

U31C MCC: Level 1 Wednesday 0830h**Facilitating Geosciences Research in Developing Countries Posters**

Presiding: W D Gonzalez, National Institute for Space Research; A Cazenave, Laboratoire d'Etudes en Géophysique et Océanographie Spatiale LEGOS - GRGS/CNES

U31C-0018 0830h INVITED POSTER**Geoscience Research in Developing Countries: Collaborative Efforts**

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In my view, "facilitating geoscience research" in developing countries is simply a matter of *collaborating* with top scientists on topics of mutual interest and proceeding from there. I have been quite fortunate to have collaborated (quite intensely) with many scientists from countries whose GNP is far less than that of the U.S. However, in my experience, it is the individuals' desire to learn new things and their background that are important for the quality of the output. GNP has little to do with this. Several countries will be discussed: Portugal, India and Brazil. I will discuss several individuals, their contributions to international space science, and finally the development of the Brazilian space program.

U31C-0019 0830h POSTER**Assessment of publication practices in geosciences in developing countries**

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We present results of a study which goal was to investigate in which journals scientists in geosciences (i.e., in the fields covered by the AGU) in developing countries publish most of their papers. We were interested in particular in looking at the percentage of publications in AGU journals. Using science indicators collected by the Institute for Scientific Information (ISI), we analysed publication practices for 1997-2002 in the following countries: India, China, Russia, Brazil, Argentina and Chile. We investigated the evolution of the number of publications through time, identified most used journals, determined times cited and impact factors of papers published in the top 15 most used journals. We also determined the percentage of articles published in AGU journals versus other journals. We found that for the 6 countries considered, this percentage varies from about 2 to 3 percent (Argentina, China) to about 8 percent (the other 4 countries). Investigation of authors addresses indicates that the majority of articles published in AGU journals are multi-country publications, involving international collaboration mainly with scientists from North America and Europe. Implications on page-charge and access to AGU journals are also discussed.

U31C-0020 0830h POSTER**Space Geophysics in Brazil**

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A review about the most important Brazilian projects in Space Geophysics will be presented, with emphasis on collaborative efforts with other countries. The main problems associated with those projects, which may be common to other developing countries, will be also mentioned. Finally, some future projects will be addressed and discussed in the context of past achievements.

U31C-0021 0830h POSTER**Developing Geosciences Research Partnerships With Colleagues from SOPAC**

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Members of the AGU have an opportunity to become involved in cooperative research with scientists from the Cook Islands, Fiji, Guam, Federated States of Micronesia, Kiribati, Marshall Islands, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu, Western Samoa as well as Australia and New Zealand. Governmental officials and scientists from the member countries of the South Pacific Applied Geoscience Commission (SOPAC) and its Science Technology and Resources Network (STAR) are looking for individuals, academic and research organizations, foundations, private industry, governmental agencies and professional societies to assist with important research efforts. Involvement would include: promoting; training; funding; equipping; facilitating; coordinating; advising; monitoring; collaborating; interpreting; evaluating and reporting. Studies in all onshore, coastal and offshore environments are needed. Topics include: development of natural resources; reduction of environmental vulnerability; support of sustainable development; development of potable water supplies; protecting coral reef environments; and basic investigations of local weather, climatology, biology, geology, geophysics and oceanography. This paper addresses ways to create such research partnerships.

U31C-0022 0830h POSTER**Deep Continental Studies in India**

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The Department of Science and Technology, Government of India, under Earth System Science deals with Research and Development programs related to Earth and Atmospheric Sciences. One of the major ongoing programs includes the Deep Continental Studies (DCS) wherein projects undertaking studies of deep structural configuration of the Indian Lithosphere are supported. Challenging and critical areas of research are first identified and transect corridors are selected for integrated multidisciplinary research to be carried out on a National scale by involving Universities, National Institutions, Survey organizations amongst others. Although results from individual projects are published independently, efforts are made to publish a special issue of a National journal containing papers with the main results. Some of the successfully completed multi-disciplinary transects include Himprobe (NW Himalaya), Nagaur-Jhalawar (NW India), Mungwan-Kalimati (Central India), Kuppam-Palani (South India). The efforts during the recent years have resulted in multi-institutional, multi-disciplinary collaboration and synthesis of data across disciplinary boundaries, augmentation of high cost instrumentation facilities as well as in building up of expertise in some of the advanced techniques. Significant achievements made under DCS including highlights of the projects, future strategy for research in the area etc. will be presented.

U31C-0023 0830h INVITED POSTER**Solid-Earth Geophysics in Latinamerica**

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Geophysical research increasingly requires of multidisciplinary global approaches. This is particularly the case on Earth system science, where studies of our planet attempt to integrate phenomena from the inner core to surface, hydrosphere, atmosphere, and beyond the magnetosphere into our solar system. To accomplish this, studies span wide ranges of spatial and temporal scales. Increasing understanding of how deeply interrelated are the Earth components and processes, the potential global impact of human activities, and view of our planet as a spaceship journeying in the solar system and galaxy emphasize the need of international cooperation. New tools are being developed to investigate the planet at different scales, with high spatial-temporal resolution, and we say - Earth scientists (particularly from highly-developed countries) do conduct global research. In this context, what is

the situation in developing countries? Do all studies in foreign countries classify as international research? - Foreign countries to some of us are the home and study areas for other researchers. What are the conditions, facilities, projects and views of those other researchers? We attempt to examine some of these questions from an inside analysis and some examples in solid Earth geophysics from a Latinamerican country. How is the situation, size of research community, education and training, facilities, economic support, major problems, participation in international programs, and bilateral and multinational collaboration? What are the perspectives for future development within the region and in an international context? International research collaboration has an immense potential and is clearly needed for study of our planet. Understanding it in terms of unselfish cooperation in equal terms with fellow researchers is yet a major challenge to make the most of that potential.

U31C-0024 0830h POSTER**Antarctica Research in the Polar Research Center of China**

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The Polar Research Center of China (PRCC) was established in the early 1990s (formerly Polar Research Institute of China) to serve as the leading national organization for Antarctica-related research in China. Current research areas of center staff scientists include glaciology and paleoclimatology, upper atmospheric physics, polar and marine biology, and oceanography. In addition to its own active research, PRCC on behalf of the China Antarctic and Arctic Administration coordinates and provides logistical support to Antarctica research activities by all Chinese scientists. The center organizes and manages the annual Chinese Research Expedition to Antarctica with participation from many other national and academic institutions. In its first decade of existence, PRCC has accumulated valuable experience in conducting and facilitating research in Antarctica, particularly in the areas of logistic support for field programs, staffing and managing the two permanent stations in Antarctica (Great Wall and Zhongshan). The successful operation of the Chinese Antarctic research program has benefitted from generous assistance from several more established national (for example, Australia, Japan and the United States) Antarctica programs and from frequent contact with international colleagues working on Antarctica research. Among the many issues and problems frequently encountered in the last decade are: (1) The scale of research activities is often seriously constrained by logistic capabilities and funding; (2) Limited computer network and library resources hamper speedy and timely access to relevant international scientific literature; (3) Acquisition of high quality scientific (field and laboratory) equipment and special supplies can be limited by funding and access to suppliers.

U31D MCC: 3016 Wednesday 1020h**Health, Air Pollution, and Climate II**

Presiding: T Holloway, Gaylord Nelson

Institute for Environmental Studies,
University of Wisconsin-Madison; G
McKinley, Princeton University

U31D-01 1020h INVITED**Assessing the Health Impacts of Air Pollution Regulations Using BenMAP, the Environmental Benefits Mapping and Analysis Program**

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The U.S. EPA Office of Air and Radiation has developed BenMAP, the environmental Benefits Mapping and Analysis Program, a new software tool for estimating the health and environmental impacts of environmental regulations. BenMAP is the US EPA's premier tool for estimating benefits associated with air pollution reduction strategies, and has recently been used in evaluating US EPA's Proposed Non-Road Diesel Vehicle Standards and the proposed Clear Skies Act legislation. BenMAP is a geographic information system (GIS) that uses modeled and monitored air quality data combined with population forecasts to develop estimates of changes in community level exposure to ambient environmental pollution (currently ambient air pollution, e.g. ozone and PM). These estimated changes in exposure to ambient pollution are used as inputs to concentration-response functions derived from the epidemiological literature, along with data on baseline incidence of health effects, i.e. county level age and cause specific mortality rates. The resulting point estimates of changes in incidence of health effects, along with their associated uncertainty distributions (currently based on reported standard errors in the literature), are then multiplied by economic unit values (represented by distributions), i.e. the cost of a hospital admission, to derive dollar estimates of health benefits. BenMAP is unique in that it uses highly detailed census and health data matched with spatially detailed environmental quality data to estimate health benefits. The program can also provide estimates of the uncertainty associated with the estimated benefits. Other features of the program include the ability to pool results from multiple studies of the same endpoint, using fixed or random effects weights, or user supplied weights. BenMAP also incorporates functions to manipulate and combine information on environmental quality from many different sources. For the current version focusing on air pollution, these sources include monitor data from the AIRS network and model data from a number of different models, including REMSAD, CMAQ, and CAMx. Users can create spatially interpolated air quality surfaces using monitored data, modeled data, or a combination of both, using the model data to scale the monitored data, across time, space, or both. These air quality surfaces can then be combined with the population data to create exposure maps. Exposure maps can also be exported to GIS ready shape files with .dbf data structures. The BenMAP software includes integrated mapping and visualization functions, so that users can easily view their air quality data, model inputs such as population, and the results of analyses. BenMAP can export results to standard spreadsheet formats, as well as to shape files for use in other geographic information systems, such as ArcView. BenMAP is a new and extremely powerful tool. It is a key component in EPA's drive to produce fast, policy-relevant analyses for decision-makers and should be a useful addition to the policy analyst's toolbox.

U31D-02 1045h INVITED

Does consideration of GHG reductions change local decision making? A Case Study in Chile

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While local air pollution has been a public concern in developing countries for some time, climate change is looked upon as a non-urgent, developed world problem. In this work we present a case study of the interaction of measures to abate air pollution and measures to mitigate GHG emissions in Santiago, Chile, with the purpose of determining if the consideration of reductions in GHG affects the decisions taken to mitigate local air pollution. The emissions reductions of both GHG and local air pollutants were estimated from emission factors (some derived locally) and changes in activity levels. Health benefits due to air pollution abatement were computed using figures derived previously for the cost benefit analysis of Santiago's Decontamination Plan, transferred to the different cities taking into consideration local demographic and income data. The Santiago estimates were obtained using the damage function approach, based on some local epidemiological studies, and on local health and demographic data. Unit social values for the effects were estimated locally (for cost of treatment and lost productivity values) or extrapolated from US values (mainly for WTP values) using the ratio of per-capita income and an income elasticity of 1. The average benefits of emission abatement (in 1997 US\$ per ton) are 1,800 (1,200-2300) for NO_x, 3,000 (2,100-3900) for SO₂, 31,900 (21,900 - 41,900) for PM, and 630 (430 - 830) for resuspended dust. Economic benefits due to carbon reduction were considered at 3.5, 10 and 20 US\$/tCO₂. Marginal abatement cost curves

were constructed considering private and net costs (private less the potential sales of carbon credits). Due to the bottom-up approach to constructing the marginal cost curve, many abatement measures (like congestion tolls and CNG instead of diesel buses) amounting to 8% reduction of PM_{2.5} concentration, exhibit a negative private cost. If the health benefits are considered for the decision, a maximum reduction of 22% in PM_{2.5} levels is obtained. Although many measures have associated reductions in GHG, due to the relatively low price considered for carbon reductions, when the potential benefits of CO₂ sales are considered, this number does not increase. Therefore, consideration of the CO₂ benefits did not change the decision for any of the 36 measures analyzed. This confirms that the main driver for air pollution policy is likely to continue to be local concerns, like public health issues.

U31D-03 1110h

An Alternative to NO_x Cap-and-Trade Programs: An Exploratory Analysis of Charging NO_x Emitters for Health Damages

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To address the problem of elevated O₃ concentrations throughout the northeastern United States in summer, a NO_x cap-and-trade program was implemented that reduced NO_x emissions from large point sources by nearly 50%. To determine whether this program has been successful, we examine O₃, NO and temperature measurements collected in the EPA-AIRS network prior to and after the cap-and-trade program went into effect in 1999. Ambient NO concentrations as measured in the EPA-AIRS network are lower in the post-cap period in all months except July. We find that the upper half of the distribution of O₃ concentrations within the region is essentially unchanged (or slightly higher) in May and June, modestly reduced in July and August (except the highest concentrations which are larger in August), and significantly lower in September (ranging from 0-20 ppb lower between the mean and highest concentrations) in the 1999-2001 post-cap period relative to the 1995-1998 pre-cap period. Except for September, the frequency with which the 80ppb 8-hour NAAQS standard for O₃ is exceeded has not decreased. Temperatures during the post-cap period were slightly higher in June, July and August, and slightly lower in September - likely contributing to reduced O₃ levels during September in the post-cap period. To explore the possibility that trading, or selective emissions over the course of the summer, could influence regional O₃ concentrations, we conduct chemical transport modeling experiments using the CAMx regional model. Even within May-September for a single year, demands for electrical power and hence NO_x emissions are greater during hot than cool periods. We demonstrate that substantially more O₃ is produced from identical NO_x emissions from a single power plant on high temperature than on low temperature days in July 1995. Thus a lack of temporal restrictions on when in a single summer month NO_x emissions may occur can result in higher O₃ levels. We also demonstrate that identical NO_x emissions in regions of high (low) isoprene emission result in greater (lesser) O₃ production. This indicates that NO_x trades from locations with low to high isoprene emissions likely result in increases in O₃ production. Since the objective of reducing O₃ concentrations is to reduce the impact elevated O₃ has on human health and welfare, we examine the mortalities that result from the O₃ produced from a fixed NO_x emission in the two cases described above as well as in regions of high and low population. We estimate substantially higher mortality rates from a unit NO_x emission as a result of elevated O₃ concentrations for high temperature days, in regions of high isoprene emissions, and for emissions occurring upwind of large populations. We attempt to assign a monetary value to the loss of life resulting from the enhanced O₃ concentrations that result from these NO_x emissions. We propose, as an alternative to NO_x emissions cap and trade programs, a system by which NO_x emitters are charged for the marginal damage they cause as a result of the O₃ produced from the NO_x they emit. Rather than resulting in a reduction in total NO_x emissions without necessarily reducing O₃ concentrations (as a cap-and-trade program does), this alternative system provides a direct incentive to reduce NO_x emissions at times and places where they cause the most harm.

U31D-04 1125h

Urban Climate, Ozone Formation, and Public Health: Should Heat be Regulated as a Traditional Air Pollutant?

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The return of record breaking heat waves to North American and European cities in 2003 highlights the growing need for urban planners to develop heat mitigation strategies for large metropolitan regions. Long associated with public health through its effects on human heat stress and heat related mortality, rising urban temperatures also hold important implications for regional air quality. This presentation will outline the results of a study focused on the relationship between regional temperatures and annual tropospheric ozone exceedances in the fifty largest (by population) metropolitan regions in the United States. With the aid of data from the EPA's National Emissions Inventory and NASA's Earth Observing System Data and Information System, this study examines trends in metropolitan emissions of nitrogen oxides, volatile organic compounds, mean regional temperatures, and annual ozone exceedances in U.S. metropolitan regions for the years 1990 through 1999. The intent of this work is to better establish connections between recent trends urban climate and ozone formation and to explore policy approaches to mitigating urban temperatures through physical planning. The results of this research indicate that annual violations of the national ozone standard during the decade of the 1990s were more closely associated with regional temperatures than with the emissions of regulated ozone precursors from mobile and stationary sources. Based on the results of this analysis, I argue that the air quality management strategies outlined in the Clean Air Act may be proving insufficient to control ozone formation due to ongoing and unanticipated changes in global and regional climate. I further argue that the emergence of urban heat as a significant threat to human health demands a strategic response from the fields of urban planning and public health. The presentation will conclude with a discussion of the linkages between urban form and ambient heat and will outline a set of policy approaches that have proven successful in mitigating urban heat production.

U31D-05 1145h

Use of Satellite-Derived Air Pollution Observations to Provide Insight Into the Relationship Between Population, Long-Range Transport and Climate

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Several satellite-derived techniques for determining the extent of regional air pollution have been developed. One approach, a unique tool for deriving tropospheric ozone from satellite observations, has recently identified several "hotspot" regions around the globe where high amounts of photochemical smog can be seen. One such area identified is across East Asia, which coincides with the region that is affected by the occurrence of the Atmospheric Brown Cloud phenomenon. The prevalence of air pollution over vast areas of Asia has a significant impact on the health and the quality of life of more than one billion people and likely on the growth and yield of many crops grown in this region. This particular technique has identified a massive pollution cloud over this region that is strongly correlated with the distribution of population in China and northern India. The intensity and extent of the pollution is greatest during the summer months when the generation of photochemical smog is most efficient. When compared with widespread air pollution episodes over the eastern United States, the extent and magnitude of the Asian events are even greater. In addition, the amount of pollution exhibits significant interannual variability and this study shows that this year-to-year variability is closely linked to the phase

of the El Niño-Southern Oscillation. This same technique has also shown linkages between transport of air pollution across the North Atlantic and a particular phase of the North Atlantic Oscillation. The consequence of such transport is that it may impact regions downwind and their ability to meet their ozone attainment goals. In addition, we have recently developed an approach to provide 48-hour air quality forecasts of PM 2.5 across the United States utilizing satellite-derived aerosol products from the MODIS (Moderate Resolution Imaging Spectrometer) instrument and meteorological data from the ETA model. Relationships between the movement of high PM events and prevailing meteorology are presented. Both of these state-of-the-art approaches highlight how satellite observations uniquely identify the regional aspect of air pollution, and how such information can be used to study linkages between pollution and climate, and even provide the foundation for air quality forecasts.

U31D-06 1200h

Dust, Climate, and Human Health

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Air pollution from both natural and anthropogenic causes is considered to be one of the most serious worldwide environment-related health problems, and is expected to become worse with changes in the global climate. Dust storms from the atmospheric transport of desert soil dust that has been lifted and carried by the winds - often over significant distances - have become an increasingly important emerging air quality issue for many populations. Recent studies have shown that the dust storms can cause significant health impacts from the dust itself as well as the accompanying pollutants, pesticides, metals, salt, plant debris, and other inorganic and organic materials, including viable microorganisms (bacteria, viruses and fungi). For example, thousands of tons of Asian desert sediments, some containing pesticides and herbicides from farming regions, are commonly transported into the Arctic during dust storm events. These chemicals have been identified in animal and human tissues among Arctic indigenous populations. Millions of tons of airborne desert dust are being tracked by satellite imagery, which clearly shows the magnitude as well as the temporal and spatial variability of dust storms across the "dust belt" regions of North Africa, the Middle East, and China. This paper summarizes the most recent findings on the effects of airborne desert dust on human health as well as potential climate influences on dust and health

U32A MCC: Level 1 Wednesday 1330h

Health, Air Pollution, and Climate III Posters

Presiding: T Holloway, Gaylord Nelson
Institute for Environmental Studies,
University of Wisconsin-Madison; G
McKinley, Princeton University

U32A-0025 1330h POSTER

Partitioning the Effects of Weather and Air Pollution on Human Mortality in Santiago, Chile: 1988-1996

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The "synergistic" or "interactive" nature of the combined impacts of weather and air pollution on human health has been the topic of much speculation, but few epidemiological studies have measured whether their combined effects are antagonistic, additive, or non-linear. The present study uses a synoptic climatological approach to identify regional weather patterns associated with poor air quality and elevated mortality in the Central Valley of Chile during the winters of 1988-1996. Two offensive weather classes were identified: extratropical low pressure systems and days with cold, dry, high pressure conditions. The offensive pollution classes had mild weather conditions best described as a surface coastal low. Offensive weather and offensive pollution conditions were both associated with a 4% increase in the risk of mortality. Surprisingly nitrogen oxide (NO) was more consistently associated with

elevated mortality than fine or coarse fraction particulates. On days in which offensive weather and offensive pollution conditions coincided, the risk of mortality increased 10%, suggesting that during the winter in Santiago, the effects of weather and pollution on mortality are additive and independent.

U32A-0026 1330h POSTER

Aerosol Optical Thickness Variability in the New York Metropolitan Area

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In July 2003 this field study was performed as part of the NASA Goddard Institute for Space Studies Summer Program "Institute for Climate and Planets". The spatial variability of aerosol spectral optical thickness (AOT) in the New York Metropolitan area was measured with a hand held sun photometer "Microtops II". Measurements were taken on board of a cruise ship around Manhattan, and several transects from North to South and East to West within New York City including on top of the Empire State Building. These data are compared to other available ground observations of urban aerosols and to satellite data from MODIS. Consequences of the spatial variability of the effect of urban aerosols on climate will be discussed.

U32A-0027 1330h POSTER

Climate Change and Ozone Air Quality Over the Eastern United States: A Modeling Study

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This paper describes results of a modeling study aimed at simulating the effects of global climate change on climate and air quality over the northeastern United States with a focus on the New York City metropolitan area. The modeling system used for this study consists of the Goddard Institute for Space Studies (GISS) Global Atmosphere-Ocean Model; the PennState/NCAR MM5 mesoscale meteorological model; the Sparse Matrix Operator Kernel Emissions Modeling System (SMOKE); and the Community Multiscale Air Quality (CMAQ) model for simulating air quality. Simulations were performed for five summer seasons each during the 1990s and future decades. An evaluation of the present-day climate and air quality predictions indicates that the modeling system largely captures the observed climate-ozone system. This is established through map-tying analyses, comparison of observed and predicted distributions of meteorological variables and ozone, as well as a comparison of observed and predicted extreme heat and pollution events. Analysis of future-year predictions shows an increase in temperature and humidity as well as mean and extreme ozone concentrations under the IPCC A2 emission scenario. In addition to the analysis of mean summertime temperature, precipitation, mixing height, and pollutant concentrations, an analysis of the changes in the severity and duration of extreme heat and pollution events is presented. Furthermore, through a series of sensitivity studies the question is addressed whether changes in meteorology due to global climate change or changes in emissions have the largest impact on predicted ozone concentrations. The modeling results are also discussed in terms of their application to the analysis of public health impacts of changing climate and air quality in the New York City region.

U32A-0028 1330h POSTER

Assessing Public Health Impacts of Heat and Air Quality Under a Changing Climate in the New York City Metropolitan Area

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New tools are needed for assessing public health impacts of climate change. This paper describes the results of an integrated assessment of the health impacts of global climate change in the New York metropolitan region, projected for the decade of the 2050s. The model systems used for this study are the Goddard Institute for Space Studies (GISS) Global Atmosphere-Ocean Model; the Penn State/NCAR MM5 mesoscale meteorological model; the Sparse Matrix Operator Kernel Emissions Modeling System (SMOKE); and the Community Multiscale Air Quality (CMAQ) model for simulating air quality. Simulations are performed for five summer seasons each during the 1990s and the 2050s, using greenhouse gas emissions projections from the Intergovernmental Panel on Climate Change (IPCC) A2 scenario. The GISS global climate model at 4 x 5 degree horizontal resolution is used as input to the MM5 model run at nested grids down to 36 km resolution. The MM5 at 36 km subsequently serves as input for the CMAQ ozone simulations. A risk assessment modeling framework is used to estimate summer heat- and ozone-related mortality in the region, with a focus on comparing respective estimates for the 1990s versus the 2050s. These endpoints represent two potentially appreciable public health impacts resulting from climate change-induced alterations in regional temperature and air quality profiles. Concentration-response functions from the epidemiological literature describing temperature-mortality and ozone-mortality relationships are applied in the risk assessment, to estimate numbers of regional deaths in a typical 1990s summer and a typical 2050s summer. An evaluation to define ozone-related mortality uses a minimum-value threshold applied across the 1-hour daily maximum ozone model outputs, to identify days that pose an elevated relative risk of ozone mortality. A parallel evaluation of heat-related mortality applies a 23.08°C (73.54°F) threshold value, above which the relative risk of heat-related mortality increases by 13.05% per 5.6°C (10°F). Preliminary analysis of future-year ozone-related mortality suggests a subtle increase in the number of summer ozone-related deaths in the New York region in the 2050s as compared to the 1990s. A parallel evaluation of heat-related mortality in a typical summer of the 2050s suggests a far greater relative increase as compared to the 1990s, with a doubling to tripling of regional summer heat deaths possible by the 2050s.

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Large Scale Numerical Modelling to Study the Dispersion of Persistent Toxic Substances Over Europe

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For the past two decades environmental research at the GKSS Research Centre has been concerned with airborne pollutants with adverse effects on human health. The research was mainly focused on investigating the