

Report of the United Nations Secretary-General on

Oceans and the Law of the Sea 2020

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Contribution by the World Meteorological Organization (WMO)

based on data provided by National Meteorological **add** Begical Services and other national and international organisations. MMO Provisional Statement on the State of the Global Climate in 2019 (released in December at the 25th Conference of the Parties of the UNFCCC, Madrid, Spain), indicates that:

- B Sea level has increased throughout the satellite altimetry record, but the rate has increased over that time, due partly to melting of ice sheets on Greenland and Antarctica.
- B In October 2019, the global mean sea level reached its highest value since the beginning of the high-precision altimetry record (January 1993).
- B As the ocean warms, sea levels rise. This rise is further increased by melting of ice on land, which then flows into the sea. Short-term trends in sea level are modulated by transitions between La Niña and El Niño, a cooling and warming, respectively of the central and eastern Pacific Ocean surface temperature.
- B During the period of the Northern Hemisphere Autumn of 2019, the global mean sea level reached its highest value since the beginning of the high-precision altimetry record (January 1993).

The 2019 Provisional Statement has a section dedicated to sea level rise (pp 8-9):

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level acceleration.

Interannual variability in sea -level rise is mainly driven by the El Niño Southern Oscillation (ENSO). Du ring El Niño, water from tropical river basins on land is transferred to the ocean (e.g., in 1997, 2012 and 2015). During La Niña, the opposite occurs, with a transfer of water from the ocean to land (e.g., in 2011). Sea level rise is not regionally

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around the globe. It was established by the WMO, with the secretariat based at the WMO in Geneva. With the clear links between melting ice sheets/glaciers and resultant sea level rise, the Global Cryosphere Watch is informing the knowledge and rate of change in the cryosphere and subsequently a critical activity for estimating the projected rate of changes in sea level in the future. Understanding the causes of these changes, and

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The Ice Sheet Mass Balance and Sea Level (ISMASS) project is to promote the research on the estimation of the mass balance of ice sheets and its contribution to sea level; The Ice Sheet Model Inter-comparison Project (ISMIP) activity fills a need for international coordination in the evaluation and testing of large-scale ice sheet models and the development of consistently-applied test cases and diagnostics.

<u>OOPC</u>

The Ocean Observations Panel for Physics and Climate (OOPC) - secretariat also based in the GCOS office at WMO - has the role of providing scientific recommendations and reviewing the implementation of the ocean observations required for climate in support of its 3 sponsors: GCOS, GOOS, and the WCRP. Through this, the OOPC also supports the work contributing to observations and research into the state of global sea level. 10:09:

Satellite s

As noted above, sea level continues to rise at an accelerated rate as shown by altimeter satellites. The total elevation of the global mean se \mathbf{a} level over the altimetry era (since January 1993) has reached 90 mm. To monitor this situation, WMO works closely with the global space agencies communities (the Coordination Group of Meteorological Satellites ±CGMS, and the Committee on Earth Observation Satellites ±CEOS) with the membership covering all national and global operational space agencies. Significant sources of information are at the following websites:

AVISO satellite altimetry data website Jason-3 satellite for sea level rise

IPCC Special Report on the Ocean and Cryosphere

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations scientific body for assessing the science related to climate change. It is co-sponsored by WMO and UN Environment, with the secretariat based at the WMO in Geneva. Experts from around the world form the Working Groups are investigating the science. In 2019, the IPCC released the Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC), which was prepared following an IPCC Panel decision in 2016. Regarding Sea Level, the report clearly indicates that:

- B The Global Mean Sea Level (GMSL) is rising, with acceleration in recent decades due to increasing rates of ice loss from the Greenland and Antarctic ice sheets (very high confidence), as well as continued glacier mass loss and ocean thermal expansion.
- B Increases in tropical cyclone winds and rainfall, and increases in extreme waves, combined with relative sea level rise, exacerbate extreme sea level events and coastal hazards (high confidence).

Further information can be found in the <u>SROCC Full Report</u> and the <u>Summary for Policy</u> Makers.

 (ii) Observed and projected environmental, social and economic impacts and resulting challenges relating to sea - level rise;

B Sea level rise and impacts in coastal areas

Rising sea levels have significant impacts along coasts. These impacts include the physical/environmental impacts, and as well, resulting social and economic challenges to coastal communities.

In addition to the WMO activities outlined above, WMO recognises the challenges to coastal areas and vulnerable communities living and or/with livelihoods reliant on the coastal zone. Of note, coastal inundation is one of the priority areas being addressed by WMO, to assist Members to improve resilience to coastal flooding whilst reducing the impact of these disasters.

Coastal inundation - on various time scales - occurs from multiple sources, including from storm surges, swell, seiching, inland river flooding on the coast, tides, sea level rise and even tsunamis. With predicted rising sea levels, coastal floods will be exacerbated with potentially more land becoming inundated. In the face of a changing climate, storms and extreme maritime weather (including trepical cyclones) are becoming more frequent and intense, which is resulting in more frequent and severe coastal flooding and erosion events - especially in soft sedimentary coastal zones. Similarly, accelerated sea level rise will mean larger swathes of coastal land will be flooded during these events, exacerbating coastal erosion and loss of land and direct impact to property, infrastructure, livelihoods and life along the coast.

Economic losses in coastal zones are particularly associated with tropical cyclones. The 2017 Atlantic hurricane season was one of the most devastating on record with more than US\$ 125 billion in losses associated with Hurricane Harvey alone. On the Indian Ocean, in March and April 2019, unprecedented and devastating back-to-back tropical cyclones hit Mozambique. Related to this, the WMO Secretary-General (and co-chair of the Science Advisory Group of the UN Climate Summit) stated that:

<u>36HD OHYHO ULVH KDV DFFHOHUDWHG DQG ZH DUH FRQFH</u>UQHG WH Antarctic and Greenland ice sheets...will exacerbate future rise. As we have seen this year with tragic effect in the Bahamas and Mozambique, sea level rise and intense WURSLFDO VWRUPV OHG WR KXPDQLWDULDQ DQG HFRQRPLF FDWDVW

 (iii) Opportunities in responding to those challenges, including through cooperation and coordination at all levels on scientific, technical, technological, and financial aspects and capacity - building

As detailed above, WMO has been responding to the challenges of accelerated sea level rise, to support WMO Members, through cooperation and coordination internationally across scientific, technical, technological and capacity development. Further examples beyond the ongoing activities/initiatives previously mentioned g-18p(ri)vioat:

Coastal Inundation

Efforts to improve early warnings for coastal inundation have been a focus of WMO for the past decade through the <u>Coastal Inundation Forecasting Demonstration Project</u> (<u>CIFDP</u>). The CIFDP was successfully completed in Bangladesh, the Caribbean, Indonesia and Fiji demonstrating the value of considering multiple sources of coastal inundation in a Multi-Hazard Early Warning System (MHEWS). It included consideration of sea level impacts, including projected future rise and impacts on coastal flooding. Building on the success of the CIFDP, WMO will continue in the future poastal Inundation Forecasting Initiatives ¶(CIFI). This will ensure vulnerable coastal countries are able to strengthen their early warning systems for coastal hazards. WMO is also working with the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG) in relation to this. Ultimately, the CIFI will be integrated into broader MHEWS for all types of flooding and severe weather impacts.

WMO is committed to developing the capacity of its Members to improve awareness of coastal hazards (inclusive of sea level impacts). One such initiative is the public awareness coastal flooding video launched by WMO to support vulnerable coastal communities in the Pacific Islands, and which will be expanded soon to other regions of the world.

WMO is also currently developing a capacity development course specifically aimed at strengthening the capacity of National Meteorological and Hydrological Services responsible for marine and coastal services. Developing the capacity of these Members to deliver robust coastal services will ensure understanding and adaptation to the impacts from issues such as accelerated sea level rise.

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WMO/IMO Symposium on Extreme Maritime Weather

WMO and the International Maritime Organisation (IMO) jointly organized the firstInternational Symposium on Extreme Maritime Weather: Towards theSafety of Life atSea and a Sustainable Blue Economyin October 2019, at the IMO Headquarters, London.

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