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SEA LEVEL RISE – HOW FAR AND HOW QUICKLY?
THE POTENTIAL IMPACT ON THE INDO-PACIFIC REGION

BY PETER C. OLESON

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Using geological evidence from the last interglacial period approximately 125,000 years ago, researchers at the Australian National University have concluded in an article published in *Nature Communications* that sea levels were 10 meters (32.8 feet) higher than today. These results could upend current estimates of sea level rise, since the Earth's temperature then was only 1 degree Celsius higher than today, and the current CO2 level, a critical factor in global warming, is 410 ppm vs 280 ppm at that time. One of the crucial factors identified was the melting of Antarctic ice, which recent observations indicate is occurring faster than anticipated.

The UN Intergovernmental Panel on Climate Change (IPCC) in 2014 estimated that sea level rise by the year 2100 would be 1 meter, but such estimates depend greatly on underlying assumptions. Most estimates of future sea level rise are based on tidal data of the past century and more recently on satellite data. This does not account for previously unobserved sudden disruptions, such as rapid concurrent melting of both Antarctic and Greenland/Arctic ice.

If correct, the Australian research could have striking implications for the region. Coastlines and their urban infrastructures are far more exposed than thought. In an editorial, the *Washington Post* (Oct. 21, 2019) wrote that the threat of flooding will come far sooner than 2100, citing significant impacts by 2050 that will affect more than 300 million people. A quick analysis, using an interactive flood map (www.floodmap.net) set at 10 meters indicates the following:

- Most islands in Oceania will be severely impacted, and most in Micronesia and the Marshalls will be gone. Large parts of Papeete will be flooded, including its airport. Large parts of American Samoa will be underwater, as will coastal areas of Guam, impacting US naval and air facilities.

- Large parts of downtown Tokyo and Yokohama will be submerged. Nagoya and Osaka will also have widespread flooding.

- Much of Shanghai will be permanently underwater, as will large areas north and south of the metropolis. Kowloon in Hong Kong, most of Macau, and almost all of Guangzhou will be inundated.

- In Vietnam, the entire peninsula south of Ho Chi Minh City, as well as most of the city itself, will be flooded to significant depths.

- Bangkok will disappear. The same is true for Jakarta. Most of Manila will be submerged.

- Significant portions of Singapore will be underwater.

- In South Asia, the delta south of Dhaka will be reclaimed by the sea, as will most of the city and large rural areas to the north and east of the city. Almost all of Kolkata will be underwater. Most of Mumbai will be gone as will be most of Karachi.

- In Australia, most of Darwin will be flooded. Large parts of Brisbane, including its airport, will be underwater. Large parts of Auckland, New Zealand, will be reclaimed by the sea.

- Along the North American coast, much of Valdez, Alaska, and downtown Juneau will be flooded; the entire Richmond area of Vancouver, British Columbia, will be inundated; Everett, Washington, will be 8 meters underwater as will large parts of Seattle, Renton, and Kent; and Astoria, Oregon, at the mouth of the Columbia

River, will be under 2 meters of sea. In California, San Francisco airport and the 101 corridor south to Palo Alto will be underwater. Flooding will extend to Stockton in the Central Valley. The Long Beach waterfront and parts of San Diego will be underwater. In Central America, the Miraflores Locks on the Pacific entrance to the Panama Canal will be inoperable due to rising sea levels.

A 10-meter sea level rise will be felt worldwide. In the eastern US, southern Florida disappears, including most of Miami, Naples, Fort Myers, Fort Lauderdale, and Palm Beach. Half of Brooklyn and much of Queens will flood. Manhattan will become a series of small islands. The threat is extreme for many other areas – the Netherlands, Denmark, and Italy, for example.

It takes little insight to foresee the impacts of such a sea level rise. Mass migrations, even within national boundaries, will be disruptive. Migrations across borders are likely to spur conflict. The nature of immigration will have to change, which will be politically volatile in countries like Australia, Japan, and the US. The need for humanitarian aid will be massive – far beyond current capabilities. Extensive flooding will affect economies, global trade, investment markets, and threaten the survival of many in affected areas.

Notably, sea level rise estimates have become more dire as more data is collected and analyzed. The rate of sea level rise is now projected to be more rapid than estimates of only a few years ago. The year 2050 is within the projected lifetimes of anyone born in the 1980s. The end of the 21st century is within the projected lifetimes of anyone born today. Sea level rise in inexorable – we cannot stop it. And it will continue into the 22nd century.

Studies, analyses, government policies, and business plans all need to take into account the possibility that sea level rise will far exceed current IPCC estimates of 1 meter. Government policies need to anticipate mass climate migrations. Disaster relief and refugee programs will need to be far more robust than today. Expenditures for sea level rise mitigation will likely become major budget items, perhaps equivalent to defense expenditures in the US and far more for other Indo-Pacific nations.

Flooding is predictable. Wise government programs will anticipate major sea level rise associated flooding and in the near-term fund preventive or limiting programs before calamites occur. Procrastination will come at a heavy price for the next generations.