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Case Study of Pollutants Concentration Sensitivity to Meteorological Fields and Land Use Parameters over Douala using AERMOD Dispersion Model

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Introduction

Since the tho past centuries, climate has significantly changed due to increase in temperature. This is due to greenhouse effects gazes and others natural sources. Africa contributes less than 4% in air pollution, but it not necessary for her to be whole protected against the damages caused by climate change. Africa is one of the regions over the world which is the most exposed to climate variability and climate changes. Climate change, including changes in climate variability, poses significant threats to people and natural systems.

Introduction

Higher temperature and changes in precipitation patterns is reducing yields of many of the most important crops currently being used to feed the African's population. Risks of floods and droughts are increasing. Air and water quality are worsened. infections diseases could spread.
In addition, resource management and public policy decisions are largely based on considerations of extreme weather and climate events. High impact weather and climate modeling and prediction in changing climate are to be studied carefully.

Introduction

Flood

Flood in our cities causes mamy damages

Introduction

Drought

Droughts cause :

- Famine in Africa/Hight impact on agriculture
- Exodus/Rural depopulation

Introduction

The main pollutants sources are Industrial source Complex

Pollution/Climate Change

Air pollution

The release of pollutants from multiple sources, most frequently by ponctual sources, as stacks, affects considerably the air quality. Air becomes stagnant, trouble, thick, foggy and misty.

Global warming

Increases in temperature are for the most cases caused by industrial activities which release radiative gases called green house effect gases in the atmosphere. These gases absorb the infrared radiation from the earth, reflect it back to the earth's surface, contributing thus to an increase in the mean air temperature on the surface.

Atmospheric dispersion

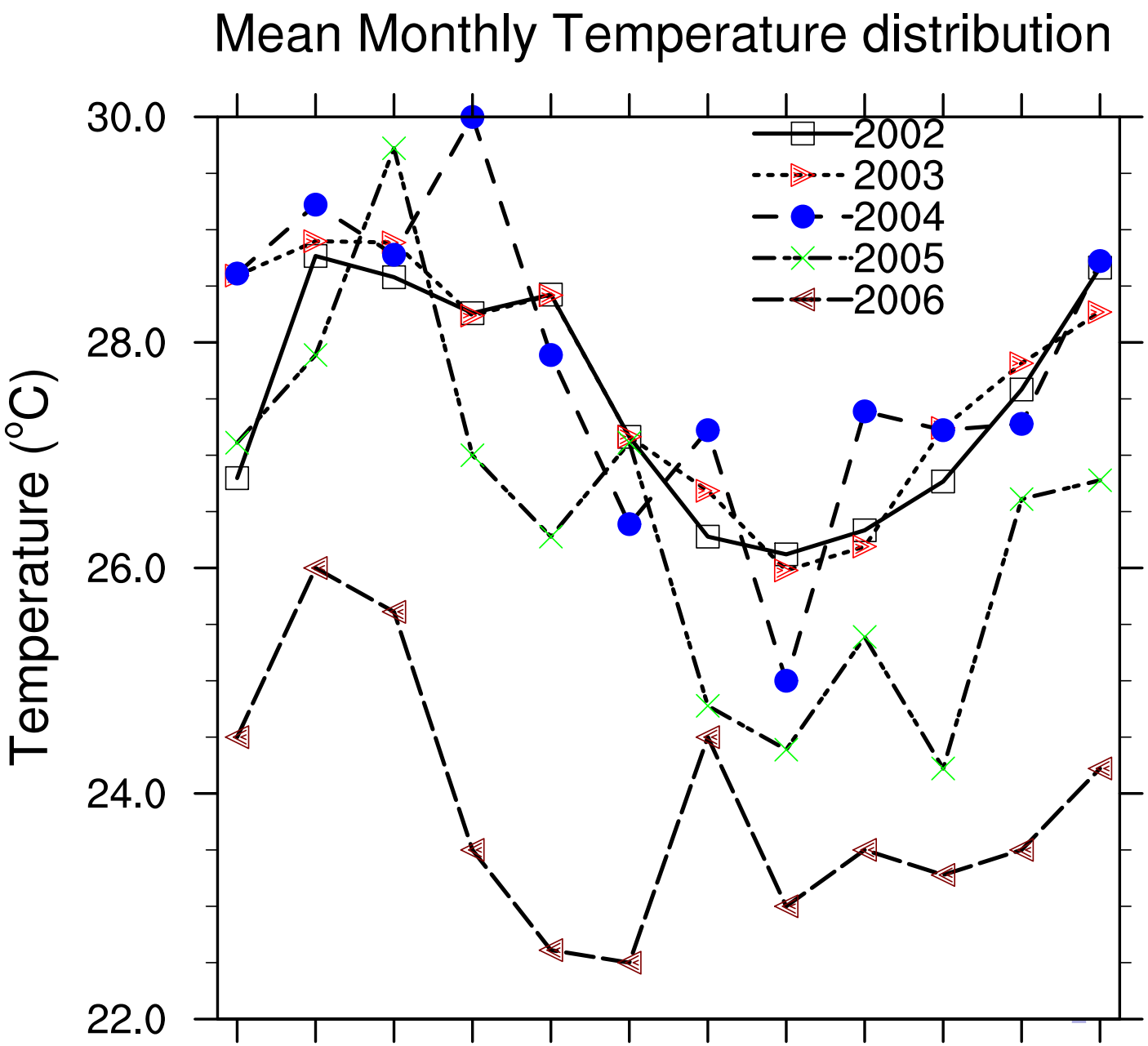
Description of AERMOD

AERMOD stands for American Meteorological Society (AMS)/Environmental Protection Agency (EPA) Regulatory Model (AERMOD) model. AERMOD is a gaussian model which uses three components : AERMET, AERMAP and AERMOD. The runstreamfiles used by AERMET require, in addition to the surface and upper air observation data, the characteristics of the terrain being modelled such as roughness length, albedo and Bowen ratio.

Land Use Parameters

1. The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorbtion. Typical values range from 0.1 for thick deciduous forests to 0.90 for fresh snow.
2. The Bowen ratio, an indicator of surface moisture, is the ratio of the sensible heat flux to the latent heat flux.
3. The surface roughness length is related to the height of obstacles to the wind flow and is, in principle, the height at which the mean horizontal wind speed is zero

Methodology



Methodology

The pollutants are Nitrogen Oxyde (NOx)

AERMOD setup

TAB.: *Source characteristics*

Stack height	Stack diameter	Gas temperature	Gas velocity
20m	0.6m	$340^{\circ}K$	19.7 m/s

Methodology

Scenario

TAB.: Values of land use parameters .

Scenario	Albedo	Bowen ratio	Roughness length
Base case	0.15	2	1 m
High albedo	0.45	2	1m
Low Bowen ratio	0.15	0.5	1m
Low roughness length	0.15	2	0.3

Results

Influence of meteorological fields in terms of distance from the source to the receptor

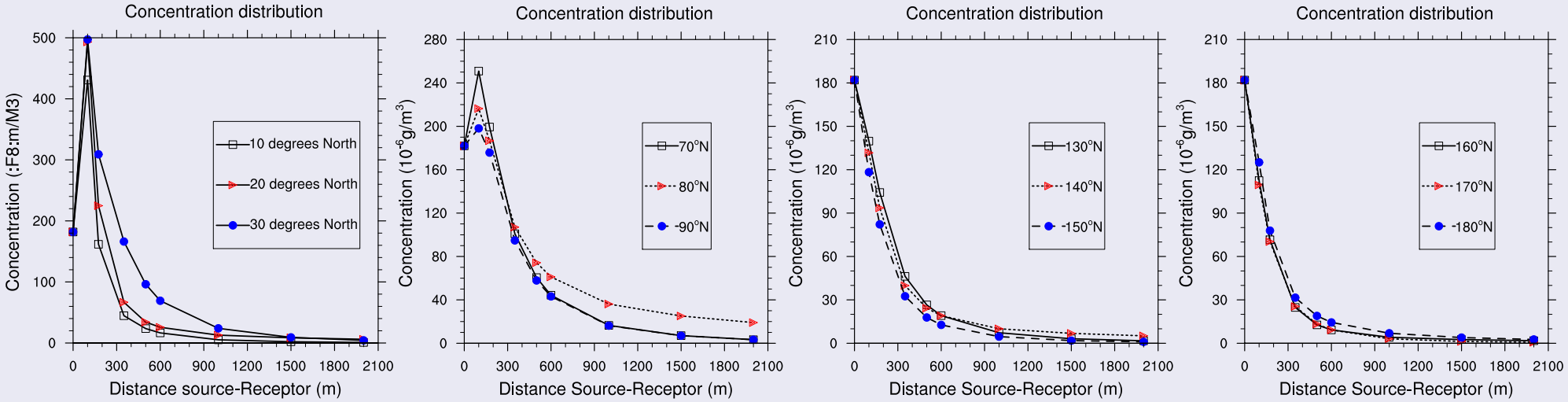


FIG.: 5 years (43800 hours) concentration distribution in terms of the distance from source to receptor. The directions of receptors are defined according to the wind rose wich extends from 10° to 360°N by step of 10°N.

Sensitivity to Land Use Parameters

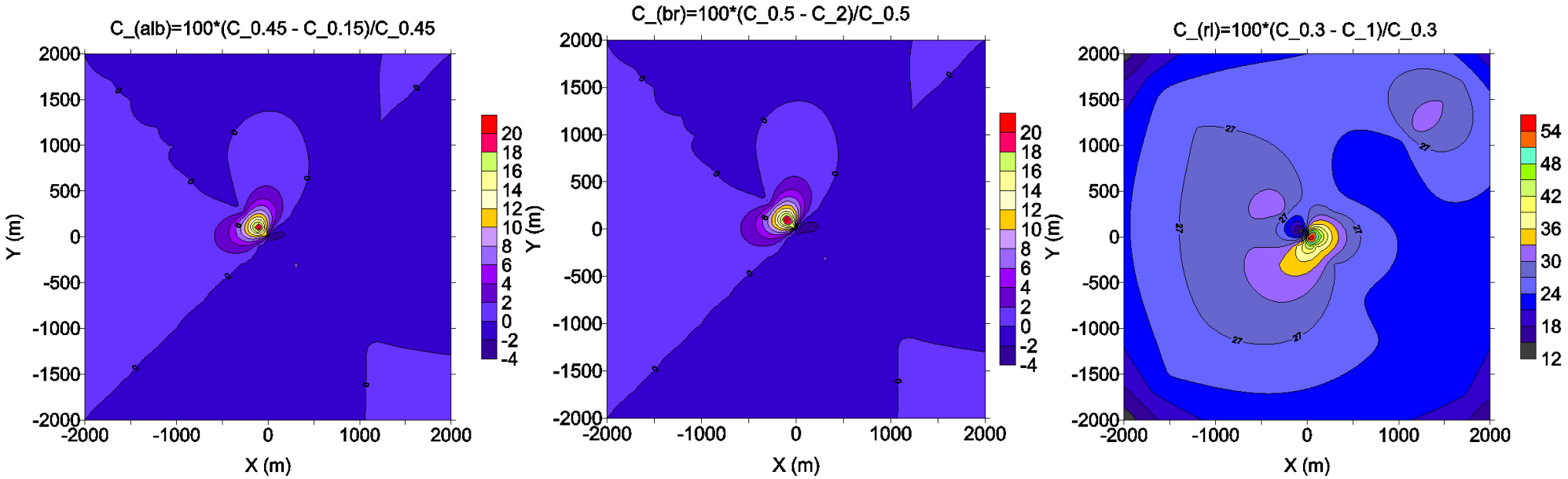


FIG.: Sensitivity to albedo, Bowen-ration and roughness lenght

Comments

- An increase in albedo leads to a decrease in concentration patterns.
- Concentrations have greatly diminished with the increase in roughness length.
- When the Bowen ratio increases from 0.5 to 2, we observe an increase in the ground concentration.

Conclusion

Conclusion

»The sensitivity of the AERMOD dispersion model to atmospheric fields and land use parameters has been investigated. We have shown that calm winds and anticyclonic conditions are not favorable to dispersion. Air temperature and solar radiation play an important role : Cool air conditions decrease the volatility of some gases.
Globally, albedo and Bowen ratio have less effects on concentration patterns than the roughness length, this to be expected since Albedo and Bowen ratio only affect the retention of incoming solar radiation, and therefore have no effect at night or just during convective conditions.

Suggestions

»The work can be imporoved by using the Weather Research and Forecasting (WRF) model.

THANKS FOR YOUR KIND ATTENTION