Session Title	**Four key components to enable digital intelligence to drive sustainable development: a CODATA discussion session**
Session Description	The major, pressing global scientific and human issues of the 21st century can only be addressed through research that works across disciplines to understand complex systems, and which uses a transdisciplinary approach to turn data into knowledge and then into action. With the growth in digital data and the urgent need to address the major planetary and societal challenges encapsulated in the Sustainable Development Goals, the demand for the reuse of data across domains has risen. The growth of interdisciplinary research attests to this. And yet — in general — science systems and the research infrastructures that serve them struggle to respond adequately to the call for Open Science or to the vision of the FAIR principles, let alone cater properly for interdisciplinary research, and the need to service data to cross-domain users at scale. To address global, complex, interdisciplinary challenges we need science to be furnished with the data and tools that enable digital intelligence to drive sustainable development. This session will cover four key enabling components of that digital intelligence. 1. Aggregation or federation of digital scientific data. 2. Interoperability, integration and reusability of digital scientific data. 3. High quality, provenance rich metadata for AI tools. 4. Transdisciplinary methodologies designed for impact and change. Speakers will explore each of these themes and present a vision of 'total science', powered by digital intelligence. The

	approach draws on a number of CODATA initiatives and collaborations which will be described. The session will conclude with a discussion involving the speakers and participants. Further information about the four key topics is given below. **1: Aggregation or federation of digital scientific data:** A key objective of Open Science is to enable the aggregation or federation of scientific data. Despite some notable successes, and ongoing initiatives in certain research areas, the vision remains only partially realised. The speaker will discuss the objectives of Open Science, the need to aggregate data on many topics, and highlight some notable progress in a number of disciplines. Particular reference will be made to areas relating to sustainable development and to disaster risk reduction. **2: Interoperability, integration and reusability of digital scientific data:** The purpose of the FAIR principles is to maximise the reusability of data. For data to be reused, combined, integrated for interdisciplinary research questions the information requirements in terms of metadata and semantics are significant. The FAIR principles have significantly helped thinking about this, but further work and guidance is needed. The speaker will present the Cross Domain Interoperability Framework (CDIF), a set of practical, implementation-level principles designed to enable interoperability in cross-domain settings. The speaker will describe the current profiles (covering five essential profiles: Discovery, Access, Controlled Vocabularies, Data Description for Integration and Universals), present new work and a number of practical implementations in the context of research around climate adaptation. **3: High quality, provenance rich metadata for AI tools:**

	A lot of work is going on to improve the richness, quality and standardisation of metadata and semantics in order to make data sets 'AI ready'. At the same time, the potential of generative AI is being explored precisely to enrich metadata and semantics. Exercising caution in this endeavor is critical, however, as the quality of the outputs is directly tied to the quality of the underlying data and documentation. Exercising caution in this endeavor is critical, however, as the quality of the outputs is directly tied to the quality of the underlying data and documentation. The speaker will discuss the urgent interaction (and even codependency) between high quality metadata and semantic richness on the one hand and Generative Artificial Intelligence (AI) and Large Language Models (LLMs) on the other. **4: Transdisciplinary methodologies designed for impact and change:** In the face of urgent global challenges around sustainable development, the International Science Council (ISC) has called for a revolution in the science model. This includes 'big science' investment in sustainability studies, but also the adoption of an approach that includes end users, citizens, decision-makers and implementers throughout the research process. The speaker will discuss the ISC initiative and related activities, and present examples of initiatives using transdisciplinary and impact oriented methodologies.