



Centre for Atmospheric Research

2018

MONOGRAPH OF ATMOSPHERIC RESEARCH

Edited by A.B. Rabiou and O. E. Abiye

A Publication of
CENTRE FOR ATMOSPHERIC RESEARCH
National Space Research and Development Agency
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PREFACE

The Centre for Atmospheric Research was established in January 2013 with a compelling mission to improve our understanding of the behaviour of the entire spectrum of the Earth's atmosphere; promote capacity development in relevant atmospheric sciences as a way of facilitating international competitiveness in research being conducted by atmospheric scientists; and disseminate atmospheric data/products to users towards socio-economic development of the Nation. CAR's extant core research focus includes: space weather, tropospheric studies, atmospheric research software and instrumentation development, microgravity and human space technology, and atmospheric chemistry and environmental research.

Pursuant to the above, The *Monograph of Atmospheric Research* published by the Centre for Atmospheric Research (CAR), is a collection of peer-reviewed manuscripts in Atmospheric Sciences and closely related fields. This maiden edition comprises articles presented during two separate workshops; *1st National Workshop on Microgravity and Environmental Research* (26 - 29 November, 2017) and *1st National Workshop on Air Quality* (13 - 16 March, 2018). Such workshops are integral part of CAR's capacity building program and they were primarily aimed at advancing the course of atmospheric research in Nigeria towards sustainable development. The Microgravity workshop was geared towards introducing new research opportunities in space life science by simulating microgravity conditions here at the earth's surface as a means of investigation space biological environment. The Air Quality workshop was organized in collaboration with Ministry of Environment and Nigerian Meteorological Agency (NIMET). The workshop analysed current Air Quality scenario in Nigeria, explored new opportunities for collaborative research and offered novel means of improving the present quality of life of the populace without jeopardizing the chance of the future generation. Cumulatively 196 participants participated in these two workshops and about 52 articles were eventually submitted for publication consideration in this monograph. The twenty-one articles in this very monograph are the articles that eventually made it through the rigorous peer-review process. We remain grateful to the reviewers for doing thorough work on the articles.

Thus, we are very pleased to present the *2018 Monograph of Atmospheric Research* which contains twenty-one articles, including some review papers, to readers in all spheres of interest across Nigeria and beyond. It is our hope that this effort will continue and will serve as a reference to atmospheric researchers in Nigeria.

Prof. A. B. Rabi and Dr. O. E. Abiye,
Editors



Centre for Atmospheric Research

Air Quality: Legislation and Advocacy in Nigeria

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ABSTRACT

Air is one of the most essential components of the physical environment which sustains life. A clean and pure air is essential for human health and survival. Any change in the natural and normal composition of air will adversely affect the ecosystem, particularly the living things. It is widely believed that having qualitative air is sine qua non to healthy living. It is against this background that this paper discussed air quality legislation and advocacy in Nigeria. It also examined whether appropriate measures are put in place to mitigate adverse effect of air pollution, and ascertain whether the extant legal regime for air quality control in Nigeria is adequate. The research employed a combination of doctrinal and empirical methods of research. As a theoretical study, it examined secondary sources of data as basis for answering the aforementioned legal propositions. The empirical approach involved a qualitative method such as, observation of other researcher's perceptions on the subject matter as expressed in related literatures. Findings revealed that; emissions of obnoxious substances which cause air pollution are largely unregulated in Nigeria. This problem is complicated by inadequate legal regime for effective air quality control. However, mitigation of the adverse effects of harmful emissions into our environment, strengthening of legislative measures, advocacies are recommended for appropriate air quality policy and planning in Nigeria.

Keywords: Air, Quality, Pollution, Legislation, Advocacy.

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INTRODUCTION

The atmospheric net air surrounding the earth is very critical to man's existence on the planet Air is reputed to be the most fundamental among the basic essentials of life - others being water and food. Scientific findings show that the life in man will terminate if he is deprived of air for few minutes. Equally threatening to human life, animals and plants is the fact that persistent emission of pollutants into the atmosphere in such quantities as to degrade the quality of air with adverse implications on public health and welfare such that this problem now requires appropriate legislative attention (*Okorodudu, 1998*). The main thrust of this paper is to examine air quality legislation and advocacy in Nigeria. It will also answer the questions as to whether adequate measures are put in place to mitigate the adverse effects of air pollution on public health and environment. Furthermore, the extant legal regime for air quality control will be examined with a view to identifying gaps and making recommendations for a sustainable air quality policy and planning in Nigeria.

Conceptual Clarifications

Pollution

According to National Environmental Standards and Regulations Enforcement Agency Establishment Act, "Pollution means man-made or man-aided alteration of chemical, physical, or biological quality of the environment beyond acceptable limits and "pollutants" shall be construed accordingly" (*NESRA Act, 2007*). The Black's Law Dictionary defines air pollution as "any harmful substance or energy emitted directly or indirectly into the air, especially, if the harm is to the environment or to the public health or welfare" (*Bryan, 2004*). Pure dry air in the lower atmosphere consists mainly of; nitrogen (78.084% by volume), oxygen (20.94%) the remaining (0.970%) are argon, carbon

dioxide, neon, helium, krypton, xenon, hydrogen, methane and nitrous, in decreasing order or percentage per volume. Activities from land, sea, and the atmosphere itself interfere with the natural constituency of these respective gasses and therefore the purity of air which the sum total of these gasses in their natural constituents make up. The atmosphere does not only afford a life sustaining gaseous net for man and other living organisms in the biosphere, it is also the medium for varied activities - natural, human and technological. It affords a navigation path for diverse kinds of aircraft/technologies, telecommunications, broadcasting (*satellite transmission*), electronic wave length, including also a ready absorptive receptacle for fallouts and emissions from volcanic eruptions, earthquakes, aircrafts, and land based vehicles, industrial engines, etc (*Okorodudu, 1998*). All these emit gases, substances or particulates which degrade the pristine characteristics of pure air.

Air pollution is a problem that is directly related to the number of people living in an area and the kinds of activities they engage in. In a place where the population is low and their energy usage is also low, the impact of people in creating pollution is minimal. However, where the population is high, the area urbanized and industrialized with high energy usage, large quantities of pollutants are released into the environment. It is obvious that the greater the concentration of people in one area, the greater the amount of pollution and the greater the sophistication of a society the more intricate and poignant its pollution (*Ladan, 2013*).

In the developed countries, minimum standards are set up to control the concentration of specific substances in the air. Air

is deemed to be polluted when due to the emission of some of these substances into the atmosphere beyond acceptable limits, it becomes contaminated (Okorodudu, 1998). In other words, air becomes polluted when the quality of air falls below an acceptable level which is considered desirable and safe for the health and welfare of human and other living organisms.

Air Quality

Air quality is referred to as the degree to which the air is clean and free from pollution (Hornby, 2005). It is the measurement of pollutants in the air or a description of healthiness and safety of the atmosphere. For Example, in the United States, allowable levels of harmful pollutants is set by the Environmental Protection Agency (EPA) in accordance with the Clean Air Act (CAA). The Act established two types of standards for ambient air quality, namely; the primary and secondary standards. Primary standards is concerned with the minimum level of air quality necessary to keep people from becoming ill and therefore are aimed at protecting public health. The secondary standards are aimed at the promotion of public welfare and the prevention of damage to animals, plants, and property.

Air Quality Legislation

Air quality legislation is the promulgation of law(s) directed towards managing and improving on air quality. For instance, the Clean Air Act (CAA) is a major legislation passed in the United States of America (USA). The law resulted to major shift in the federal government's role in air pollution control. It is a legal framework for promoting public health and welfare which authorizes the development of comprehensive federal and state regulations to limit emissions from both stationary and mobile sources. The US federal law is designed to control air pollution on a national scale whereas; the state laws are to perform similar role in their respective domains. The law empowers the U.S Environmental Protection Agency to set maximum allowable atmospheric concentrations of six major "criteria pollutants" by establishing National Ambient Air Quality Standards (NAAQS). Individual states then develop State Implementation Plans (SIPs) that show how they will meet these standards with the assistance of the national programme. The CAA is widely believed to be one of the U.S first and most influential modern day laws, and of the most comprehensive air quality laws in the world.

Legal Regime

The word "regime" in the context of this paper means, an organised system or ordered way of doing a particular thing. A legal regime is therefore, a system of principles and rules governing something, which is created by law. It is a framework of legal rules comprehensively put together to address some legal concerns. This paper is particularly concerned with the measures taken by the government in Nigeria through legislative means to regulate or mitigate the adverse effects of emissions of harmful substances into the atmosphere. It is by no means a study of all forms of pollution sources in Nigeria. It is an examination of the measures put in place to regulate emission of harmful substances into the air by past and present regimes to ascertain their effectiveness or otherwise.

Advocacy

Advocacy is the giving of public support to an idea, a cause of action or a belief (Hornby, 2005). In other words, it is the active promotion of a cause or principle which involves taking of decisive action that leads to a specific goal. It is a process that carefully selects one or more option(s) among many possible strategies or ways to approach an identified problem. Advocacy usually involves getting a government, individuals or institutions with the appropriate power to correct an unfair or harmful situation affecting people adversely in a given society. The situation may be resolved through persuasion, compromise or through political or legal actions. An effective advocacy must be for a just cause which is identified, thoroughly researched with regards to the merits and demerits, as well as the various approaches may be well considered.

To this effect, the Center for Atmospheric Research, Anyigba, Kogi State has identified that explosive population growth and its attendant rural-to-urban migration coupled with industrial expansions has led to excessive emission of wide range of air pollutants into our environment. This problem is exacerbated by lack of in-situ measurements to monitor pollutants concentrations obviously due to fiscal, temporal and spatial constraints at all possible locations of interest. It is important to note here that, the foregoing situation justifies the motive of the organisers of this National Air Quality Workshop (NAQW, 2018). We hereby commend them and will continue to encourage and partner with them until this dream becomes a reality.

Evolution of Air Quality Legislation in Nigeria

From the onset of British Rule in the 1900s, Nigeria's environmental protection effort had been through the colonial bye-laws. The colonial economic development policies and plans contain little or no stringent rules to conserve the natural resources or to limit pollution. The major laws on pollution include Criminal Code of 1958 with section 246 aimed at controlling burial in houses and the Public Health Act of 1958 which aims to control the spread of diseases, slaughtering of animals and disposal of refuse. The fines and penalties are liberal and the laws are quite often poorly enforced.

The period between 1960 and 1988 marked the era of political-socio-economic factors which began to enhance the development of the concept of environmental law in Nigeria. This period however, witnessed the development of cocoa industries and many other cash crops, which created many problems in terms of pollution and attracted industrial waste management in variably, infected the environment with various kinds of pollutants. The discovery of oil and subsequent oil boom in the early seventies depicts the state of unpreparedness of the government of the day for the environmental pollution which usually associated with industrial development. In 1988, the government promulgated the Federal Environmental Protection Agency Decree which establishes an agency charged with the overall responsibility for environmental management and protection. Having learned lessons from the drawbacks of the Federal Environmental Protection Agency, the National Assembly enacted the National Environmental Standards Regulations and Enforcement

Agency (NESREA) Act in 2007. NESREA is charged with the responsibility of enforcing all the environmental laws, guidelines, policies, standards, and regulations in Nigeria. It also has responsibilities for enforcing compliance with the provisions of international agreements, protocols, conventions and treaties on the environments to which Nigeria is a signatory.

Currently, air pollution is partly managed by regulations issued by the Honourable Minister of Environment pursuant to the provisions of NESREA Act such as; National Environmental (Hazardous Chemicals and Pesticides) Regulations, Nigeria Civil Aviation Regulations, 2015, National Environmental (Control of Vehicular Emission from Petrol and Diesel Engines) Regulations, and National Environmental (Air Quality Control) Regulations 2014, which purpose among other things is to provide for improved control of the nation's air quality to enhance the protection of human health, flora and fauna, and other resources affected by air quality deterioration (Tawfiq, 2016).

Legal Regime for Air Quality Control in Nigeria: A Review of Related Literatures

Okorodudu, (1998) is one of the pioneers of environmental law in Nigeria. The learned author wrote in 1998, a book titled "Law of Environmental Protection: Materials and Text" which provides a broad overview of environmental law in Nigeria. The research is backed with substantial reference to developments in the field of air quality legislation in the United States. Chapter 5 is dedicated to air resources protection in Nigeria. The work stressed the fact that, the problem of air pollution did not emerge with industrial development or the incidence of rural-urban drift. These factors merely aggravated an already existing condition. The pre-industrial sources of air pollution are outlined as; nature, bush burning, waste incineration, and the remaining sources associated with industrial era are; vehicular emissions, industrial process, petroleum production, space/aero technology and scientific manipulation of the atmosphere. On statutory control of air pollution in Nigeria, this writer argued that a semblance of air quality protection is contained in chapter 23 of the Criminal Code where certain acts likely to affect the quality of air are prohibited as offences against public health. Arguing further, the work stated that, the main weakness of the statutory air quality control measure is that, air quality is addressed strictly from the perspective of public health and not the broader objective of environmental atmospheric air protection. The author outlined applicable legislation with the aid of some decided cases both from the courts in Nigeria and the United States. The book concludes among other things that, legislation fails to address the problem of gas flaring in Nigeria.

Umozurike, (2007) in his book, "Introduction to International Law" observed that the serious threat to man's existence on earth and the nature itself exists from the resultant activities of civilised living. In Chapter 20, titled "International Law for the Protection of the Environment" the writer argued that every industrial activity exudes pollutants into the air, water or soil. Air pollution emanates from the operation of engines of all types, from factories and locomotives. Air is polluted by

artificial heating using firewood, coal, gas or oil with global consequences to plants, animal life and environment such as depletion of the ozone layer in the upper atmosphere and reduces its ability to filter hazardous ultraviolet radiation from the sun. He argued further, that states are under customary obligation to utilise their environment in a manner that it will not impede other states from enjoying theirs. This principle led to the signing of bilateral and multilateral agreements to deal with specific aspect of pollution such as the Earth Summit in Rio de Janeiro 1992, the Kyoto Protocol of 1997 which provides that industrial nations shall reduce their emission of carbon dioxide by 5.2 %. This work concluded that there should be laws that ensure that human activities are in harmony with the natural environment and the scientific law of nature.

Olarenwaju, (2010) wrote "The Law of Oil Pollution and Environmental Restoration: A Comparative Review" a book on the environmental aspect of oil production in Nigeria. He compares the position of the laws of some countries on control of pollution from oil operations with the legal regime in Nigeria. In particular it provides an overview of the different legislations on control of environmental pollution in the oil industry in Nigeria. The effects of emission of particulates and gaseous substances from oil production on the atmosphere in Nigeria are identified as: increased concentration of gases into the atmosphere which leads to greenhouse effects, emission of primary elements like sulphur and nitrogen oxide which affect water bodies, damages from acidic gases or substances to properties, emission from gas flaring which leads to destruction of the ozone layer, vegetation and alteration of genes of living organisms among others. The book also highlights the shortcomings of the legal framework for control of pollution, including emission control in the oil industry in Nigeria.

Olowoporoku et al (2011) wrote an article titled "Towards a new Framework for Air Quality Management in Nigeria" where the authors made the case for the establishment of risk-based air quality management approach based on monitoring, modeling and assessment of; vehicular traffic growth, increased reliance on petrol and diesel fuelled generators for electricity supply in homes and other public facilities, uncontrolled open incineration of waste and major thermal power stations within Nigerian cities. The study discovered that institutional and legislative frameworks for pollution control in Nigeria are inconsistent and too limited to address the scale and nature of urban air pollution. The regulatory frameworks are weak and in most cases uncertain on the statutory responsibilities and duties of the government with regard to environmental management and protection. The authors recommended four elements that will be required to initiate and develop air quality management framework in Nigeria as follows: First, there is a need for a government-led scientific inquiry to identify and analyse both the spatial and temporal components of air pollution problems in Nigeria. Second, is the establishment of numerical air quality standards and limit values for individual pollutants with the potential to compromise public health. Third, there is a need for robust legislation and regulations which will guarantee these standards as well as conferring powers and duties on specific governmental

institutions such as NESREA and state government agencies with regards to air quality. Finally, the introduction of suites of proportionate and cost-effective evaluation and management programmes to be undertaken at the local and national level for achieving the air quality objectives.

Tawfiq, M.L. (2016) appraised the recent trends in environmental regulation of industrial pollution, energy sector and air quality control in Nigeria. He provides an overview of the development of environmental law in Nigeria, highlighting the drawbacks of the defunct Federal Environmental Protection Agency Act and regulations made pursuant to it. Reviewed also is the more comprehensive regime established by National Environmental Standards Regulations and Enforcement Agency Act¹ (*NESREA Act, 2007*), and Regulations made pursuant to it from 2009 to 2014. The learned Author observed that, the NESREA Act and Regulations are aimed at addressing the preponderance of obsolete environmental regulations, standards and enforcement mechanisms which resulted over the years in the high rates of non-compliance with environmental laws, and regulations. Among the Regulations reviewed is the National Environmental (Air Quality Control) Regulations which purpose among other things is to provide for improved control of the nation's air quality to enhance the protection of human health, flora and fauna, and other resources affected by air quality deterioration. The work commended the new initiative brought by NESREA Act as substantive, particularly with regards to its enforcement roles and provisions of more realistic monetary sanctions that will prevent destructive environmental practices in Nigeria.

The article of *Ladan, (2013)* reviewed air pollution and control measures in Nigeria. It uses the doctrinal approach to study, in examining air pollution control measures in eight major cities in Nigeria. The work outlined various sources of air pollution in Nigeria to include; vehicular exhaust, industrial emissions from petrochemical industries and cement manufacturing, use of gasoline generators and the use of fuel wood for domestic and energy for small industries. Furthermore, the article outlined air pollution control measures in urban centers in Nigeria to include; environmental legislations by both the federal and various state governments and environmental education. Lamenting that all measures taken by various government policies in major cities have not sustainably reduced air pollution, the author recommended that; vehicular inspection, improved power supply, alternative means of cooking and heating for homes and small industries, effective refuse collection, enforcement of pollution regulations, and enlightenment could mitigate the adverse effect of air pollution on the environment.

In a related article, *Abam and Unachukwu, (2009)* conducted an investigation of vehicular emission in selected areas of Calabar, Cross River State, Nigeria using three areas as sampling points. Five air pollutants: Carbon Monoxide (CO), Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Particulate Matter (PM₁₀) and noise level were critically monitored as part of the air quality index. The study reveals that transport-related pollution in Calabar is significant with possibly severe health consequences.

The study suggests putting in place a proper legislative framework to regulate and control vehicle emission in the city.

However, the work did not specifically state what law should be enacted to mitigate transport related pollution in Nigeria.

Urhie, et al (2017) carried out a research on economic growth, air pollution standards enforcement and unemployment generation nexus in Nigerian context. They reviewed the correlation between economic growth and unemployment in Nigeria between 2000 and 2014. They argued that, economic growth is associated with a variety of cost such as pollution and environmental degradation and an effective regulation of firm's productive activities and household consumption has a chain effect on sustainable economic growth. The work further suggests that an increase output in Nigeria will result in an increase in Carbon Monoxide (CO) emission which effect has two economic implications; firstly; loss of productivity and death, secondly, higher expenditure on health, lower savings and eventually lower investment. They further suggest among other things that, an effective enforcement of environmental and air pollution rules could serve the dual purpose of engendering both inclusive and sustainable economic growth. The researchers outlined the types of air pollution, cause, source and scope of environmental damage and effect of air pollution in Nigeria. Air pollution is viewed as the prevalent of harmful substance in the atmosphere which is detrimental to health and wellbeing of people, animal and the environment. These researchers concluded that the problem of Nigerian economy is not the absence of appropriate law, but the challenge of effective and efficient enforcement mechanism.

MATERIALS AND METHODS

This work employed a combination of doctrinal and empirical methods of research to examine air quality legislation and advocacy in Nigeria. As a theoretical study, it examined primary and secondary sources of data as basis for answering the legal propositions. Primary sources are legislation and policy guidelines on air quality management in Nigeria, such as, National Environmental Standards and Regulations Enforcement Agency Act and regulations made pursuant to it. The secondary sources involved the review of related Textbooks and Journal Articles on the subject matter.

Empirical research in law involves the study through direct methods rather than secondary sources of the institution's rules, procedures, and personnel of the law, with a view to understanding how they operate and what obstacles they have encountered. The empirical impulse to measure the 'gap' between 'formal law' and 'practical reality' -how the law actually works- can be seen as a highly important and complex shift from the doctrinal (*Bell, 2016*). Conducting a research of this nature involved methods developed in the social sciences, different from the traditional legal research, in that, it systematically explores facts about the application of the laws and regulations by the relevant institutions. For this research, a qualitative approach such as, observation of other researcher's perceptions on the subject matter as expressed in related literatures is employed. To this effect, a review of related Textbooks and Journal Articles was

carried out, which formed the basis for determining whether the extant legal regime for air quality control in Nigeria is adequate. These methods are chosen because, the researchers consider it to be the most appropriate considering the nature, the aims and the objectives of this research.

FINDINGS

The above literature review has revealed substantially that there are no appropriate legislative measures put in place to mitigate the adverse effects of air pollution in Nigeria. This is because; all measures taken by various legislations and government policies in major cities in Nigeria have not substantially reduced pollution. It is important to state here that the NESREA Act and Regulations made pursuant to it, were laudable as commended by some authors who equally emphasis the need for effective and efficient enforcement of the laws and regulations. However, the foregoing review also reiterated the need to deploy the instrument of the law to ensure that human activities are harmonised with the natural environment and the scientific law of nature. This brings us to the main object of carrying out this investigation and also justifies the motive of the organisers of this national workshop. Nigeria is in dire need of a more efficient legal regime to mitigate the effects of pollutants from both natural and anthropogenic sources. We therefore, call on every well-meaning Nigerian to support Centre for Atmospheric Research, Anyigba to advocate for a sustainable and efficient legislation on air quality management in Nigeria.

CONCLUSION

This paper has examined some attempts made by past and present legal regimes to manage air quality in Nigeria. Air Quality is conceived as the degree to which the air in a particular place is pollution-free. It is the measurement of pollutants in the air or a description of healthiness and safety of the atmosphere. Previous researchers have argued that emissions of obnoxious substances which cause air pollution are largely unregulated in Nigeria. This study discovered that, there is a consensus among scholars in this and related fields that the legislative actions taken by various governments are grossly inadequate. It has also emphasized the need to advocate for a more robust legal regime for efficient management and control of air quality in Nigeria. To this effect we hereby recommend the following measures as the solutions to the problem of air quality management in Nigeria:

Mitigation of the adverse effects of releasing harmful substances into the atmosphere can be achieved with the aid of legislative and non-legislative actions as well as advocacy or creation of awareness about the negative effects of having a polluted atmosphere.

As a legislative measure, the government should consider upgrading the National Environmental (Air Quality Control) Regulations made by the Federal Minister of Environment in the exercise of the powers conferred on him by virtue of the provisions of NESREA Act to an Act of the National Assembly. The Act should be named; "The Clean Air Act", establish an agency to; set standards, issue licenses, monitor compliance among other functions for effective protection of human health, plants and animals as well as other resources affected by air quality

deterioration.

Air policy objectives can also be achieved using non-regulatory measures such as awareness-creation programmes and events encouraging behavioural change. The people should be enlightened about certain behaviours or practices of everyday life such as; means of transportation, sustainable waste disposal, alternative fuel for domestic cooking and heating, and agricultural practices which depletes the environment should be discouraged. For example, the use of alternative fuel to power locomotives and cycling as other means of transportation within the metropolises should be encouraged.

The Government should consider it an obligation to enlighten the general public on the risk of exposure to elevated CO₂, SO₂, PM₁₀ and Ozone concentrations. It should keep citizens informed about air pollutant emissions, including when limits are breached, as well as providing information about innovations and control programmes.

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Conflict of Interest

This work attempts to use legal measure to solve a problem which can better be comprehended in scientific terms. The research is affected by want of time and financial resources. It has also baffles with competing professional interest which largely influenced the approach employed for this study.

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Our Mandates

The Center for Atmospheric Research, CAR, is a research and development center of NASRDA committed to research and capacity building in the atmospheric and related sciences. CAR shall be dedicated to understanding the atmosphere—the air around us—and the interconnected processes that make up the Earth system, from the ocean floor through the ionosphere to the Sun's core. The Center for Atmospheric Research provides research facilities, and services for the atmospheric and Earth sciences community.

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