

CCI views and activities related to global climate indicators



WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

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With valuable input from Maxx Dilley &
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● Annual Statement on the State of the Global Climate

- New CCI role
- WMO-UNFCCC Memorandum of Understanding
- SoC Report and indicators

● Alignment with IPCC and the Global Stocktake

- Scientific paper to promote alignment with IPCC Assessments
- IPCC Task Group on the Organization of the Future Work of the IPCC in Light of the Global Stocktake

● Climate science basis for climate rationales for all GCF projects

- WMO-GCF agreement
- Climate rationale elements

Annual Statement on the State of the Global Climate

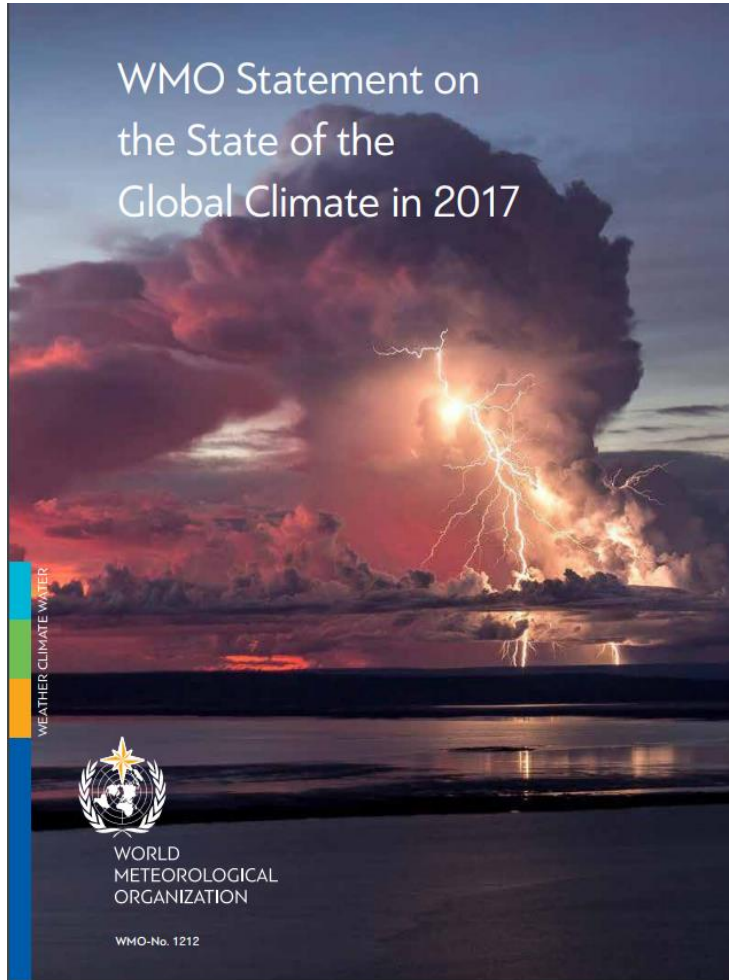
● Role of the Commission for Climatology

- At the CCI-17th Conference was approved Resolution 8 on Climate information for policy processes and decision support, deciding:

To develop guidance material for Members for in the provision of climate information for high-level climate policy processes and decision support, on the past, present and future status of key climate features, such as headline indicators on the state of the climate system, sector-specific climate indices and extreme climate events

- The **WMO Annual Statement on the State of the Global Climate** is an example **flagship** product in this respect, compiled from inputs provided by WMO Members and the WMO community, encouraged and guided by CCI

WMO Reporting on Climate Change Indicators



Values of key climate indicators

Indicator	Time period	Value	Ranking
Global mean surface-temperature anomaly (1981–2010 baseline)	2017, annual mean	+0.46°C	Second-highest on record
Global ocean heat content change, 0–700 metre layer	2017, annual mean	1.581 x 10 ²³ J	Highest on record
Global mean CO ₂ surface mole fraction	2016, annual mean	403.3 parts per million	Highest on record
Global mean sea-level change since 1993	2017, December	8.0 cm	Highest on record
Arctic sea-ice extent summer minimum	2017, September	4.64 million km ²	Eighth-lowest on record

- Since **1993**, WMO has released **annual** and **multi-year Statements** on the State of the Global Climate
- These reports **provide updated** climate information annually, 5 years, **complementing** the **IPCC ARs**
- The Statements draw primarily on **input** and **observations** from **NMHSs** and partners.
- They are regular updates on key climate indicators and extreme events, translated into six languages.

Annual Statement on the State of the Global Climate

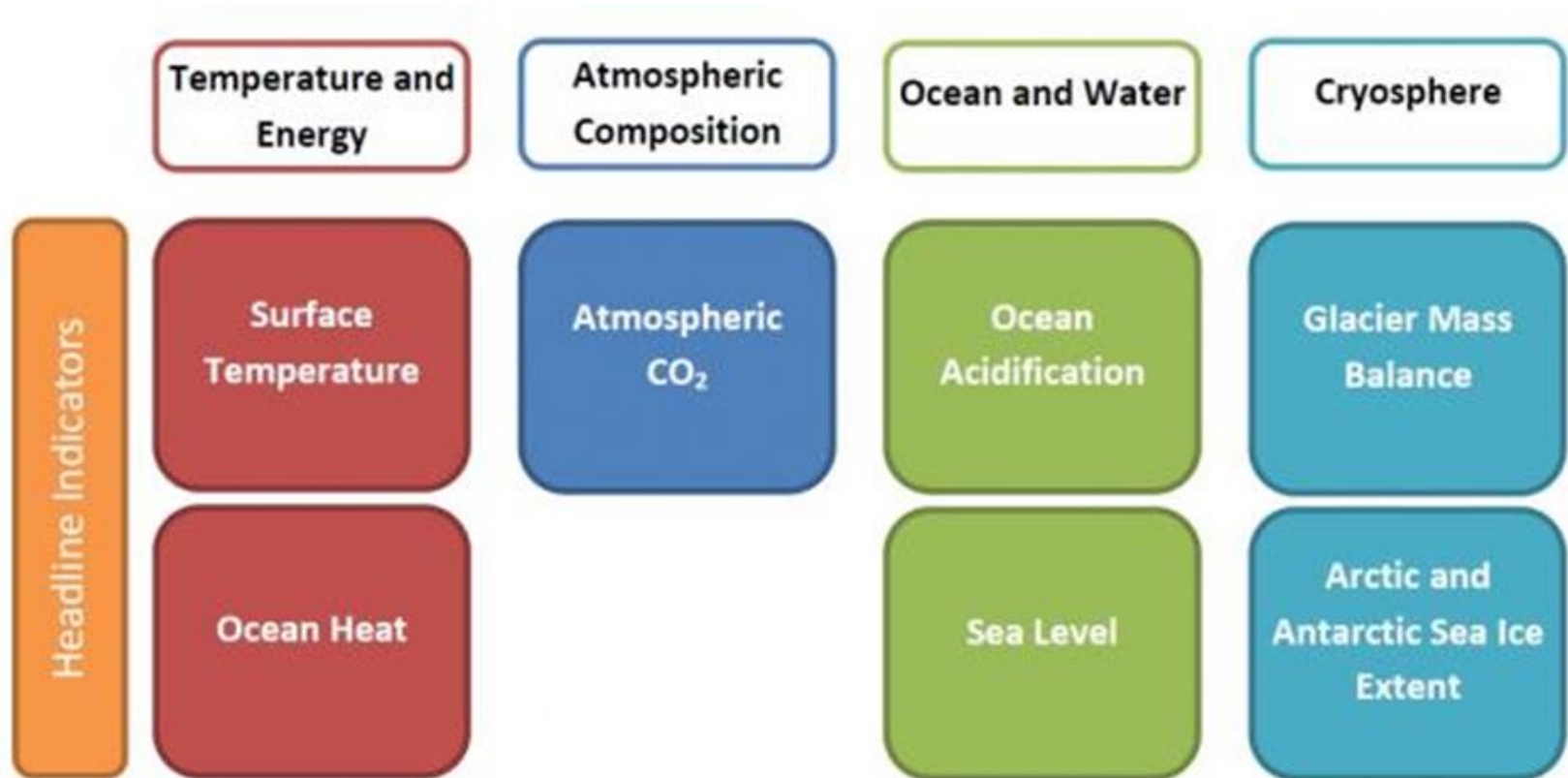
● Annual climate statement in UNFCCC context

- SBSTA-45 invited WMO to **provide submissions** on the state of the global climate on a **regular basis** to fill information gap between ARs' longer cycles

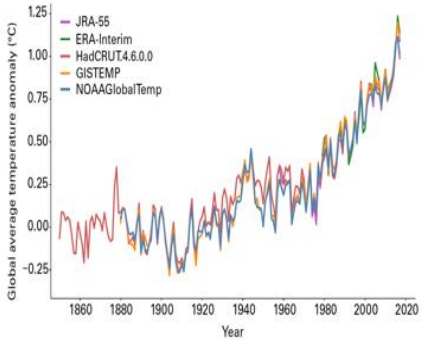
● WMO-UNFCCC MoU

- Signed at COP 23 in Bonn
- An overarching framework encompassing:
 - **Research** and **evidence** to **support** climate policy-making and investment
 - Technical **cooperation** on **data, tools** and **methods** to improve climate products and services for mitigation and adaptation
 - Frameworks and mechanisms for **capacity-building** at the regional and national levels
- **One** of **four** specific “**collaborative projects**” defined under the MoU concerns **annual** reporting on the **state of the climate**, to be regularly presented at the **Conference of Parties** meetings and during **Research Dialogues** and other for a
- WMO and UNFCCC are collaborating on further **introducing** the **report** into **UNFCCC processes**

Global Headline Climate Indicators featured in the WMO annual climate statement *Definition based on GCOS concept*

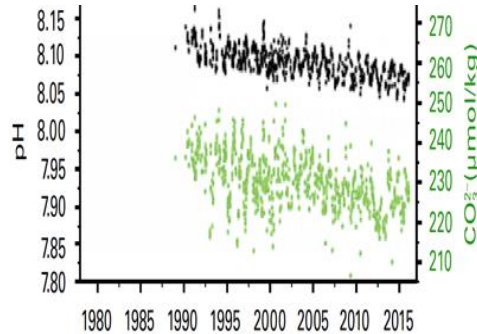


Mean Temperature



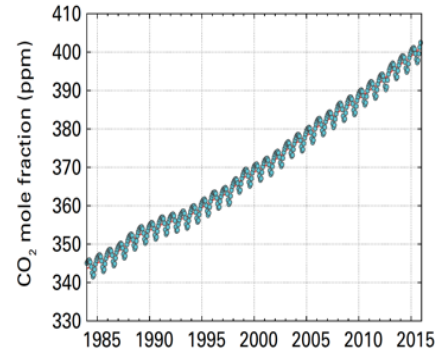
Global mean temperature anomalies, wrt 1850–1900 baseline, for 5 global datasets (Source: UK Met Office Hadley Centre)

Ocean Acidity



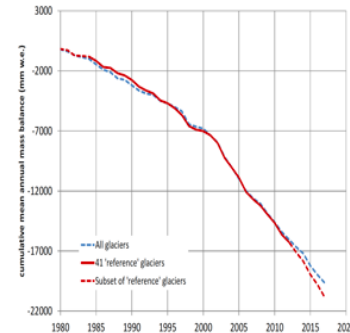
Trends in surface (< 50 m) ocean carbonate chemistry calculated from observations obtained at the Hawaii Ocean Timeseries (HOT) Program in the North Pacific over 1988–2015. Seawater pH (black points) and carbonate ion

Atmospheric CO₂



Globally averaged mole fraction (measure of concentration), from 1984 to 2016, of CO₂ in ppm (left). Source: WMO Global Atmosphere Watch)

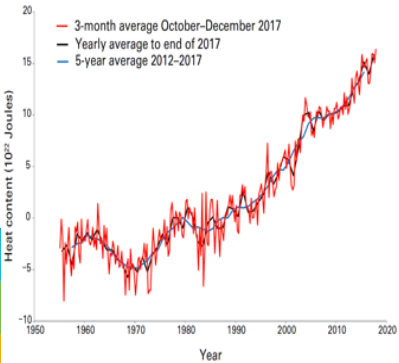
Glacier Mass Balance



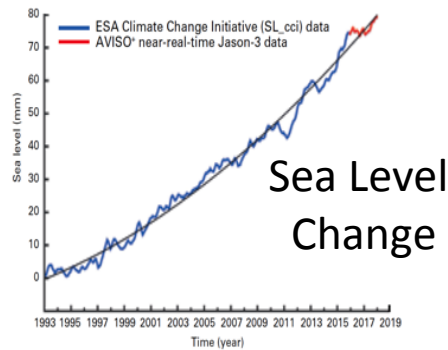
Mean cumulative mass balance of all reported glaciers (blue line) and the reference glaciers (red line). SOURCE: world glacier monitoring service <http://wgms.ch/>

The report includes analysis of trends and variability in the indicators' time series

Ocean Heat Content



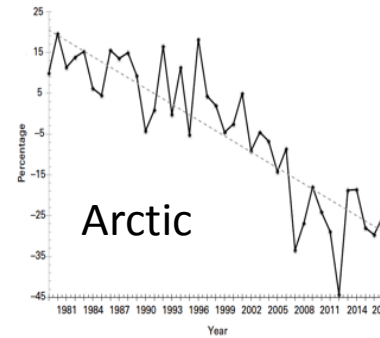
Global ocean heat content change (x 10²² J) for the 0–700 m layer: 3-monthly means (red), and annual (black) and 5-year (blue) running means, from the NOAA dataset. (Source: prepared by WMO using data from NOAA NCEI)



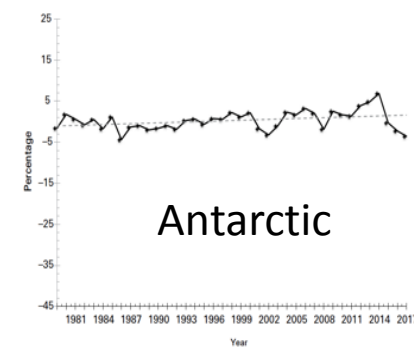
Sea Level Change

Global mean sea-level series (with seasonal cycle removed), 1993–Jan 2018, from satellite altimetry multi-missions. Data from AVISO (Source: Collecte- Localisation-Satellite (CLS) – Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS))

Sea Ice Extent



Arctic



Antarctic

September sea-ice extent for the Arctic, and (right) September sea-ice extent for the Antarctic. % of long-term average of the reference period 1981–2010 (Source: prepared by WMO using data from the US National Snow and Ice Data Center)

Inclusion of Extreme Events and Climate Change



There is currently **no agreed-upon single indicator** to use for characterizing the **status of extreme event globally**. However an important aspect in reporting on the State of the Climate Indicators is **identifying the link** between **climate change** with observed **high impact events**, such as HW, CW, Droughts, Storms, Heavy Precipitation, Floods, ... **Statistical and model analysis** of these events can provided useful **information** on the extent to which anthropogenic **climate change** had likely **influenced its trigger** or the **magnitude** of the observed extreme events. Also the analysis can contribute, on the cases when there is no evidence of the role of anthropogenic climate change, in explaining the occurrence and magnitude of the events

Attribution to anthropogenic climate change ?

SoC also reports on high impact events

Although SoC **doesn't include** formally defined **global impact indicators**, in **2016** WMO initiated **collaboration** with several **UN agencies** for including information on impacts (agriculture and food production, humanitarian aspects, migration and population displacements, health, environmental & economic aspects). It **includes a summary** on **climate related risks and impacts**. **Greater standardization** of these impacts would be highly **beneficial**.

In collaboration with UN Agencies on impacts

- FAO
- IMF
- IMO
- IOC/UNESCO
- UNEP
- UNHCR
- UNISDR
- WHO
- WFP



● **Scientific paper to promote alignment with IPCC Assessments**

- Climate indicators as part of the Earth Monitoring System
- Assessing Climate Indicators
 - Data Collection (ECVs)
 - Scientific issues: baselines, reference periods
 - Data sets development and versioning
 - WMO Catalogue of Maturity Assessed Datasets
 - Data Infrastructure (NMHSs, WDCs, RCCs, Collaborative international)
 - National, regional and global expertise
 - Inter-agency collaboration
- Reporting on Climate Indicators
- Conclusion and way forward

● **IPCC Task Group on the Organization of the Future Work of the IPCC in Light of the Global Stocktake**

IPCC has invited Observer Organizations to identify and share, by 30 November, possible options for organizing and scheduling the future work of the IPCC in light of the global Stocktake





Climate Rationales for Enhanced Climate Science in Decision-Making Processes

Paris Agreement

(sub-paragraph 7(c)) mentions: “..**strengthening scientific knowledge on climate**, including **research, systematic observation** of the climate system and **early warning systems**, in a manner that **informs** climate services and supports decision-making..”

At B.07/04 (b) (iii)

Board Decision mentions the need for: “... increased generation and use of climate information in decision-making..”

At B.19/06

Board called on the Secretariat to develop an integrated approach to enhance the climate rationale of GCF-supported activities.

WMO & GCF signed a USD 1.4M agreement to develop & test a methodology to ensure all GCF projects include a climate rationale founded on the best available climate science

Climate rational climate science inputs

Annex 1 Climate rationale climate science basis: input data and products for country level use

Data and products type	Past/present	Predicted/Projected
<p>State of the climate indicators</p> <p><i>Description:</i> “Headline” indicators characterizing the state of the climate system</p> <p><i>Example data and products:</i> means, trends and variability of surface temperature, precipitation, sea-ice extent, glacial extent, sea level, ocean heat content and acidity</p> <p><i>References:</i> GCOS, WMO State of the Climate Reports, IPCC reports</p> <p><i>N.B.</i> A number of these are also considered indicators for tracking slow onset events under the Warsaw International Mechanism for Loss and Damage</p>	<p><i>Sources:</i> National Climate Monitoring Products, global data sets including re-analyses, Global Data Processing and Forecasting System (GDPFS), satellite data, and blended products</p> <p><i>Access:</i> National data bases, Regional Climate Centres, World Climate Data Centres, global climate monitoring centres</p> <p><i>Technical/processing requirements:</i> Data rescue, homogenization, continuously updated time-series, Climate Services Toolkit, climate data management system, infrastructure for downloading and processing large data sets</p>	<p><i>Sources:</i> Coupled Model Inter-Comparison Project (CMIP), Coordinated Regional Climate Downscaling Experiment (CORDEX), IPCC assessments</p> <p><i>Access:</i> Collaborating global and regional research and operational centres, and academia</p> <p><i>Technical/processing requirements:</i> Model validation and verification on a regional basis, infrastructure for downloading and processing large data sets</p>
<p>Sector- and impact-specific indexes</p> <p><i>Description:</i> Additional climate-related indexes associated with specific socio-economically relevant outcomes - identify for important sectors their main risks and appropriate indices</p> <p><i>Example data and products:</i> Information relevant for climate-sensitive sectors, derived from ClimPACT indices, Essential Climate Variables (soil moisture, humidity, vegetation, streamflow, solar radiation, wind speed), sector-specific indices, and others, depending on the particular context</p> <p><i>References:</i> Global Framework for Climate Services Implementation Plan, GCOS Essential Climate Variables, WMO Commission for Climatology</p>	<p><i>Sources and access:</i> Same as above, but including products derived from reanalysis and sectoral information</p> <p><i>Technical/processing requirements:</i> Establishing the contribution of a particular climate-related indicator or group of indicators to a socio-economic or environmental outcome requires having additional data, both on the outcomes as well as on other factors which may contribute to that outcome, in order to establish the climate-outcome relationship and decision support needs</p>	<p><i>Sources and access:</i> Same as above and impact modelling</p> <p><i>Technical/processing requirements:</i> For climate change time-scales, requires assumptions about the future evolution of non-climatic factors, many of which do not have a known scientific basis for projecting into the future</p>
<p>High-impact events</p> <p><i>Description:</i> Events potentially associated with significant and widespread, multi-sectoral, impacts (also known as extreme events), which can be characterized in terms of magnitude, location, duration, timing and frequency</p> <p><i>Example data and products:</i> Indices for characterizing heatwaves, floods, droughts, storms, severe weather, etc. and their return periods</p> <p><i>References:</i> Indices of frequency & severity of these events e.g. CCI/WCRP/JCOMM ETCCDI, event types as per Resolution 9, 17th World Meteorological Congress</p>	<p><i>Sources:</i> Event catalogues, extraction of events from climate databases, derived from above; WMO State of the Climate reports</p> <p><i>Access:</i> National holdings, WMO Regional Climate Centres, global climate data and monitoring centres, research institutions</p> <p><i>Technical/processing requirements:</i> Probabilistic assessment of event frequencies and intensities based on reanalysis. Association of local events with larger scale synoptic events, the latter of which may be trans-boundary, assignment of unique event identifiers, association of events with impacts</p>	<p><i>Sources and access:</i> Same as above</p> <p><i>Technical/processing requirements:</i> Probabilistic assessment of event frequencies and intensities based on projected climatic tendencies. (N.B. Impacts are a function not only of the characteristics of the events but also of the degree of exposed societal assets and their vulnerabilities)</p>

set of standard “headline” indicators

group of sector-specific indexes

high-impact events

Additional considerations: degree of societal exposure and vulnerability to the prevailing and anticipated climate conditions, non-climate-related considerations such as development priorities, feasibility of various response options in light of prevailing capacity and financial constraints, opportunity costs of action

What will the work entail?

phase

1

- Assemble a fully elaborated climate rationale concept and methodology with expert input from CCI and other TCs, GCOS, WCRP, NMHSs, and regional and global centers
- Compile methodologies and data sources for each element of the rationale
- Provide a methodological overview of the compiled materials and a structured access to them
- Test methodology and its constituent materials in five countries/cases (tentatively Antigua and Barbuda, Colombia, Democratic Republic of Congo, Nepal, and Tanzania)

phase

2

Incorporate and summarize outputs of Phase I into GCF guidance and policy documents

phase

3

Develop a costed proposal for rolling out support for climate rationale preparation on a global scale & supporting implementation of climate rationale into country-level decision-making processes

**Thanks for attention
Questions?**