in the next IPCC assessment, due in 2014 — have been putting forward ideas about how the panel might reconsider its rules and procedures. The hope is to reduce errors in the final product and create policies on potential conflicts of interest.

The IPCC had already planned for the next assessment report, known as AR5, to follow the same basic outline as its last one, with three working groups to tackle three areas of

interest: the physical science of climate change, the impacts such change is likely to have and how these might be mitigated. There are two review editors for each chapter and the whole thing will be checked before publication, first by expert reviewers and then by governments. Governments and scientific organizations around the world are looking for people to serve as authors and reviewers; nominations are due by 12 March.

In addition to the Himalayan glacier error, the panel has been accused of saying that climate change has caused an increase in economic losses from extreme weather; the IPCC last week refuted that allegation, saying that a study in one part of the report had been taken out of context. Others have challenged the source of an estimate contained in the report that up to 40% of the Amazonian rainforest “could react drastically” to reduced rainfall.

Those involved in the process say it works well. “The IPCC is a bottom-up process in which hundreds of scientists dedicate their time on a voluntary, unpaid basis to provide an assessment of climate science,” says Thomas Stocker of the University of Bern, co-chair of AR5’s first working group, on the physical science of climate change. “This

The group’s next assessment will focus on the socio-economic effects of climate change.

model has been extremely successful.”

“In my view, the IPCC’s institutional structures and processes are very strong,” adds Pachauri, who says he will not step down as chairman. “What we have to do is to ensure full and complete compliance with the procedures while preparing IPCC’s assessment reports.”

Others say there is room for improvement. Kevin Trenberth of the National Center for Atmospheric Research in Boulder, Colorado, a lead author of the 2007 report, says that critics

Project set to map marks on genome

PARIS

At one time, sequencing the whole human genome seemed almost impossible. But even as it was being completed, biologists were realizing that the genes encoded within it would reveal little about what makes each of us unique.

By 2003, it was clear that the true key to understanding our differences was more likely to be found in epigenomics — the reversible chemical modifications to DNA and its associated proteins that determine when genes can be expressed. And epigenomic studies could open up new research avenues in cancer and other complex diseases.

So it was with some fanfare that top biologists launched the

Chromatin fibres (red) can display epigenetic changes.

International Human Epigenome Consortium (IHEC) in Paris last week, a global consortium that aims, as its first phase, to map 1,000 reference epigenomes within a decade.

“Epigenomes are changeable, programmable and will feed us the bottom line on how the genome works,” says Rob Martienssen of Cold Spring Harbor Laboratory in New York, a member of the consortium’s steering committee. “IHEC is an exciting prospect.”

IHEC is now recruiting members among funding agencies and other organizations to raise US\$130 million for its first phase. Executive-committee members must commit \$10 million over five years, and participants must agree to make their data freely available.

The initiative was spearheaded by the US National Institutes of Health, which launched its \$190-million, five-year Roadmap Epigenomics Program in 2008, and

the European Commission, which in July will publish a call for proposals for a €30-million (US\$42-million) epigenetics consortium, including a large component for reference epigenomes. Representatives from Canada, France, Germany and several Asian countries voiced interest at the launch in joining IHEC.

The consortium faces a much greater challenge than did the Human Genome Project when it was launched in 1990. “The human genome is singular and finite, but the human epigenome is almost infinite — the epigenome changes in different states and different tissues,” says Philip Avner of the Pasteur Institute in Paris, a member of IHEC’s steering committee.

Epigenomics is indeed a complex

BEA WIHART/REUTERS

have grossly underestimated the rigour of the IPCC review process. However, he does say that the reports from the three working groups could be better coordinated.

The reports are done in parallel, even though the impacts working group is supposed to build on the results of the science working group. "Often a separate assessment is done in the [impacts] working group, and results can differ as the expertise is quite different," Trenberth says.

The 2007 error on Himalayan glaciers reflected the lack of coordination: it appeared in the impacts report even though the science

group had not found any peer-reviewed study that reached this conclusion.

Coordination will matter even more for the next assessment, which was set up to focus more heavily on assessing socio-economic aspects of climate change and its implications for sustainable development. As such, issues including water availability, ice-sheet shrinkage and sea level rise are likely to get more scrutiny — and will require more consistent treatment across working groups. The suggested approach, adopted in October 2009, is for each working group to assign a small group of authors the task of coordinating with their counterparts in the other working groups.

However, critics also say that, in the last round, IPCC lead authors ignored comments from reviewers and governments questioning the validity of the glacier claim. For instance, David Saltz of Ben-Gurion University of the Negev in Israel questioned why one sentence in the report said that the Himalayan glaciers would disappear completely, whereas the next said that they would shrink to 100,000 square kilometres. A later note from the writing team said only: "Missed to clarify this one".

Some errors will inevitably creep in, says Jürgen Willebrand, an oceanographer at the Leibniz Institute of Marine Sciences in Kiel, Germany, and a coordinating lead author of the 2007 report. "IPCC reports are written by humans," he says. "I have no doubt that similar

"I have no doubt that similar errors could be found in earlier IPCC reports."

errors could be found in earlier IPCC reports, but nobody has bothered to look in detail because at the time of these reports the IPCC was less visible to society, politics and media." But he says the IPCC should have a more formal process for ensuring each flagged error is dealt with promptly.

He also calls for the IPCC to develop a policy on potential conflicts of interest.

Andrew Weaver, a climate scientist at the University of Victoria in Canada, wants more far-reaching procedural changes. Rather than carrying out "monolithic" assessments, he says, the IPCC should focus on more specific problems such as describing emissions path-

ways required to avoid a given temperature rise. The distinction between different working groups should also be revised, he suggests.

"If you have diverse interdisciplinary teams working on specific problems, then you can have scientists, economists and engineers all looking at a particular problem through the lens of their expertise," he says. "There is so much science out there to assess; it needs to be better focused."

Any such structural changes — or any change in Pachauri's leadership of the group — would need to be approved in the plenary session of the IPCC panel. The next such meeting will take place in October in Busan, South Korea.

Quirin Schiermeier

WARMING SLOWDOWN
Drop in stratospheric water vapour counters greenhouse effect.
go.nature.com/7FxFUgG

ZEMDEGA/ISTOCKPHOTO.COM

business. The human genome comprises strings of coiled DNA supercoiled around histone proteins into dense material called chromatin. Genes can be transcribed only when the chromatin is opened up to expose them, and this process depends heavily on chemical marks — the epigenome. Methyl groups, small non-coding RNAs and other small molecules can all serve to mark the DNA and the chromatin.

Whereas the hard-wired genome is virtually identical in all of a person's roughly 250 different types of tissue and is essentially stable during that person's lifetime, the epigenome changes during development such that each cell type has its own characteristic set of marks. These marks change with age and may also change, possibly in a heritable way, in response to environmental stress. Some diseases, such as cancer, may

be caused by harmful changes to the epigenome, or changes in the epigenome may be a consequence of disease.

The normal variation in the many epigenomes a single person will have in a lifetime, or even during the circadian day, is unknown, and technologies to detect the diverse types of epigenomic mark are still developing. Some scientists at the meeting were therefore concerned that IHEC might be premature.

"But this is exactly the point of launching IHEC now — to avoid confusion and move the field forward more quickly," says Peter Jones, director of the Norris Comprehensive Cancer Center at the University of Southern California in Los Angeles.

The number of publications on epigenomics is growing exponentially, he says, which is

why researchers need to agree now on how to standardize data. "We need a set of high-quality reference epigenomes that everyone can trust, we need to standardize technological approaches and we need to avoid unnecessary duplication," he told the meeting.

Already, the costs of some epigenome technologies are falling rapidly. The first genome-wide map of DNA methylation, or methylome, was published last November (R. Lister *et al. Nature* 462, 315–322; 2009) at a cost of \$100,000, according to lead author Joseph Ecker of the Salk Institute for Biological Studies in La Jolla, California. "I expect the cost of a similar methylome will fall to \$10,000 in the next six months," he says. So IHEC's target budget of \$130 million could allow more than 1,000 epigenomes to be mapped.

At the meeting, project leaders decided that the vast majority of reference epigenomes should be from normal human tissue. "When we have all the references, we'll be able to compare diseased tissue against them," says Avner. The new consortium may ally itself with large genomics consortia such as the International Cancer Genome Consortium to share samples.

IHEC plans to have a final policy document by April, and nominations for the executive and scientific boards by June. The boards will choose the reference epigenomes and decide how to implement open-access policies. They will also ensure quality control and a realistic level of bioinformatics support, given that the scale of the data will dwarf that of the human genome.

Alison Abbott

See Editorial, page 587.