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PARTE A

(TRADUCCIÓN AL ESPAÑOL Y POR ESCRITO DE UN TEXTO EN INGLÉS SIN DICCIONARIO)

Ocean-Climate Nexus

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The ocean is a thin layer of saltwater that envelopes 71% of the Earth and contains 96% of its water. It contains the most varied biodiversity on the planet and is responsible for around 50% of gross primary production. It also acts as the Earth's thermostat, absorbing and transforming a significant portion of the radiation from the sun that reaches the Earth's surface. It provides water vapour to and exchanges heat with the atmosphere, shaping the Earth's weather and climate and its variability over a range of time scales, from hours to millennia. It mitigates climate change by absorbing almost all the excess heat and a quarter of the CO_2 produced by human activities.

The ocean receives heat from the sun electromagnetic radiation, mainly in the tropical regions. There is a constant back and forth exchange of water, energy and carbon between the ocean surface and the atmosphere at all latitudes where it is not ice-covered. The ocean is not static and ocean currents redistribute the excess heat received in the tropics towards higher latitudes, and towards the deep ocean. This transport is stronger at high latitudes – in polar regions – where surface waters become denser and sink, mainly due to high heat losses. The time scale of the transport and redistributions is highly variable, from season or year in tropical regions to a decade in the surface layers, and several hundred years, even thousands of years in the deep layers.

The global transport of heat, fresh water and carbon through the ocean is not only comparable in size to that of the atmosphere, but the ocean is the main reservoir of these properties for the atmosphere. The continuous ocean-atmosphere exchange of these properties and their storage in the ocean makes the ocean a key regulator of weather and climate at every time scale (from minutes to millennia), extending the predictability of the Earth system at these scales. Seasonal and decadal prediction systems rely principally on accurately forecasting the fast dynamic and slow ocean modes of variability and their role in modulating the atmosphere. In order to ensure skilful – useful – predictions, models must be initialized with the ocean observations.

Timely and sustained ocean observations, both satellite and in situ, are crucial for the development of skilful predictions that meet societal expectations and needs.

Modificado de The Ocean, Our Climate and Weather, 18, Vol. 70 (1) – 2021, WMO Bulletin.

PARTE B

(RESUMEN EN INGLÉS DE UN TEXTO LEÍDO A LOS OPOSITORES EN INGLÉS)

Is the Climate Becoming More Extreme?

While there is evidence that increases in greenhouse gases have likely caused changes in some types of extremes, there is no simple answer to the question of whether the climate, in general, has become more or less extreme. Both the terms 'more extreme' and 'less extreme' can be defined in different ways, resulting in different characterizations of observed changes in extremes. Additionally, from a physical climate science perspective it is difficult to devise a comprehensive metric that encompasses all aspects of extreme behaviour in the climate.

One approach for evaluating whether the climate is becoming more extreme would be to determine whether there have been changes in the typical range of variation of specific climate variables. For example, if there was evidence that temperature variations in a given region had become significantly larger than in the past, then it would be reasonable to conclude that temperatures in that region had become more extreme. More simply, temperature variations might be considered to be becoming more extreme if the difference between the highest and the lowest temperature observed in a year is increasing. According to this approach, daily temperature over the globe may have become less extreme because there have generally been greater increases in mean daily minimum temperatures globally than in mean daily maximum temperatures, over the second half of the 20th century. On the other hand, one might conclude that daily precipitation has become more extreme because observations suggest that the magnitude of the heaviest precipitation events has increased in many parts of the world. Another approach would be to ask whether there have been significant changes in the frequency with which climate variables cross fixed thresholds that have been associated with human or other impacts. For example, an increase in the mean temperature usually results in an increase in hot extremes and a decrease in cold extremes. Such a shift in the temperature distribution would not increase the 'extremeness' of day-to-day variations in temperature, but would be perceived as resulting in a more extreme warm temperature climate, and a less extreme cold temperature climate. So the answer to the question posed here would depend on the variable of interest, and on which specific measure of the extremeness of that variable is examined. As well, to provide a complete answer to the above question, one would also have to collate not just trends in single variables, but also indicators of change in complex extreme events resulting from a sequence of individual events, or the simultaneous occurrence of different types of extremes. So it would be difficult to comprehensively describe the full suite of phenomena of concern, or to find a way to synthesize all such indicators into a single extremeness metric that could be used to comprehensively assess whether the climate as a whole has become more extreme from a physical perspective. And to make such a metric useful to more than a specific location, one would have to combine the results at many locations, each with a different perspective on what is 'extreme.'

A number of different metrics have been considered to avoid these problems, and thereby allow an answer to this question. One approach is to count the number of record-breaking events in a variable and to examine such a count for any trend. However, one would still face the problem of what to do if, for instance, hot extremes are setting new records, while cold extremes are not occurring as frequently as in the past. In such a case, counting the number of records might not indicate whether the climate was becoming more or less extreme, rather just whether there was a shift in the mean climate. Also, the question of how to combine the numbers of record-breaking events in various extremes (e.g., daily precipitation and hot temperatures) would need to be considered. Another approach is to combine indicators of a selection of important extremes into a single index, such as the Climate Extremes Index (CEI), which measures the fraction of the area of a region or country experiencing extremes in monthly mean surface temperature, daily precipitation, and drought. The CEI, however, omits many important extremes such as tropical cyclones and tornadoes, and could, therefore, not be considered a complete index of 'extremeness.' Nor does it take into account complex or multiple extremes, nor the varying thresholds that relate extremes to impacts in various sectors.

Modificado de Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Special Report of the Intergovernmental Panel on Climate Change, Chapter 3: Changes in Climate Extremes and their Impacts on the Natural Physical Environment, FAQ 3.1 | Is the Climate Becoming More Extreme? Pag.124-125