

### **El-Nino and La-Nina**

El-Nino is a Spanish word meaning “the boy child” (‘Child Christ’) because El-Nino occurs around Christmas time each year when the waters off the Peruvian coast warm slightly. In every three to six years, the waters become unusually warm. 'El Nino' is now used more widely to refer to this abnormal warming of the ocean and the resulting effects on weather. 'La Nino' is used popularly to signify the opposite of El Nino occurring when the waters of the eastern Pacific are abnormally cold. La Nino episodes are associated with more rainfall over eastern Australia, and continuing drought in Peru. The El-Nino event is due to decrease in atmospheric pressure over the South East Pacific Ocean. At the same time, the atmospheric pressure over Indonesia and North Australia increases. Once the El-Nino event is over, the atmospheric pressure over the above regions swings back. This sea-saw pattern of atmospheric pressure is called Southern Oscillation. Since El-Nino and Southern Oscillation are linked they often termed as ENSO.

### **History of the greenhouse effect and global warming:**

Svante Arrhenius (1859-1927) was a Swedish scientist who was first to claim in 1896 that fossil fuel combustion may eventually result in enhanced global warming. He proposed a relation between atmospheric carbon dioxide concentrations and temperature. He found that the average surface temperature of the earth is about 15°C because of the infrared absorption capacity of water vapor and carbon dioxide. This is called the natural greenhouse effect. Arrhenius suggested a doubling of the CO<sub>2</sub> concentration would lead to a 5°C temperature rise. He and Thomas Chamberlin calculated that human activities could warm the earth by adding carbon dioxide to the atmosphere. After the discoveries of Arrhenius and Chamberlin the topic was forgotten for a very long time. At that time it was thought that human influences were insignificant compared to natural forces, such as solar activity and ocean circulation. It was also believed that the oceans were such great carbon sinks that they would automatically cancel out our pollution. Water vapour was seen as a much more influential greenhouse gas. The argument that the oceans would absorb most carbon dioxide was still intact. However, in the 1950s, evidence was found that carbon dioxide has an atmospheric lifetime of approximately 10 years. Moreover, it was not yet known what would happen to a carbon dioxide molecule after it would eventually dissolve in the ocean. Perhaps the carbon dioxide holding capacity of oceans was limited, or carbon dioxide could be transferred back to the atmosphere after some time. Research showed that the ocean could never be the complete sink for all atmospheric CO<sub>2</sub>. It is thought that only nearly a third of anthropogenic CO<sub>2</sub> is absorbed by oceans.

In the 1980's, finally, the global annual mean temperature curve started to rise. In the late 1980's the curve began to increase so steeply that the global warming theory began to win terrain fast. Environmental NGO's (Non-Governmental Organizations) started to advocate global environmental protection to prevent further global warming. In 1988 it was finally acknowledged that climate was warmer than any period since 1880. The greenhouse effect theory was named and Intergovernmental Panel on Climate Change (IPCC) was founded by the United Nations Environmental Programme and the World Meteorological Organization. This organization tries to predict the impact of the greenhouse effect according to existing climate models and literature information. The Panel consists of more than 2500 scientific and technical experts from more than 60 countries all over the world. The scientists are

from widely divergent research fields including climatology, ecology, economics, medicine, and oceanography. The IPCC is referred to as the largest peer-reviewed scientific cooperation project in history. The IPCC released climate change reports in 1992, 1996, 2001, 2007, 2014 and the next will be released in 2022. In the 1990's scientists started to question the greenhouse effect theory, because of major uncertainties in the data sets and model outcomes. They protested the basis of the theory, which was data of global annual mean temperatures. They believed that the measurements were not carried out correctly and that data from oceans was missing. The idea began to grow that global warming models had overestimated the warming trend of the past 100 years. This caused the IPCC to review their initial data on global warming, but this did not make them reconsider whether the trend actually exists. We now know that 2016 was globally the warmest year on record, followed by 2019 (second warmest). The 10 warmest years on record have all occurred since 1990.

So far not many measures have been taken to do something about climate change. This is largely caused by the major uncertainties still surrounding the theory. But climate change is also a global problem that is hard to solve by single countries. Therefore in 1998 the Kyoto Protocol was negotiated in Kyoto, Japan. It requires participating countries to reduce their anthropogenic greenhouse gas emissions (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, and SF<sub>6</sub>) by at least 5% below 1990 levels in the commitment period 2008 to 2012. The Kyoto Protocol was eventually signed in Bonn in 2001 by 186 countries. Several countries such as the United States and Australia have retreated. From 1998 onwards the terminology on the greenhouse effect started to change as a result of media influences. The greenhouse effect as a term was used fewer and fewer and people started to refer to the theory as either global warming or climate change.

### **Overview of emission reductions required by the Kyoto Protocol:**

According to the Kyoto Protocol countries must reduce total greenhouse gas emissions by 2012, compared to 1990 levels. This is an overview of the contribution of various countries to this total emission reduction:

- Australia: rejected Kyoto protocol but allowed an 8% increase by 2012 compared to 1990 levels
- Canada: 6% total reduction by 2012 compared to 1990 levels

- Europe: 8% total reduction by 2012 compared to 1990 levels
- Japan: 6% total reduction by 2012 compared to 1990 levels
- Russia: no obligated reduction
- Ukraine: no obligated reduction
- United States: decided in 2001 not to ratify the protocol, but achieved a 7% reduction by 2012 compared to 1990 levels

A country has various options for measures to meet the Kyoto standards. Examples are:

-Plant forests and vegetation to remove more CO<sub>2</sub> from the air.

-Sustainable management practices in forestry and on farms.

- Clean Development mechanisms; industrialized nations earn credits for projects implemented in developing countries.

-Buy emissions permits from Kyoto countries which cannot meet their target because of the costs.

## DOHA AMENDMENT

In Doha, Qatar, on 8<sup>th</sup> December, 2012, the 'Doha Amendment' to Kyoto Protocol was adopted for a 2<sup>nd</sup> commitment period, starting in 2013 and lasting until 2020. However, Doha amendment has not yet entered into force, it still requires few instruments of acceptance.

The amendment includes:

- New commitments for parties under Kyoto Protocol who agreed to take on commitments in a 2<sup>nd</sup> commitment period from 1 Jan 2013 to 31 December 2020.
- A revised list of Green House Gases (GHGs) to be reported on by parties in 2<sup>nd</sup> commitment period.
- Amendment to several articles of Kyoto Protocol which specifically referenced issues pertaining to 1<sup>st</sup> commitment period and which needed to be updated for 2<sup>nd</sup> commitment period.

During 1<sup>st</sup> commitment period, 37 industrialized countries and European community committed to reduce GHG emissions to an average of **5% against 1990 levels**.

During 2<sup>nd</sup> commitment period, parties committed to reduce GHG emissions by **atleast 18% below 1990 levels in 8 year period from 2013 to 2020**.

## **Impact Of Climate Change On Agriculture And Food Supply**

- For any particular crop, the effect of increased temperature will depend on the crop's optimal temperature for growth and reproduction. If the higher temperature exceeds a crop's optimum temperature, yields will decline.
- Higher CO<sub>2</sub> levels can affect crop yields. Some laboratory experiments suggest that elevated CO<sub>2</sub> levels can increase plant growth. However, other factors, such as changing temperatures, ozone, and water and nutrient constraints, may counteract these potential increases in yield.
- More extreme temperature and precipitation can prevent crops from growing. Extreme events, especially floods and droughts, can harm crops and reduce yields.
- Dealing with drought could become a challenge in areas where rising summer temperatures cause soils to become drier.
- Many weeds, pests, and fungi thrive under warmer temperatures, wetter climates, and increased CO<sub>2</sub> levels.
- Though rising CO<sub>2</sub> can stimulate plant growth, it also reduces the nutritional value of most food crops. Rising levels of atmospheric carbon dioxide reduce the concentrations of protein and essential minerals in most plant species, including wheat, soybeans, and rice.
- Livestock may be at risk, both directly from heat stress and indirectly from reduced quality of their food supply.
- Fisheries will be affected by changes in water temperature that make waters more hospitable to invasive species and shift the ranges or lifecycle timing of certain fish species.