Haiyan/Yolanda: Inside Each New Born Violent Storm Is the DNA of the Fossil Fuel Industry and Capitalism

Wednesday 20 November 2013, by COSTA Alexandre Araújo (Date first published: 20 November 2013).

Contents

- Haiyan may be just a taste of
- Can we say that global warming
- At 400 PPM of atmospheric CO2
- From madness to total inferno?
- People must take control (...)

While I write this article, in the Phillipines the death toll reaches about 4,000 people and continues to grow, 12 days after Supertyphoon Haiyan (also called "Yolanda") hit that country with the power of 310 km/h (195 mph) sustained winds and gusts that reached 375 km/h (235 mph). It fitted into the "Category 5", the class for the most powerful storms using the scale that is currently used to classify hurricanes. [1] However, with winds that strong, if one more category was added, Haiyan would certainly be classified as a "Category 6". Haiyan is recognized as one of the most powerful storms of all times to strike against human settlements. Along with the extremely strong winds, the storm surge immediately began to cause a huge amount of damage and loss of life. Many hundreds of thousands have become refugees; many are now orphans and widows/widowers.

Haiyan may be just a taste of the storms of a close future

"As you warm the climate, you basically raise the speed limit on hurricanes"
— Kerry A. Emanuel, atmospheric scientist, MIT

Typhoons (in the Pacific), hurricanes (in the Atlantic) are essentially the same phenomenon: tropical cyclones. These meteorological systems form over warm oceanic waters, over which the air heats up and ascends, leaving a low pressure near the surface. Because of Earth's rotation, when low-pressure conditions appear, the air is not simply sucked in as by a vacuum cleaner. Instead, the winds are deflected and start to rotate clockwise (in the Southern Hemisphere) or counter clockwise (in the Northern Hemisphere). As the air gains speed, it enhances evaporation, bringing abundant water vapour into the atmosphere. The ascending motion transports the moisture to upper levels where it condensates, producing clouds. In this process, as water molecules that originally came from a warm ocean go from vapour to liquid phase, they liberate the large amount of energy they contained ("latent heat"). As a consequence, air warms up even further, tends to accelerate upwards. This process boosts the low-level pressure system, which makes the wind rotation stronger, again augmenting evaporation and so on. Typhoons and hurricanes are therefore born from what we climate scientists call a "positive feedback". If conditions are favourable, these monsters arise as sustained and powerful storms that have warm oceanic waters for their food.

Based on this, imagine what we might expect if ocean temperatures rise… And they have risen. A lot. According to the recent Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (AR5), the sea surface has been warming up at an average rate of more than a tenth of a degree Celsius per decade since the 1970's. This is not surprising at all, as the oceans retain about 93% of the excess heat associated with Earth's energy imbalance caused by the cumulative effect of the human emission of greenhouse gases (especially CO_2). In fact, thermal energy is accumulating in the upper 700m of world's ocean at a rate of 137 TW (Tera-Watts). This is about 60 times larger than the entire electricity generated by our species worldwide! [2] This energy must be liberated somehow! And storms are nothing but a perfect means of the climate system to resolve this physical instability, moving a huge amount of this stored energy into the oceans (made bigger by global warming) and into to the atmosphere. Haiyan may be just a flavour of what is to come .

Additionally, it is known that warming causes ocean water to expand, elevating sea level. Along with the already discernible human effect on global mean ocean levels, which, with the concurrence of natural factors, has raised the water levels around the Phillipines at a rate of about 10 cm per decade in the recent years, as also shown by the IPCC's AR5. As the oceans continue to rise, the impacts of all storms in coastal areas tend to be amplified.

Can we say that global warming is causing these storms?

Sometimes people say: "there were always big storms". In fact, from 1961 to 1990 (the period the World Meteorological Organization usually takes as reference for "current" climate) there were 10 very strong Atlantic hurricanes (or "category 5") and there are reports of deadly storms raging through the Phillipines since the 19th century (such as the Angela typhoon that killed about 1800 people in 1867).

However, at the moment, global sea surface temperatures are, on average, almost 0.4°C warmer than the 1961-1990 mean and probably more than 0.6°C warmer than they used to be 150 years ago. And each tenth of a degree matters when it comes to the amount of vapour that may get out from warm waters as it increases exponentially, according to simple Physics [3]. In addition, due to the same physical cause, the amount of water vapour in the atmosphere has increased by 3.5% in 40 years.

If global warming means heated waters and more atmospheric water vapour, the conclusion is that a warmer world, which is what we already have, now, is more prone to produce massive storms such as Haiyan! This is why many of us climate scientists do not accept the old jargon that simply suggests that "no individual storm is caused by global warming". This is a half-truth or worse than that. If global warming provides extra fuel for giant storms, all storms in the present already have the human fingerprint; every single storm has greater chance of being stronger than it would be over colder waters. As a whole, they cannot even be seen as "natural phenomena" anymore!

There are plenty of analogies for this type of "probabilistic causation". "A classic one is placing a bet on a loaded casino dice, whose outcome may not be clear when rolling it once, but may show a spectacular effect after multiple repetitions, as the numbers in the dice have no longer the same chance of occurrence. Another one is to depict warmer atmosphere and oceans as athletes using steroids and/or stimulants. A soccer player under the effect of any of these substances will certainly have his/her overall performance altered. Although linking a particular kick or run to the presence of these substances in his/her bloodstream may be difficult, it is cynicism to use this to disregard the role they play in the big picture. This is exactly what climate change deniers do to help the cause of the fossil fuel industry. In opposition to that, it is scientifically reasonable to consider that global

warming is already fuelling stronger storms!

At 400 PPM of atmospheric CO_2, the fossil fuel industry must be liable for greater disasters

Current global warming is caused by the accumulation of greenhouse gases in Earth's atmosphere as successively shown by the IPCC reports and a huge number of scientific papers that show clear evidence of that. As we approach an annual mean value of 400 parts per million of CO_2, way above the "safe limit" suggested by the Climate Science [4], the human contribution for Earth's energy imbalance, mostly because of those gases, gives us an amount of energy equivalent to the explosion of 17 Hiroshima bombs per second. A significant part of this imbalance warms up the ocean, especially in its upper portion [5].

Due to fossil fuels being the major source of emissions of the most important greenhouse gas (CO_2) it is reasonable to say that the oil and coal companies do, in fact, hold responsibility for the intensification of tropical cyclones. The question we need to raiseis, thus: Will we allow them to keep hiding behind the uncertainties in the climate science (because of the limitations that still persist in the observation network and in the computational modelling tools), when there is a clear physical mechanism that links global warming and warmer oceans to more extreme events and more vigorous hurricanes and typhoons? There is a great dealof evidence showing us that a warmer world will give birth to monstrous storms, that Haiyan can become the first of a series of devastating disasters; will we allow fossil fuell companies to walk out of the court with impunity?

The influence of the extra atmospheric CO_2 is ubiquitous. Therefore the influence of the fossil fuel corporations, which poured that gas into the atmosphere as waste, is inside everything that happens in Earth's atmosphere today and consequently in the other parts of the climate system [6]. In addition, the amount of CO_2 beyond the pre-industrial levels in the atmosphere, even with not a single further anthropogenic emission, is already capable of warming up the world at least some extra tenths of a degree Celsius. It is also capable of maintaining a long-term trend of warming in the deep oceans that may last for many centuries or a few millennia, with much more sea level rise as a consequence. Those two factors (warmer waters that propel tropical cyclones with stronger winds and more precipitation and elevated sea levels that amplify the storm surge) already magnify the impacts of the disaster caused by the landfall of a hurricane of a typhoon especially over poorer, more vulnerable people.

The tendency, however, as emissions continue to increase year after year and more CO_2 accumulates, is to surpass other boundaries , way beyond 350 ppm. Besides providing a warming of more than 2°C relative to the pre-industrial times, going beyond 450 ppm is like walking on quicksand. Global warming may become self-sustained if some "positive feedbacks" are initiated at certain intensity. This includes the "water vapour feedback" (the warmer the atmosphere, the more water vapour it is able to retain, but as vapour is itself a greenhouse gas, its enhanced presence in the atmosphere favours further warming of the atmosphere itself and the surface below it); the "ice-albedo feedback" (the warmer the world, more ice loss occurs and, as sea ice is a brilliant surface that reflects a large proportion of sunlight, preventing it to penetrate the ocean and to be absorbed by it, its reduction leads to further warming and so on, i.e., warming produces melting, which favours warming); the "permafrost feedback" (frozen soil contains organic matter and, as it thaws because of global warming, this matter gets exposed to decomposition, liberating both methane and carbon dioxide into the atmosphere thus enhancing the greenhouse effect, providing extra warming, and producing further permafrost thawing), etc.; other feedbacks involve breaking the stability of land biomes such as tropical forests, the liberation of methane that is currently stored at the bottom

of the oceans in the form of clathrates and more.

Maybe the high concentrations of methane found in the Arctic [7] and the disintegration of the North Pole sea ice (very well documented in the scientific literature including IPCC AR5) are not yet complete indicators of irreversible climate change. But these facts should at least be taken as severe alerts to the risk of triggering those feedbacks that may ultimately drive Earth's climate system into an unstable, out of control, spiral. Therefore, we can only agree with Mr. Yeb Saño, from the Filipino delegation at the 19th Conference of the Parties (COP19) in Warsaw, who describes the climate crisis as "madness".

From madness to total inferno?

"My philosophy is to make money. If I can drill and make money, then that's what I want to do."
— Rex Tillerson, Chairman, President and CEO, Exxon Mobil

According to very recent estimates there are about 7.3 to 11 trillion tons of carbon stored in fossil fuel reserves (including not only conventional oil, coal and gas, but also tar sands, shale gas and other unconventional sources), as stated by the GEA [8].

What would be a world with all fossil fuels burnt? According to a paper by Dr. James Hansen and collaborators, published at the "Philosophical Transactions of the Royal Society" [9], it may become simply uninhabitable in many areas. Based on evidences from particularly warm past climates (as the Palaeocene–Eocene Thermal Maximum and the Mid-Eocene Climatic Optimum at about 56 and 42 million years ago, respectively) and modelling, they state "global warming of that magnitude would make most of the planet uninhabitable by humans. The human body generates about 100 W of metabolic heat that must be carried away to maintain a core body temperature near 37°C, which implies that sustained wet bulb temperatures above 35°C can result in lethal hyperthermia. Today, the summer temperature varies widely over the Earth's surface, but wet bulb temperature is more narrowly confined by the effect of humidity, with the most common value of approximately 26–27°C and the highest approximately of 31°C. A warming of 10–12°C would put most of today's world population in regions with wet a bulb temperature above 35°C".

This extreme scenario is what we may achieve if we burn the more than 7 trillion tons of fossil carbon stored as coal, oil and gas. For those who may get sceptical on such scenario, our neighbouring planet, Venus, with average temperatures above 460°C, reminds us what a runaway greenhouse may produce an inferno where tin and lead are liquids, no water no chance of complex life (at least as we know it), and covered by a dense atmosphere mostly composed of CO_2, with thick sulphuric acid clouds.

But way before this extreme situation, we may face the issue that no adaptation is possible for many millions, perhaps billions of people in view of the expected changes in the occurrence of extreme events (not only tropical cyclones, but also floods, landslides, heat waves, forest fires, blizzards – yes, they do get more intense in a warmer world, with more atmospheric water vapour, even during the winter - droughts, etc.). For the most vulnerable populations, adapting is simply not possible for a warming much greater than the one we already have. The Philippines are a clear example that for the poorest, adaptation is already a difficult issue for the storms of the present. Each tenth of a degree Celsius matters, unless the world's ruling class aims for the multiplication of climate refugees and body bags!

People must take control of fossil fuels to keep them where they are

"We're more likely to see other companies as collaborators rather than adversaries… We aren't so much competing with each other as we are competing with the earth. And maybe that's a healthy way to look at it."
— George Kirkland, managing director of Chevron Nigeria

"'Realizability' or 'unrealizability' is in the given instance a question of the relationship of forces, which can be decided only by the struggle."
— Leon Trotsky, in "the Transitional Program"

Despite all of the evidence pointing to climate change as an extremely serious and urgent issue, it is not in the plan of the corporations to reduce their profits, allowing the dramatic cuts in CO_2 emissions that are necessary. Those companies own fossil fuel reserves capable, if burnt, of driving the climate system to a point of no-return. The report entitled "Unburnable Carbon 2013" [10] states that the carbon budget for a 2°C scenario would be around 565–886 billion tonnes (Gt) of CO_2 to 2050". This amount is what comes from mere 154-242 Gt of fossil carbon, which is much less than if it was estimated by the GEA in the world's fossil fuel reserves! Those companies are merged with the financial system as described in bright colours by the Transnational Institute [11], and only 200 of them own reserves that contain much more carbon than this very tight budget, as burning their certified reserves would correspond to emitting 746 $GtCO_2$, again according to the "Unburnable Carbon 2013". In fact, only one coal company (Severstal JSC) and 3 oil companies (Lukoil, Exxon and British Petroleum) control reserves that might produce almost 261 $GtCO_2$, beyond the upper limit of the 2°C carbon budget estimates [12]. Investors want this huge amount of fossil carbon to be extracted and burned, to turn into profits. But this is clashing the stability of Earth's climate and the global ecosystem. It destroys the material conditions necessary to guarantee the long-term survival of our species (and many others).

Therefore, as long as these fossil fuel reserves are kept as private property, the more undermined becomes the chances of maintaining physical, objective conditions for a human society with dignity, equality and justice. Further, they must become collective, in order to be kept intact… keep the oil in the soil, and the coal in the hole.

Leon Trotsky, in his *Transitional Program* was always driven by a sense of urgency, because of the effects that the economic crisis right before the World War II was producing in the working class. He stated, *"The question is one of guarding the proletariat from decay, demoralization and ruin. The question is one of life or death of the only creative and progressive class, and by that token of the future of mankind. If capitalism is incapable of satisfying the demands inevitably arising from the calamities generated by itself, then let it perish."*

Perhaps what we are facing regarding climate change is not only the urgency of guarding the poor, the workers, the youth, the women, the indigenous people, the peasants, i.e., the protagonists of change, from decay, ruin and even death, as Haiyan produced in a dramatic fashion. Perhaps we are talking about guarding the stability of the global biogeochemical cycles and of the very physical conditions that allow food and water to be produced. No Socialism is possible in an isolated country. Barbarism becomes much more probable than Socialism in a scorched Earth.

Alexandre A. Costa

Alexandre Costa is PhD in Atmospheric Science, Professor at the State University of Ceará, Brazil and one of the authors of Brazilian Panel

on Climate Change First Asseessment Report.

Footnotes

[1] The Saffir–Simpson scale is as follows: Category 1 hurricanes have wind speeds between 119 and 153 km/h, followed by Categories 2 (154-177 km/h), 3 (178-208 km/h), 4 (209-251 km/h) and 5 (≥252 km/h).

[2] The amount of electric energy produced worldwide in 2010 according to the US EIA (Energy Information Administration) was 20,238 billion kWh (http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=12), which corresponds, as a year has 8760 hours, to 2.3 billion kW or 2.3 TW.

[3] More specifically the "Clausius-Clapeyron equation", which shows that the saturation vapor pressure increases (almost exponentially) when the temperature increases.

[4] Hansen et al. (2008): Target atmospheric CO_2: Where should humanity aim?, Open Atmos. Sci. J. (2008), vol. 2, pp. 217-231, available at http://arxiv.org/pdf/0804.1126v3.pdf.

[5] Earth's energy imbalance due to anthropogenic factors is on the order of 2.29 W/m2, which, as we multiply this number by the total area of the planet's surface gives us 3.7·1022J (1J = 1 Joule, the unity of energy in the International System). A significant part of that is not retained in the climate system because as the Earth warms up, it irradiates more infrared. Anyway, about 1/4 is actually stored in the oceans (energy flux of f 0.71 W/m2, according to IPCC's AR5).

[6] In the ocean, besides warming, excess atmospheric CO_2 is also causing rapid acidification, with potentially catastrophic consequences to marine biota, as organisms depending on the fixation of calcium carbonate cannot grow in an acid environment (in fact the shelves and exoskeletons of many life forms tend to get literally dissolved as ocean acidify beyond a certain point, the saturation with respect to aragonite, one of the forms of calcium carbonate).

[7] Specialists estimated a "7% rise in wetland methane emissions over 2003–2007, due to warming of mid-latitude and Arctic wetland regions" (Bloom, A. A.; Palmer, P. I.; Fraser, A.; Reay, D. S.; Frankenberg, C., 2010: Large-Scale Controls of Methanogenesis Inferred from Methane and Gravity Spaceborne Data, Science, v. 327, p. 322–325.

[8] Global Energy Assessment 2012 Toward a sustainable future (eds Johanson TB, et al.). Laxenburg, Austria: International Institute for Applied Systems Analysis.

[9] Hansen, J., Mki. Sato, G. Russell, and P. Kharecha, 2013: Climate sensitivity, sea level, and atmospheric carbon dioxide. Philosophical Transactions of the Royal Society A, 371, 20120294, doi:10.1098/rsta.2012.0294.

[10] Available at http://carbontracker.live.kiln.it/Unburnable-Carbon-2-Web-Version.pdf

[11] See this link: http://www.tni.org/article/dirty-money-finance-and-fossil-fuel-web

[12] Many more calculations can be done using these data, based on Unburnable Carbon 2013 information:
https://s3.amazonaws.com/s3.350.org/images/Top_200_Companies_by_Carbon_Reserves_1.xlsx