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ICT AND CLIMATE CHANGE

Jean PLA, Frequency Management

Rapporteur ITU-D Question 24/2
ICT and Climate Change

CNES, Toulouse, FRANCE
jean.pla@cnes.fr

SUMMARY

❶ Monitoring of the planet, earth observation

❷ Some facts about Climate change

❸ Connection between extreme events and climate change

❹ Need to limit the increase of temperature

❺ Role of ICT

❻ Conclusion, recommendation

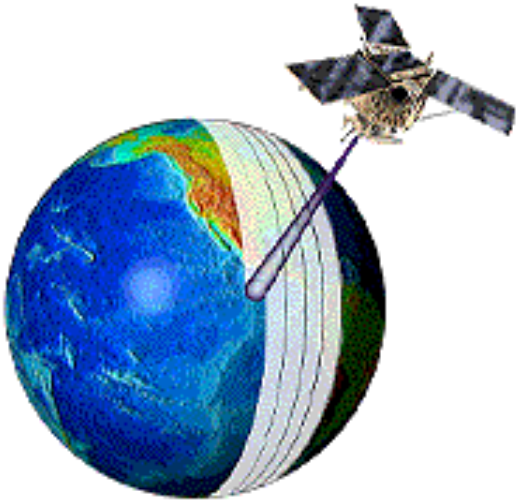
1: Monitoring of the planet, earth observation: climate change

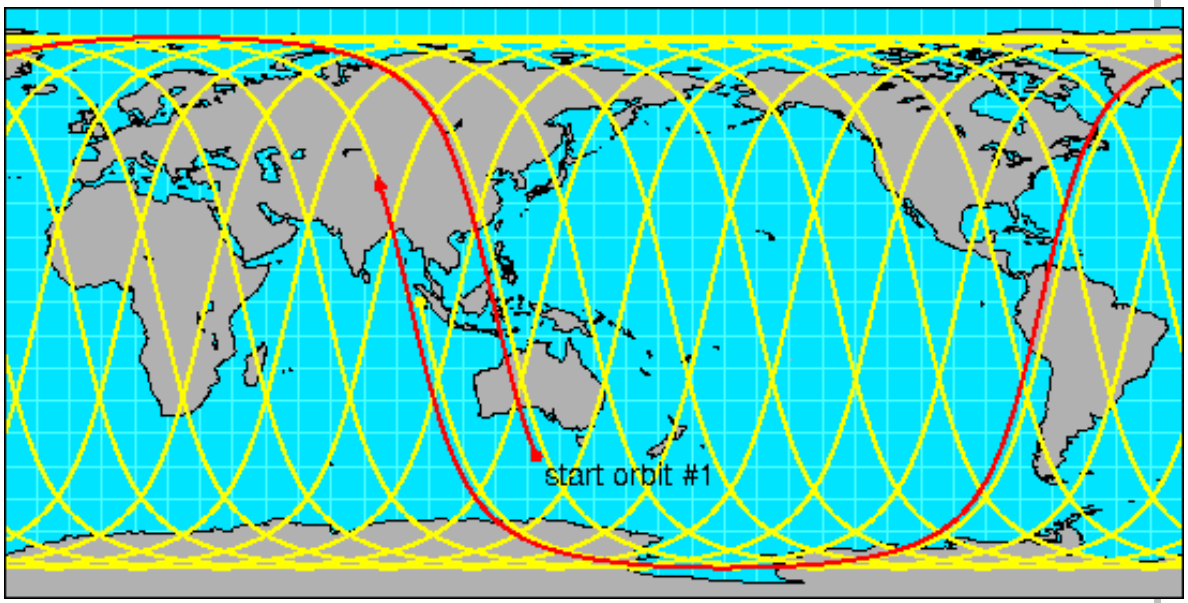
Climate change: one of the greatest long term challenges facing society. How to broaden our understanding of the planet's climate and the ways it is changing?

Climatology relies increasingly on space technology. **Earth observation** delivers series of precise, global measurements matching the scale of planetary climate phenomena.

1: Monitoring of the planet, earth observation: why observing the Earth from space?

Satellites orbiting around the Earth offer an excellent viewpoint from where to sense the Earth surface (land and oceans) as well as the components of the Earth atmosphere.
Geostationary satellites offer continuous monitoring of a large area, while low orbiting polar satellites cover all the Earth at regular intervals (as shown below).





1: Monitoring of the planet, earth observation

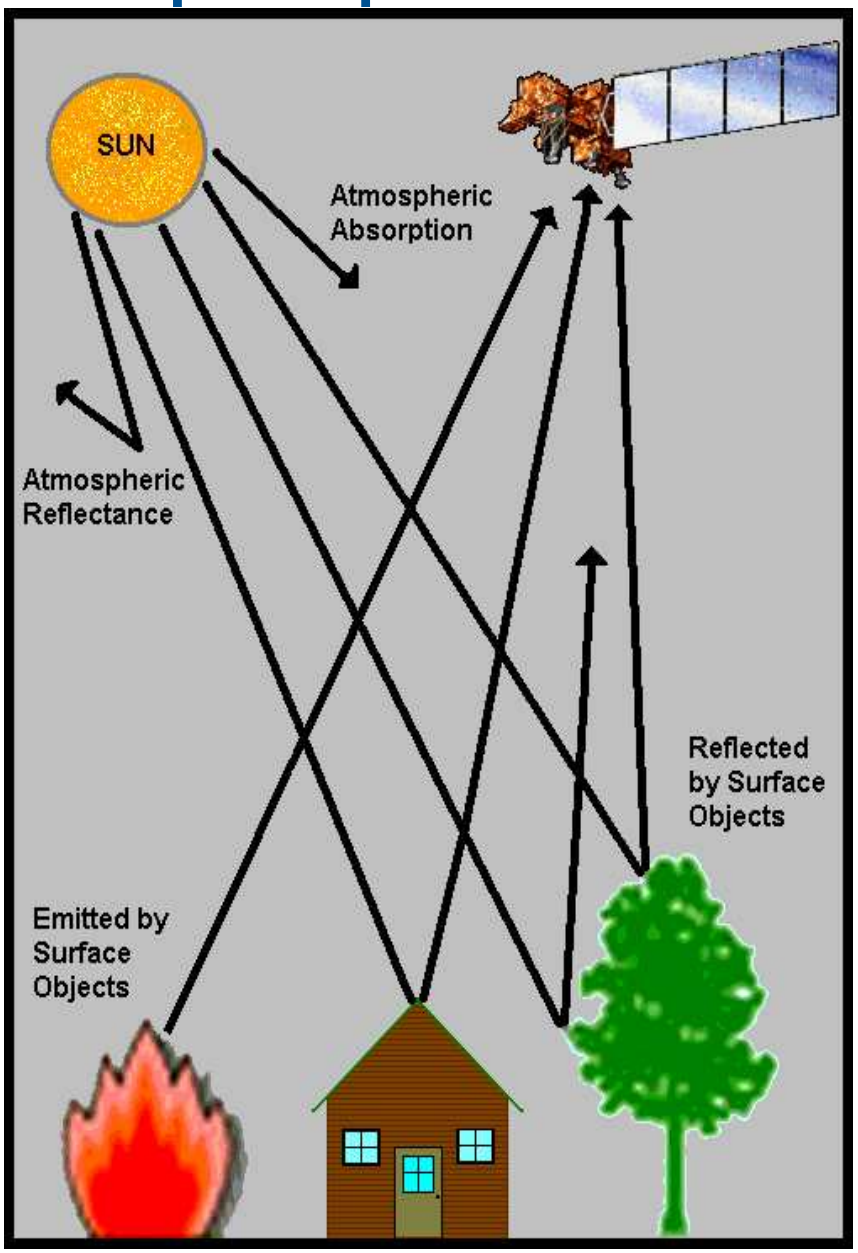
Remote sensing: art and science of **recording and measuring information about a phenomenon from a distance**.

Instruments capable of studying of large areas of the Earth's surface and of the atmosphere are known as remote sensors.

A **passive sensor** needs an external energy source: Sun, Earth, atmosphere. These **sensors generally detect reflected and emitted energy wave lengths from a natural phenomenon**.

An **active sensor** transmits a signal that is reflected on a surface and received by the sensor. These **sensors are used for altimetry, cloud detection or imagery**.

Example of passive sensor



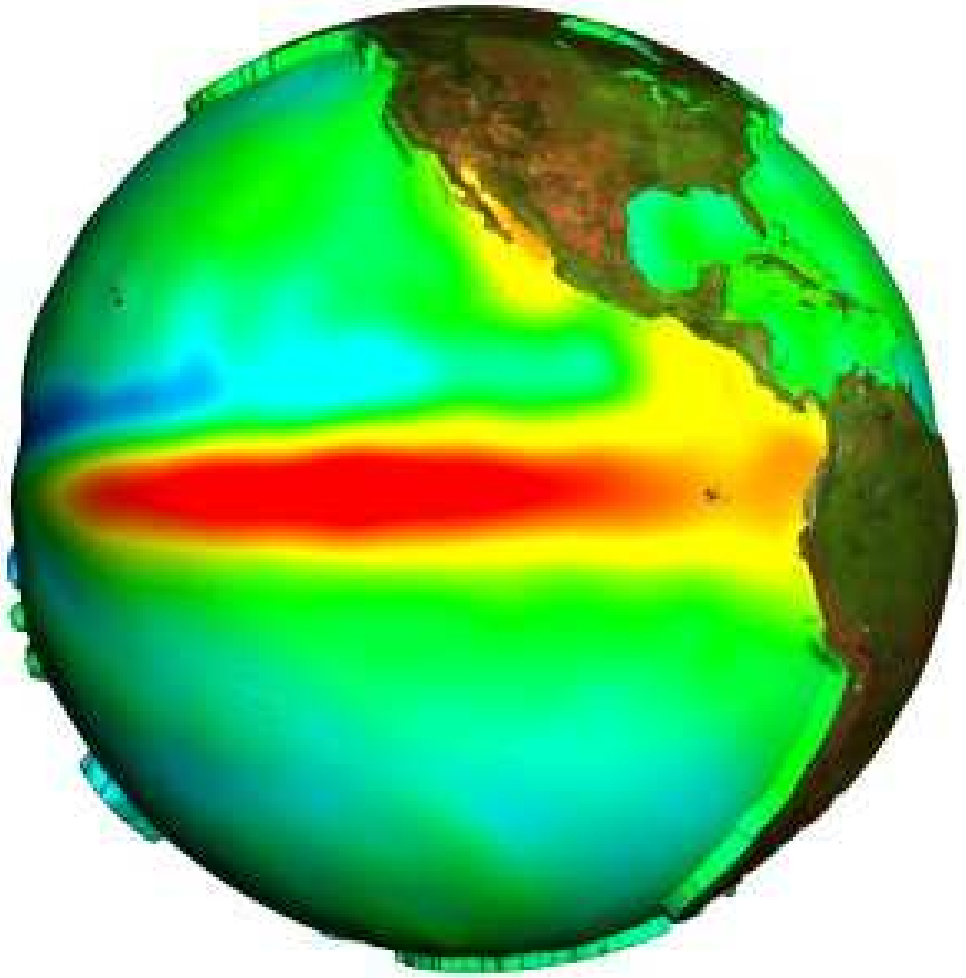
1. Monitoring the ocean using active sensor

Ocean: 71% of Earth surface, it plays a major role in climate change and thermal regulation.

Altimetry (example of active sensor): one of the most important tools for monitoring ocean dynamics

Radar altimeter: provides precise measurements of the distance from the satellite to the Earth's surface.

Events as **El *Niño*: see figure**



2. Some facts about Climate change: mean sea level rise

Altimetry: allows to know the mean sea level rise

sea levels all over the world is widely recognized as potentially one of the most devastating consequences of global warming.

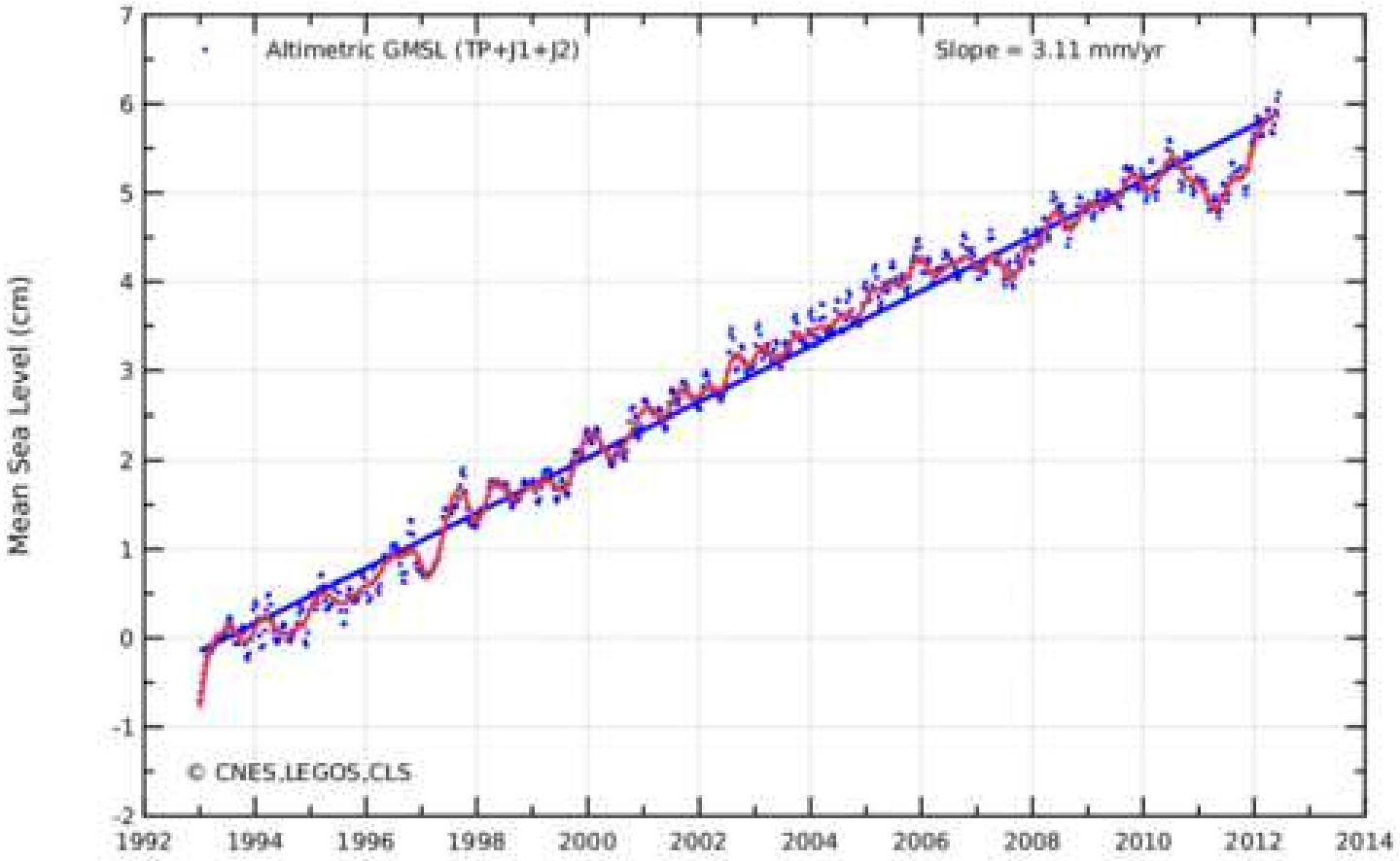
Global mean Sea Level rise is one of the consequences of global warming. Monitoring this level is an application of altimetry, and one of the main issue in Environmental sciences of the 21st century.

Difficult to separate the natural variability of the climate from the warming effects. The *measurements of the mean sea levels are derived from a period of time of **15 years** of satellite earth observation*: **such a period of time is short**.

Climate change signals can be detected only if they are greater than the background natural variability. Detecting global climate change is much more demanding than monitoring regional impacts.

Rise: **3,1 mm per year, roughly 5 cm within 15 years.**

2. Some facts about Climate change: mean sea level rise



2. General facts about Climate change

2012: ninth warmest of any year since 1880
2010: warmest year on record

global average surface temperature increased at a rate of:

0.7 C per century since 1900

0.16 C per decade since 1970

Average global temperature has risen about 0.8 C since 1880

Annual global combined land and ocean surface temperature was 0.57 C above the 20th century average of 13.9 C

The principal anthropogenic GHG is carbon dioxide (CO_2), the concentration of which has increased by 31 per cent since 1750 to a level that has probably not been exceeded for 20 million years.
The global atmospheric concentration of CO_2 has increased from pre-industrial values of about 280 ppm (parts per million, an atmospheric measurement based on carbon molecules) to 385 ppm in 2008.

3. Connection between extreme events and climate change

Direct link between the increase in GHG levels and the growing intensity of precipitation in the form of rain and snow in the northern hemisphere, coupled with a higher risk of flooding.

Scientists are convinced that estimates of internal climate variability cannot explain the increased precipitation intensity observed during the second half of the twentieth century. For over ten years now, it has been acknowledged that the number of extreme rainfall episodes has been on the increase in certain parts of the northern hemisphere.

"There is evidence that some extremes have changed as a result of anthropogenic influences, including increases in atmospheric concentrations of greenhouse gases"

(IPCC report, 2012)

4. Need to limit the increase of temperature

Result of the Kyoto protocol in 1997

The objective negotiated Kyoto was a 5.2 per cent reduction in GHG emissions by 2012 with respect to the level achieved in 1990.

Result of the Copenhagen conference in 2009

COP-15 produced the first global agreement aimed at **halving GHG emissions by 2050 with respect to those of 1990**, in order **not to exceed an average increase of 2 C in 2100 with respect to the preindustrial era**.

Result of the Doha Conference in 2012

The goal of keeping global average temperature rise below two degrees C still remains a big challenge.

Consequences of not limiting the temperatures by 2 C

Recent report (World Bank, 2012) spells out what the world would be like if it warmed by 4 degrees Celsius, which is what scientists are nearly unanimously predicting by the end of the century, without serious policy changes. The 4 C scenarios are devastating: the inundation of coastal cities; increasing risks for food production potentially leading to higher malnutrition rates; many dry regions becoming dryer, wet regions wetter; unprecedented heat waves in many regions, especially in the tropics; substantially exacerbated water scarcity in many regions; increased frequency of high-intensity tropical cyclones; irreversible loss of biodiversity …

5. Role of ICT

« Information and Communication Technologies have an important role to play in reducing the energy intensity and increasing the energy efficiency of the economy, in other words, in reducing emissions and contributing to sustainable growth.” (E U)

In the US: electricity sector is responsible for about one-third of all U.S. greenhouse gas emissions and 42 percent of total carbon dioxide (CO2) emission

Relative contribution of ICT

2008: electricity consumption of 8% (2.6% of the worldwide primary energy consumption), 2 % of greenhouse gas emissions in Europe (which is also equivalent to the carbon emissions attributed to the aviation industry)

2020: expected electricity consumption for ICT of 14%

5. Role of ICT: green ICT and rebound effect

Green ICT , e-waste

Development of technical means for optimizing energy and resource consumption, smart technologies or possibilities for substitution for a minimal or no impact on the environment

Encouraging traders to take back and dispose of electrical and electronic appliances.

Many administrations still think that green ICT are not yet affordable.

Rebound effect

The rebound effect (or take–back effect) is well-known in economy and in energy saving. It generally refers to the introduction of new technologies, or other measures taken to reduce resource use. ***Such responses tend to offset the beneficial effects of the new technology or other measures taken***.

This theory can also be **applied to the use of any natural resource**.

Green ICT can encourage rebound effect. Recent studies show: **if rates of electricity are lower than 10%, the resulting rebound effect equals 20% of over electricity consumption.**

6. Conclusion: climate change

ICT: may reduce electricity: Information and Communication Technologies (ICTs) may allow a thirty percent reduction in electrical consumption in cities if good practices and adequate behavior are used.

Smart grid for an efficient use of the electricity when necessary a way to enable more green electricity production technologies to supply power to the electricity grid.

Need for adaptation

The STERN report states: "*Using the results from formal economic models, the Review estimates that if we don't act,* ***the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year****, now and forever. If a* ***wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more****. In contrast,* ***the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around 1% of global GDP each year****."* .

6. Conclusion: recommendation ICT and climate change

1. Countries elaborate guidelines/best practices and implement national policies;
2. Support is provided to help countries invest more in meteorology monitoring services in order to prevent extreme events that could be devastating as better prediction would cost little and helps reduce the carnage carnage;
3. Help to countries to invest in the technologies they need to know more about the climate change, better access and understanding to the meteorological data (satellite and terrestrial) ;

6. Conclusion: recommendation ICT and climate change (cont.)

4. Countries to elaborate training programs;
5. To develop a program based on real figures showing the effect of reduced energy consumption and the benefit of ICT;
6. As ICTs may need to operate in difficult meteorological conditions (hot weather, high humidity…), it becomes urgent to help countries develop MORE AFFORDABLE green ICTs, as well as more robust and reliable;
7. Better cooperation between countries to be established in the areas of monitoring meteorological data and mitigating climate change using ICTs.