



Unleashing expert judgment in assessment



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ARTICLE INFO

Article history:

Received 17 June 2016

Received in revised form 11 February 2017

Accepted 21 February 2017

Available online

Keywords:

Expert judgment

Assessment

Uncertainties

Intergovernmental Panel on Climate Change

Fifth Assessment Report

ABSTRACT

Assessment evaluates accumulated knowledge and its limits. It informs and ideally empowers decisions and actions on complex, contested issues with persistent uncertainties. Applying rigorous expert judgment is an important dimension of assessment. Here we evaluate advances and challenges in approaches to expert judgment in the Intergovernmental Panel on Climate Change's Fifth Assessment Report (IPCC AR5). We find that revised guidance for author teams improved the development of balanced judgments on scientific evidence across disciplines. In particular, expert judgments underpinning conclusions are more extensively, transparently, and consistently communicated: degree-of-certainty terms are more abundant in AR5 policymaker summaries; wider ranges of possible outcomes are presented with greater inclusion of lower-certainty, decision-relevant findings; and expert judgments supporting conclusions are more comparable across working groups. But challenges in developing and communicating assessment conclusions persist, especially for findings with substantial uncertainties and for subjective aspects of judgments. Based on our evaluations and AR5 lessons learned, we propose a simpler, more rigorous framework for developing and communicating expert judgments in environmental assessment. We also describe practices for reducing expert-judgment biases, for advancing integration of evidence and expert judgment, and for addressing subjective dimensions of expert opinion directly and proactively.

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1. Introduction: Expert Judgment in Assessment

Assessment evaluates accumulated knowledge and its limits, generally on topics transcending disciplinary boundaries and interfaces among science and societies. Through integrative assessment, experts synthesize and communicate understanding for societally important questions. The goal is to frame, support, and empower decisions on complex, contested issues with persistent uncertainties (Mitchell et al., 2006). To increase their relevance and traction, assessment processes often directly include decision-makers. Such two-way, iterative interactions enable experts to understand key decision-making questions and approaches. They can also foster decision-maker understanding of resulting assessment products, bolstering choices and actions. Prominent environmental assessments that have informed diverse public and private decisions include Intergovernmental Panel on

Climate Change (IPCC) reports (e.g., IPCC, 2013a, 2014a,b,c,d), the Millennium Ecosystem Assessment (e.g., MEA, 2005), the Global Energy Assessment (GEA, 2012), the Scientific Assessments of Ozone Depletion (e.g., WMO, 2014), and many other efforts spanning international to local scales.

Rigorous expert judgment is an essential dimension of assessment. Integrating evidence across disciplines, for example, requires evaluating and synthesizing diverse research results, underpinned by different methods, assumptions, terminologies, uncertainties, and analytical strengths and weaknesses. Building from such integration, expert judgment is needed to answer policy- and decision-relevant questions, develop conclusions, and ensure effective communication of the state of scientific understanding. Participating experts must grapple with many sources of uncertainties, evaluating their implications. Sources of uncertainty can include, for instance, measurement error in observations, incomplete understanding of Earth system dynamics, and alternative approaches for modeling impacts, responses, and possible societal development trajectories. Participating experts also must consider appropriate generalizations across results, summaries

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understandable for and relevant to decision-makers, and the social and cultural dimensions of assessment itself. Across such domains, effectively capturing, distilling, and conveying balanced overviews of understanding and uncertainties is not simple.

To support future environmental assessment, here we evaluate advances and challenges in approaches to expert judgment in the IPCC’s Fifth Assessment Report (AR5). Over decades, the IPCC has iteratively refined methods for applying expert judgment to knowledge and uncertainties relevant to climate change (Mastrandrea and Mach, 2011). The aim has been enabling traceable, transparent expert judgments in assessment across the scientific, technical, and socioeconomic literature on climate change, its causes and impacts, and the options for response. In this tradition, the AR5 began with a revisiting and revision of the expert-judgment guidance for authors (Mastrandrea et al., 2010, 2011). In this study, we consider the degree to which the IPCC AR5 moved toward a coherent and comprehensible framework for expert judgment, evaluating successes and failures. Section 2 provides an overview of IPCC AR5’s guidance for expert judgment in assessment. Sections 3 and 4 evaluate its application across working groups, also with comparison to the previous IPCC assessment report (the IPCC’s Fourth Assessment Report, or AR4). Section 5 introduces possible next directions for expert judgment in environmental assessment.

2. The Revised Expert-Judgment Approach for the IPCC AR5

2.1. The IPCC AR5 Framework for Characterizing Knowledge and Uncertainties

Since its first report in 1990, IPCC assessments have included designated terms and other methods to communicate authors’ expert judgments (Mastrandrea and Mach, 2011). Approaches have ranged from broad summary headings to calibrated scales for characterizing degrees of certainty in assessment conclusions. The overall goal has been to facilitate consistent treatment of uncertainties in characterizing and communicating the state of knowledge. Since the Third Assessment Report (2001), authors have worked from shared expert-judgment guidance. The 2013/2014 AR5, however, is the first IPCC report to adopt a single framework (Fig. 1) that could be applied consistently across working groups, spanning diverse disciplines and topics (Mastrandrea et al., 2010, 2011). This shared framework aimed to increase the comparability of assessment conclusions across all topics related to climate change, from the physical science basis to resulting impacts, risks, and options for response.

Building from previous guidance (Moss and Schneider, 2000; IPCC, 2005), the IPCC AR5 framework (Mastrandrea et al., 2010) conceptualizes assessment of scientific understanding and

Evaluation and communication of degree of certainty in AR5 findings

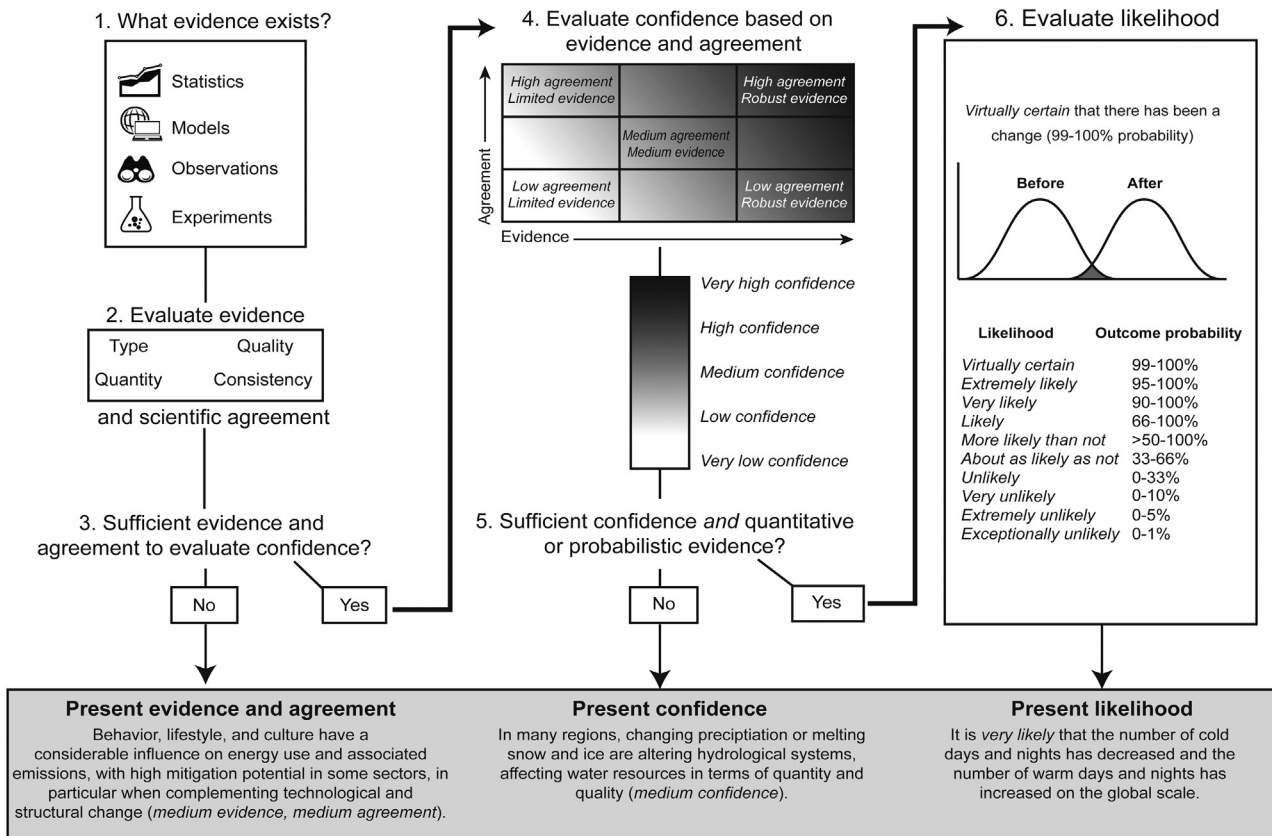


Fig. 1. The IPCC AR5 expert-judgment approach for characterizing assessment findings. This diagram illustrates the process IPCC AR5 authors used to evaluate and communicate the state of knowledge in their assessment (Mastrandrea et al., 2010). The process begins with evaluation of evidence and agreement (steps 1–3). Where possible, authors then evaluate confidence, synthesizing evidence and agreement in one qualitative metric (steps 3–5). Where uncertainties can be quantified probabilistically, authors subsequently evaluate likelihood or a more precise measure of probability (steps 5–6). Note that the likelihood categories should be considered to have “fuzzy” boundaries (step 6; CCSP, 2009; Mastrandrea et al., 2010). Unless otherwise specified, assessment conclusions characterized probabilistically are underpinned by high or very high confidence. Authors present evidence/agreement, confidence, or likelihood terms with assessment conclusions, communicating their expert judgments accordingly. Icons in step 1 were made by Freepik and Sarfraz Shoukat from www.flaticon.com; example conclusions were drawn from the IPCC AR5.

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