Summary of

Stefan Rahmstorf : "Climate change in perspective" (Monday the 19th of September)

Climate change, and particularly CO2 concentration change in the atmosphere, when seen in a historical perspective comes from natural processes. Those are taking place at different time of scale : *plate tectonics* - acting in a range of 10th millions of years and affecting the carbon cycle (the carbon is mainly present in rocks as carbonates, then weathering processes transform it in mobile sediments further being washed out to oceans, and further released by volcanic eruptions as CO2), *earth's orbit* (Milankovich-cycles causing an oscillation of carbon content in the atmosphere around 200 ppm) – process taking several 10th of years, *solar variability* – every 10 to 100s years, and finally *short scale events* like volcanic eruptions, fall of meteorites, ...

However, besides those natural processes, an anthropogenic climate change is taking place, and can be considered at two levels : human activities have already noticeably changed the climate, and anthropic emissions of greenhouse gases (GHG) will lead to a significant global warming in the future. Evidence for the first meaning, which is that the Earth is warming since the beginning of the 20th century, is that the glaciers are retreating all over the world (although historically we should be in an ice-age). The cause is predominantly anthropogenic because the magnitude of warming is what can be expected from the rise in GHG emissions. Data provided by the study of ice cores show that this concentration is by far 1/3 higher today than since 600 000 years. Other possible causes (natural processes) show no significant trend for the past 65 years. Pattern detection (or "finger prints") studies show that warming pattern agrees with GHG's emissions. Models can reproduce history quite well (ex.: Hansen et al., 2005), and the warming is unusual (2004 is the warmest year since 200 years following different sources of data). Evidence for future anthropogenic climate change are that we know the quantity of CO2 emitted and that ½ of it has to be taken in the atmosphere (the isotope composition of this CO2 is different than the isotope of the CO2 exchange between the ocean and the atmosphere). The decrease of O2 concentration is in the order of 2 to 1 ratio. The hemispheric gradient in CO2 concentration matches the sources of emissions, and the quantity of CO2 in oceans (following the uptake from the atmosphere) increases everywhere on earth.

Estimations of the effect of a doubling of CO2 concentration has been studied since the 20th century with the conclusion that the consequent range of temperature rise would be between 1.3 and 3.8°C (data from radiative forcing and physical feedbacks, from Vostok ice cores, from last glacial maximum) which is consistent wiht the run of thousands models. The risks associated with that warming are the increase of extreme events such as flooding, drought, hurricanes, the change in the ice sheets (melting and subsequent increase in vulnerability to higher temperature), the sea level rise between 2.7m to 5.1m and the change in Atlantic circulation.

The international community needs to react now in order to avoid those dramatic consequences even if the effect of an action taken today will have some effect in 50 years. The Intergovernmental Panel on Climate Change (IPCC) has been established in 1988 by World Meteorological Organisation (WMO) and United Nations Environment Program (UNEP) to"assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation". In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) has agreed on an international law stating that countries should stabilise GHG emissions at level that avoid dangerous interference in climate system. The Kyoto Protocol, having more powerfull (and legally binding), has been approved and entered into force on the 16th of February 2005.

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