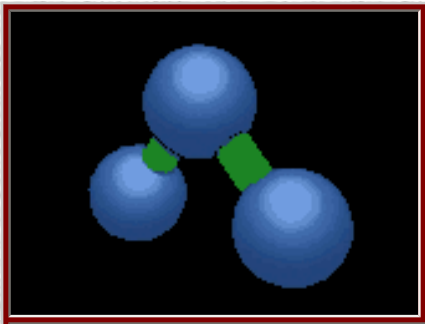

LABORATORIO DE FISICA DE LA ATMOSFERA

Universidad Mayor de San Andrés - La Paz Bolivia

RESEARCH INTO GASES RELATING TO

THE GLOBAL WARMING EFFECT

INTRODUCTION

Global Warming - the Greenhouse Effect

Emissions of so-called greenhouse gases, caused by human activities, may increase the temperature on earth and thereby strongly affect our environment and living conditions.

What is the greenhouse effect?

The greenhouse effect is a name for a natural phenomenon, which warms up the earth surface. The ultra-violet radiation from the sun passes through the atmosphere and is absorbed by the earth's surface. The temperature on earth rises, also the earth emits heat radiation but with another wavelength (long infrared radiation). Some of this heat is absorbed by greenhouse gases in the atmosphere and is re-emitted back to earth.

What are the problems with global warming?

The function of the climate on earth is complicated, and it is difficult to make any precise predictions about the effects that an increased temperature will have, for example the temperature might increase in some areas, affecting the climate, while other areas might not experience any temperature increases. The most accepted effects that might be observed are:

- The level of the sea will increase due to the warming up of the sea and due to the melting of ice masses at the poles and hence low-lying areas and cities (even whole countries) will be badly flooded, for example Bangladesh and the Netherlands.
- The precipitation pattern will change and therefore changing the local climates, this could have adverse effects like an increased spreading of the deserts.
- Summarising the above, a changed climate will cause great social, economical and political

problems, for example shifting agriculture conditions and changing resources of drinking water.

What are the sources of greenhouse gases?

The naturally occuring gases in the atmosphere responsible for the greenhouse effect are carbon dioxide (CO_2), water, dinitrogen oxide, methane and ozone. Due to human activities the contents of carbon dioxide and the other mentioned gases are increasing. Emissions of man-made cholofluorcarbons (CFCs) also contribute to the greenhouse effect.

Carbon dioxide is the most important of the greenhouse gases since the emissions are very large and will account for approximately half the expected increase in greenhouse for the next 50 years. The emissions of CO_2 originate mainly from the combustion of fossil fuels like gas and petrol. burning of forrests can have significant impact on the icrease of such gas.

CARBON DIOXIDE MEASURES

Laboratory of Ozone and Ultraviolet Radiation (Loruv) Research

Our lab has two CO_2 instruments, one measures CO_2 in a fixed location while the other instrument is portable and is currently located an automated station in Cobija (town on the Bolivian-Brazilian border). The equipment was aquired in 1998 and has been in operation since July 1998. Measurements of the La Paz city air are taken daily every 30 minutes. Similar work has been carried in Cobija since December 1998 where temperature and relative air humidity data are also recorded.

As well as recording La Paz data every 30 minutes we also on occasions carry out measurements by the minute. With both types of data we aim to establish the normal values of CO_2 and relate these to the effects of massive field/forrest burning in the Amazon region. At present we calculate the normal value of CO_2 in La Paz city as 451 +/- 6 ppmv, which corresponds to the period December-April (during other months is seen to fluctuate and there is a significant increase during August) this is higher than the world average and is in contrast to the level obtained from our secondary station, Cobija, where a normal CO_2 level of 380ppm +/-12 ppmv has been recorded .

INSTRUMENTS

- Phonoacoustic Monitor of gases (INNOVA Air Tech Instruments A/S. modelo 1312)

INNOVA , is an instrument designed for very accurate gas concentration measurements. It is capable of measuring any gas which absorbs infrared light. For each gas it is neccesary to use a different filter. At present our Lab has the filters for carbon dioxide and water vapour.

- Portable CO_2 Analyser, (California Analytical Instruments, Inc. Model ZFP-5).

This CO2 device uses a non dispersive infrared system for measuring gas concentrations. This equipment is specifically designed to be portable for field measurements. It can work connected to a battery for 8 hours continuously or with normal feed 115 VAC.

INNOVA

CAI

OTHER ATMOSPHERIC GASES

NITROGEN DIOXIDE MEASUREMENTS

In order to measure nitrogen dioxide (NO2) levels our Lab uses a Brewer spectrometer and analyses the data by applying the Umkher method. The method consists of measuring the solar radiation intensity by looking at different masses of air combined with matrix inversion methods. During 1997 and 1998, we carried out such measurements of NO2 at the tropospheric as well as stratospheric level.

NO2 is an important chemical involved in the production of ozone. At the stratospheric level ozone is formed primarily as a result of shortwave solar ultraviolet radiation (wavelengths shorter than 242 nanometres) and the effects of NO2, dissociating the normal molecular oxygen (O_2) into two oxygen atoms. These oxygen atoms then combine with nondissociated molecular oxygen to yield ozone.

Preliminary results relating to research on the seasonal dynamic of NO_2 at the troposphere show a slight correlation between solar radiation intensity and levels of superficial ozone. As NO_2 production is associated with hydrocarbon burning (automobile emissions) we are also investigating a possible correlation between superficial ozone levels, and levels of automobile activitiy as well as automobile type.

The tropospheric nitrogen dioxide level at La Paz is extremely low for a city with over a million inhabitants, a fact that needs further study. There are of course examples of temporary pollution increases in localised areas. We currently evaluating annual data, crossing values with meteorological information and standard models. In addition to the Brewer instrument we have been using a 'surface ozone monitor' in order to obtain more cross reference data relating to pollution within the city.