EURASAP GOVERNING BODIES 2005-2007

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EDITORIAL

Dear EURASAP members,

In the first half of 2006 EURASAP has supported participation of young scientists in the ICUC6 in Göteborg, Sweden. Contributions to the Newsletter from them will be published soon.

At the ICUC conference Gerald Mills has presented a review on the earliest urban climate studies and was kind to share the information through the EURASAP Newsletter.

Dr. Antoaneta Yotova has proposed a topic for discussion within the EURASAP Community. All views are welcome (Antoaneta.Iotova@meteo.bg) and will be published in the Newsletter.

Your opinions on the form of the EURASAP Newsletter "paper and web" or "only web" are to be expressed to the EURASAP Newsletter Editor (Ekaterina.Batchvarova@eurasap.org) by the end of November 2006.

The Newsletter Editor

Scientists' Contributions

LUKE HOWARD AND THE CLIMATE OF LONDON

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INTRODUCTION

The International Association for Urban Climate (IAUC) recently undertook to produce a new edition of **The Climate of London**, which was originally published in 1818 (1st Ed.). While Luke Howard's international fame is based on his classification of clouds (e.g. Pedgley, 2003) over the course of his career he produced several seminal works on climatology and meteorology. **The Climate of London** represents his grandest achievement as it is based on nearly thirty years of observations and analysis. It undertakes to provide a firm observationally-based analysis of climate, a field which hitherto had received little concerted inquiry:

> *Now, in no one department of Natural knowledge is the field less trodden, or the opportunity for a successful exertion of the judgment in establishing general principles greater, than in Meteorology, in its present state. There is no subject on which the learned and the unlearned are more ready to converse, and to hazard an opinion, than on the Weather — and none on which they are more frequently mistaken! This, alone, may serve to show that we are in want of more* ***data****, of a greater store of facts, on which to found a Theory that might guide us to more certain conclusions; and facts will certainly multiply together with observers…. So, to become qualified to reason on the variations of our own Climate, we should begin by making ourselves familiar with their extent and progress, as marked by the common instruments, and the common natural indications: for which purpose such a model as the present Volume may be found very serviceable.*

Howard was part of a gifted generation of 'amateur' scientists that were to be found in London at a time of burgeoning scientific inquiry. Much of this activity was driven by the 'professional' classes, many of whom were Dissenters. Howard himself was a devout Quaker and his examination of natural phenomenon is underpinned by his Christian beliefs, which are freely expressed in his published work. Although he was trained as a pharmacist, he had a passionate interest in climate and weather; clouds held a particular fascination for him. His science was developed through interaction with others in formative scientific societies such as the Askesian Society, where Howard first presented his famous essay on clouds (Hamblyn, 2001).

THE FIRST MODERN TEXTBOOK ON CLIMATE

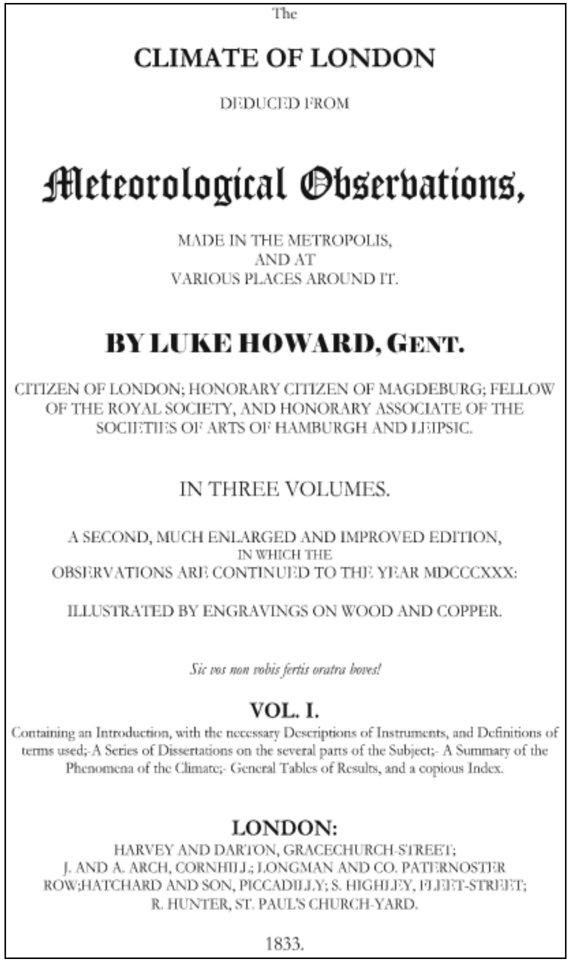
The IAUC edition of **Climate** is based upon the second edition, which was published in three volumes (Figure 1). The first of these provides Howard's analysis of each of the climate elements (temperature, pressure, wind, precipitation, etc.) and searches for trends, patterns and correlations. The second and third volumes consist of his daily records of the weather arranged by month. In addition, it contains notes and reports that he gleans from 'reputable' sources and newspaper records. In many respects, it may claim to be the first 'modern' textbook on climate. In support of this consider three characteristics of the work:

1. A concern for precision in the use of language: Howard's famous essay on clouds, which he presented to the Askesian Society in London in its 1802/03 lecture season, is reproduced in Volume I. In his introduction to the essay he re-states his reasons for employing Latin terms:

> *But the principal objection to English, or any other local terms, remains to be stated. They take away from the Nomenclature its present advantage of constituting, as far as it goes, an universal Language, by means of which the intelligent of every country may convey to each other their ideas, without the necessity of translation. And the more this facility of communication can be increased, by our adopting: by consent uniform Modes, Terms, and Measures for our observations, the sooner we shall arrive at a knowledge of the phenomena of the atmosphere in all parts of the globe, and carry the science to some degree of perfection.*

2. A concern for accurate observations: Howard was frustrated in his attempts to obtain accurate precipitation records from the Royal Society, the most important English scientific authority at the time. In the following passage, he publicly castigates their record-keeping in this regard:

> *The average Annual rain of the ten years (from 1820 to 1830, omitting 1826) is 17.615 in. which corrected for the elevation of the gauge gives 23.277 — **a quantity falling below the real average of the district by more than two inches**. It may be said that probably other causes than such as have been stated, and those peculiar to a great city, contribute to this deficiency. It would be very satisfactory to be able to appreciate the action of such causes, and their annual share of effect — but until an Instrument, which is understood to be that of so respectable a Scientific corporation, and the indications of which they have so long been in the habit of publishing, shall be deemed worthy of **daily use** when Rain is falling, we shall in vain expect from this quarter the **data** needful even for the construction of the problem.*



The

CLIMATE OF LONDON

DEDUCED FROM

Meteorological Observations,

MADE IN THE METROPOLIS,
AND AT
VARIOUS PLACES AROUND IT.

BY LUKE HOWARD, GENT.

CITIZEN OF LONDON; HONORARY CITIZEN OF MAGDEBURG; FELLOW OF THE ROYAL SOCIETY, AND HONORARY ASSOCIATE OF THE SOCIETIES OF ARTS OF HAMBURGH AND LEIPSIC.

IN THREE VOLUMES.

A SECOND, MUCH ENLARGED AND IMPROVED EDITION,
IN WHICH THE
OBSERVATIONS ARE CONTINUED TO THE YEAR MDCCCXXX:

ILLUSTRATED BY ENGRAVINGS ON WOOD AND COPPER.

Sic vos non vobis fertis oratra boves!

VOL. I.

Containing an Introduction, with the necessary Descriptions of Instruments, and Definitions of terms used;-A Series of Dissertations on the several parts of the Subject;- A Summary of the Phenomena of the Climate;- General Tables of Results, and a copious Index.

LONDON:
HARVEY AND DARTON, GRACECHURCH-STREET;
J. AND A. ARCH, CORNHILL; LONGMAN AND CO. PATERNOSTER ROW;HATCHARD AND SON, PICCADILLY; S. HIGHLEY, FLEET-STREET; R. HUNTER, ST. PAUL'S CHURCH-YARD.

1833.

Figure 1. The title page of the second edition of ***The Climate of London****.*

3. Use of graphs and diagrams: Howard employs graphs and tables throughout the text in order to describe, analyse and illustrate his work. Figure 2 is from Volume I and shows the distribution of temperature through the year in relation to the mean temperature. This diagram was employed to show the relationship between the annual declination of the sun and the recorded temperature (the original is in colour).

THE URBAN TEMPERATURE EFFECT

Despite the title, Howard's work is a general book on climatology as observed from the vantage point of London and its vicinity (Table 1, Figure 3). Nevertheless, its relevance to the field of urban climatology and the reason that the IAUC has re-published this work is that Howard is the first to recognize that urban areas alter climate. This is discovered when he compares his temperature records against those made by the Royal Society at Somerset House in the centre of the London Metropolis (Figure 4). He concludes that '*the temperature of the city is not to be considered as that of the climate; it partakes too much of an artificial warmth, induced by its structure, by a crowded population, and the consumption of great quantities of fuel in fires*'. His is the first analysis of two related, but distinct issues:

1. the urban 'contamination' of meteorological records and,
2. the magnitude and cause of the urban effect.

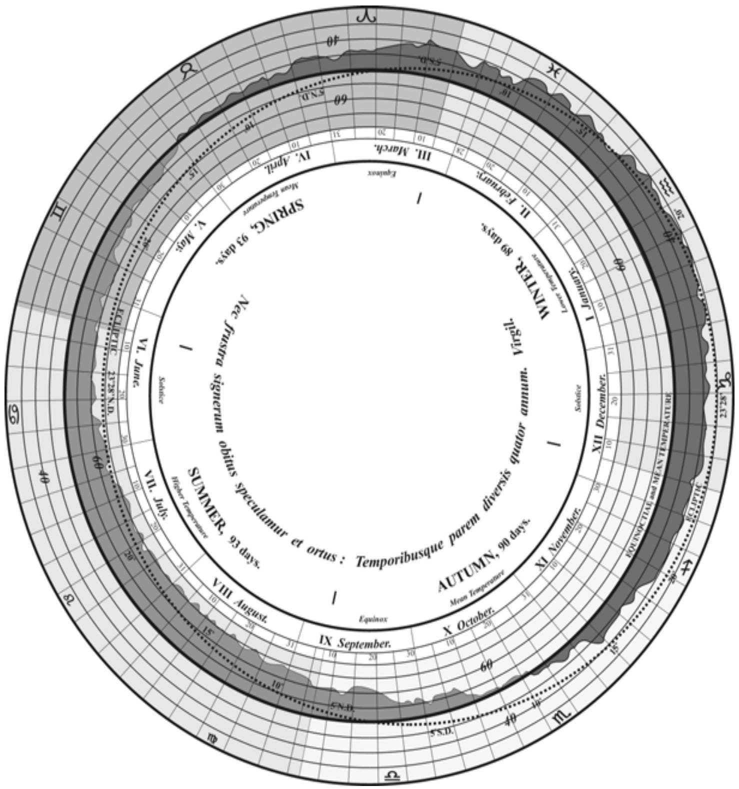


Figure 2. A reproduction of Plate 2 from the 2nd edition of **The Climate of London** entitled the yearly cycle of temperature. The circles represent a graduated temperature scale and the days of the year form the azimuth. The annual temperature curve is presented as an irregular curve and is shaded according to whether it is above or below the annual average temperature. Also shown is the declination of the sun and Howard's delineation of the year into 'natural' seasons.

Table 1. Luke Howard's Observations 1806-1830		
Years	Location	Originally Published†
1806-09	Plaistow	Athenæum
1810-11	Stratford&Clapton	Unpublished
1811-12	Plaistow	Nicholson's Philosophical Journal
1813-19	Tottenham	Thomson's Annals of Philosophy
1819-27	Tottenham& Stratford	Annals of Philosophy, Philosophical Magazine and Journal
1828-30	Stratford	Unpublished
†Howard's original tables were published as a Meteorological Register in a number of journals.		

The urban effect is measured as the difference between the 'rural' and 'urban' temperature records (ΔT_{u-r}). In his chapter on Temperature, Howard concludes:

> *Thus, under the varying circumstances of different Sites, different Instruments, and different Positions of the latter, we find London always warmer than the country, the average excess of its temperature being 1.579°…; for the purposes of comparison rate the **Mean of the Latitude and level** of London at 48.5°, and that of the **Metropolis itself** at 50.5°.*

And in the chapter on summary of climate:

> *The **Mean Temperature of the Climate** … is strictly about 48.50° Fahr.: but in the denser parts of the*

> *metropolis, the heat is raised, by the effect of the population and fires, to 50.50°; and it must be proportionately affected in the suburban parts. The excess of the Temperature of the city varies through the year, being least in spring, and greatest in winter; and it belongs, in strictness, to the* ***nights****; which average three degrees and seven-tenths warmer than in the country; while the heat of the day, …. falls, on a mean of years, about a third of a degree short of that in the open plain.*

Virtually all of the essential characteristics of the **Urban Heat Island** (UHI) are outlined in this work. He has found that it is a night-time phenomenon and that, although he has observations for the city centre only, hypothesizes that the circumstances which cause the temperature to be elevated in the city must operate to a lesser degree in the suburbs (Figure 5). His examination of the urban effect consists of a description of its character from which he deduces potential causes. His analysis is thorough and prescient.

> *That the superior temperature of the bodies of men and animals is capable of elevating, in a small proportion, the Mean heat of a city or populous tract of country in a temperate latitude, is a proposition which will scarcely be disputed. Whoever has passed his hand over the surface of a glass hive, whether in summer or winter, will have perceived, perhaps with*

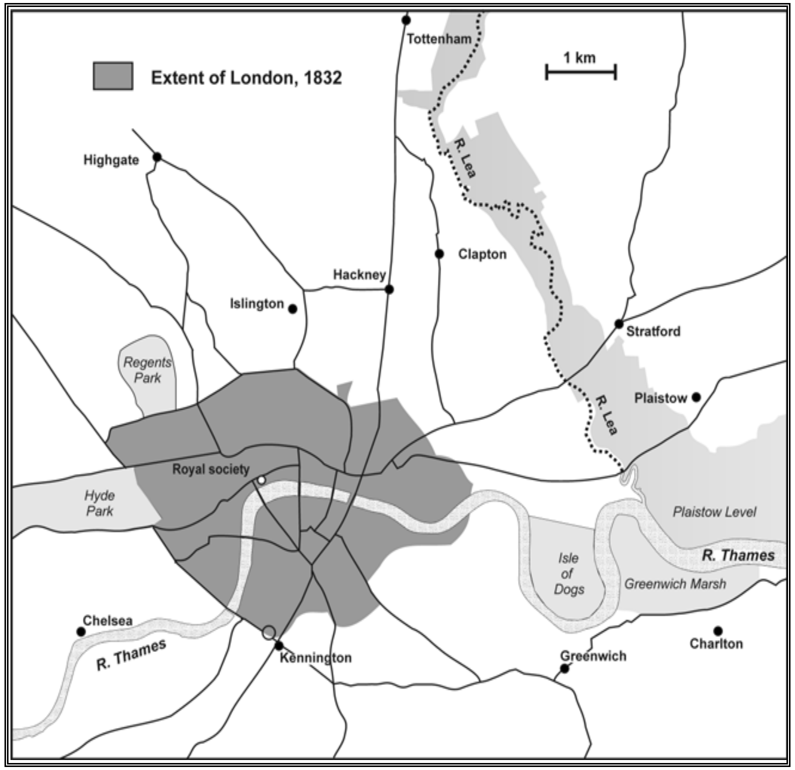


Figure 3. This map shows London in 1832 and the various places where Howard made his obeservations. It also shows the location of the Royal Society from which he obtained his urban temperature observations. This map is based on *The Environs of London*, Published by Baldwin and Cradock, 47 Paternoster Row, London (Source: http://www.londonancestor.com/maps/)

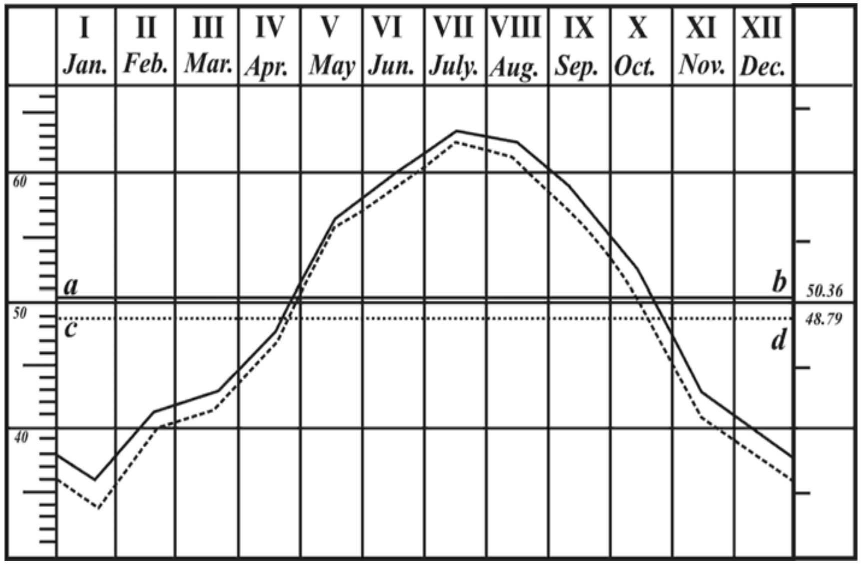


Figure 4. The temperature graph is Figure 3 in **The Climate** and shows the annual temperature curves for the city (solid) and the countryside (dashed). The labeled horizontal lines represent the means for the city (a-b) and countryside (c-d).

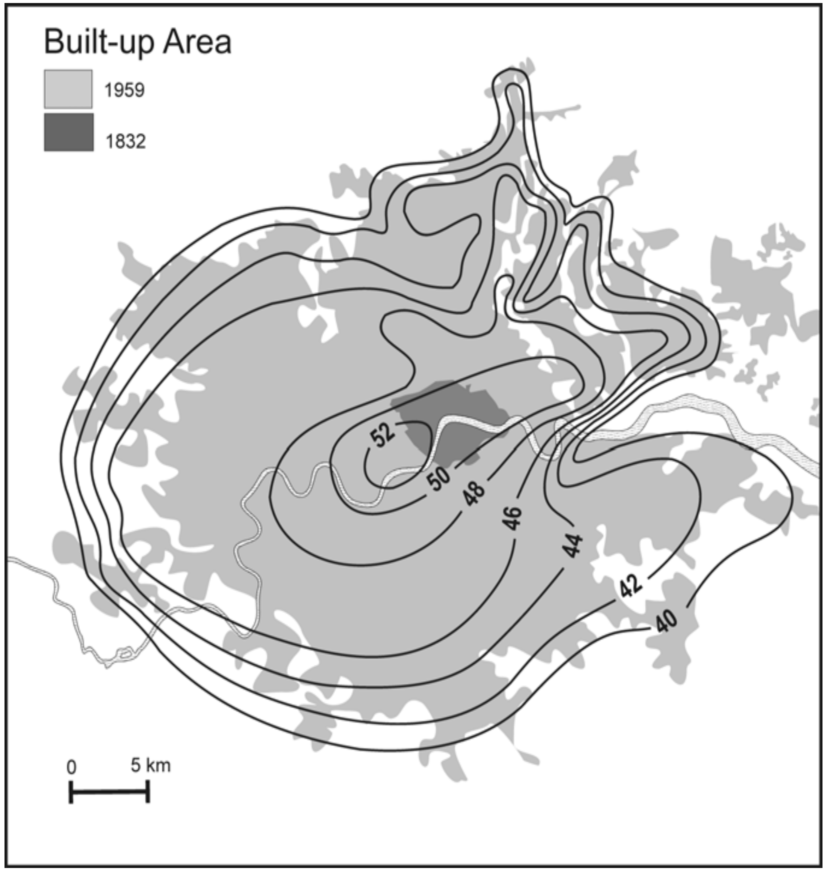


Figure 5. This map is redrawn from Figure 55 in Chandler, 1965 and shows the minimum air temperature on 14 May 1959. The extent of London during Howard's time is also illustrated.

surprise, how much the little bodies of the collected multitude of Bees are capable of heating the place that contains them: hence, in warm weather, we see them ventilating the hive with their wings, and occasionally preferring, while unemployed, to lodge, like our citizens, about the entrance.

But the proportion of warmth which is induced in a city by the Population, must be far less considerable than that which emanates from the fires: the greater part of which are kept up for the very purpose of preventing the sensation attending the escape of heat from our bodies. A temperature equal to that of Spring is hence maintained, in the depth of Winter, in the ***included*** *part of the atmosphere, which, as it escapes from the houses, is continually renewed: another and more considerable portion of heated air is continually poured into the common mass from the chimnies; to which, lastly, we have to add the heat diffused in all directions, from founderies, breweries, steam engines, and other manufacturing and culinary fires. The real matter of surprise, when we contemplate so many sources of heat in a city is, that the effect on the Thermometer is not more considerable.*

To return to the proportions held by the excess of London, it is greater in winter than in summer, and it sinks gradually to its lowest amount as the

temperature advances in the spring, all which is consistent with the supposition, that in winter it is principally due to the heat diffused by the fires.

It appears that London does not wholly lose its superiority of temperature, by the extinction of most of the fires in Spring: on the contrary, it is resumed in a large proportion in the Sixth month, and continues through the warm season. It is probable, therefore, that the Sun in summer actually warms the air of the city more than it does that of the country around. Several causes may be supposed to contribute to this: the country presents for the most part a plain surface, which radiates freely to the sky, — the city, in great part, a collection of vertical surfaces, which reflect on each other the heat they respectively acquire: the country is freely swept by the light winds of summer, — the city, from its construction, greatly impedes their passage, except at a certain height above the buildings: the country has an almost inexhaustible store of moisture to supply its evaporation — that of the city is very speedily exhausted, even after heavy rain. When we consider that radiation to the sky, the contact of fresh breezes, and evaporation, are the three principal impediments to the daily accumulation of heat at the surface, we shall perceive that a city like London ought to be more heated by the summer sun than the country around it..

This analysis is relatively complex. In summary, he identifies four causes for the observed differences in air temperature:

1. Anthropogenic sources of heat resulting in atmospheric warming, particularly in winter.
2. The geometry of urban surfaces which 'traps' radiation and obstructs 'free radiation to the sky'.
3. The effect of urban 'roughness' in impeding the passage of 'the light winds of summer'.
4. The availability of moisture for evaporation in the country.

While the first cause is invoked to explain the excess warmth of London in the Winter, the latter three are used to explain the fact that *London does not wholly lose its superiority of temperature, by the extinction of the fires in Spring.*

The causes of the warming effect are explored in greater detail when Howard considers the rates at which the urban area warms and cools relative to the surrounding country.

> *But this effect is not produced suddenly. For while, in the forenoon, a proportion of the walls are exposed to the sun, the remainder are in shade, and casting a shadow on the intervening ground. These are receiving, however, in the wider streets, the reflected rays from the walls opposed to them; which they return to the former, when visited in their turn by the sun. Hence in the narrow streets, especially those that run East and West, it is generally cooler than in the larger ones, and in the squares. Hence too, in the morning of a hot day, it is sensibly cooler in London than in the country; and in the evening sensibly warmer. For the hottest time in a city, relatively to the hour of the day, must be that, when the second set of vertical surfaces having become heated by the Western sun, the passenger is placed between two skreens, the one reflecting the heat it is receiving, the other radiating that which it has received. Many of my readers must recollect having felt the heat of a Western wall, in passing under it long after sunset.*

This analysis is readily translated into modern research on the urban effect, which is framed in terms of its energetic basis (Table 2). It is a pity that Howard had no means of recording wind velocity except by direct observation. With detailed wind information he would certainly have examined the correspondence between ΔT_{u-r} and wind-speed, to which he alludes. In addition, he had no comparative data to examine rates of evaporation or differences in humidity. His examination of the urban effect was therefore largely limited to temperature (he had little trust in the available urban rainfall data). Howard did not attempt to formalize his analysis by examining the relative magnitudes of the causes he hypothesized (such as the anthropogenic contribution). Moreover, he did not consider the impact of urban construction materials on the thermal properties of the city's surfaces. Despite this, Howard identified virtually all of the factors that are responsible for the UHI – that he did so in

1820, at the very beginning of the scientific study of weather and climate is remarkable. By any measure, 'Luke Howard's account is monumental' (Chandler, 1965).

Table 2.
Suggested causes of modern canopy layer Urban Heat Island (Oke, 1982)

Energy Budget term	Urban features	Urban effect
Increased absorption of solar radiation.	Canyon geometry	Increased surface area and multiple reflection
Increased long-wave radiation received from the sky.	Air pollution	Greater absorption and re-emission
Decreased long-wave radiation loss from surfaces of buildings and streets.	Canyon geometry	Reduced sky view factor
Heat added by human activities.	Buildings & traffic	Direct addition of heat
Increased storage of heat in city fabric.	Construction materials	Increased thermal admittance
Decreased latent heat exchange.	Construction materials	Increased water-proofing
Decreased sensible and latent heat exchange.	Canyon geometry	Reduced wind speed

THE IAUC EDITION

The Climate of London represents the starting point for the field of urban climatology. The IAUC edition has been was created from a scanned version of the 2nd edition, originally published in 1833. The original was scanned and converted into text using optical character recognition software. All of the tables have been retyped and all the original diagrams have been redrawn. To extent that it was possible, this edition attempts to duplicate the style of the original edition. The IAUC are pursuing several means of making **Climate** more widely available. It is intended that it will be made available at the IAUC website before January 2007 (www.urban-climate.org). In addition, a limited number of high-quality boxed sets will be produced. If readers are interested in this project or wish to indicate interest in obtaining copies of **Climate**, they should contact me.

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Chandler, T. 1965: **The Climate of London**. Hutchinson & Co., LTD., London.

Hamblyn R. 2001: **The Invention of Clouds**. Farrar, Straus and Giroux, New York.

Oke T.R. 1982: The energetic basis of the urban heat island. *Quarterly Journal of the Royal Meteorological Society* 108, 1-24.

Pedgley D.E. 2003: Luke Howard and his clouds. *Weather* 58, 51-54.

OZONE-FRIENDLY CHEMICALS LEAD TO WARMING

JOHN HEILPRIN,
Associated Press Writer – *Sun., Aug 20, 2006*
Source:
http://news.yahoo.com/s/ap/20060820/ap_on_sc/ozone_global_warming

WASHINGTON - Cool your home, warm the planet. When more than two dozen countries undertook in 1989 to fix the ozone hole over Antarctica, they began replacing chloroflourocarbons in refrigerators, air conditioners and hair spray. But they had little idea that using other gases that contain chlorine or fluorine instead also would contribute greatly to global warming.

CFCs destroy ozone, the atmospheric layer that helps protect against the sun's most harmful rays, and trap the earth's heat, contributing to a rise in average surface temperatures. In theory, the ban should have helped both problems. But the countries that first signed the Montreal Protocol 17 years ago failed to recognize that CFC users would seek out the cheapest available alternative. The chemicals that replaced CFCs are better for the ozone layer, but do little to help

global warming. These chemicals, too, act as a reflective layer in the atmosphere that traps heat like a greenhouse.

That effect is at odds with the intent of a second treaty, drawn up in Kyoto, Japan, in 1997 by the same countries behind the Montreal pact. In fact, the volume of greenhouse gases created as a result of the Montreal agreement's phaseout of CFCs is two times to three times the amount of global-warming carbon dioxide the Kyoto agreement is supposed to eliminate.

This unintended consequence now haunts the nations that signed both U.N. treaties.

Switzerland first tried in 1990 to sound an alarm that the solution for plugging the ozone hole might contribute to another environmental problem. The reaction?

"Nothing, or almost," said Blaise Horisberger, the Swiss representative to U.N.-backed Montreal treaty. "We have been permanently raising this issue. It has been really difficult." Horisberger, a biologist with the Swiss Agency for the Environment, Forests and Landscape, kept trying. Finally, the first formal, secret talks on the subject were held in Montreal last month.

"Saving the ozone layer by reducing CFCs and at the same time promoting alternatives was an urgent crisis in the early years of the Montreal Protocol," said Marco Gonzalez, the treaty's executive secretary, in Nairobi, Kenya. "Now there is always a need to find new substances which are safe, energy-efficient and also have minimal impact across a range of environmental issues."

The Montreal Protocol, which now has 189 member nations, is considered one of the most effective environmental treaties. Almost $2.1 billion has been spent through an affiliated fund to prod countries to stop making and using CFCs and other ozone-damaging chemicals in refrigerators, air conditioners, foams and other products.

Scientists blame CFCs for poking a huge, seasonal hole in the stratospheric ozone layer about 7 miles to 14 miles over Antarctica. Last year, the ozone hole peaked at about 10 million square miles, or the size of North America. That was below the 2003 record size of about 11 million square miles. Scientists expect the hole will not heal until 2065.

CFCs also are thinning the ozone layer over the Arctic and, to a lesser extent, globally. As the protective layer thins, more ultraviolet radiation gets through, increasing people's risk of skin cancer and cataracts and threatening more plants and animals with extinction.

Some of the replacement chemicals whose use has grown because of the Montreal treaty — hydrochloroflourocarbons, or HCFCs, and their byproducts, hydrofluorocarbons, or HFCs — decompose faster than CFCs because they contain hydrogen. But, like CFCs, they are considered potent greenhouse gases that harm the climate — up to 10,000 times worse than carbon dioxide emissions.

The Kyoto treaty's goal is to reduce carbon dioxide emissions from power plants, motor vehicles and other sources that burn fossil fuels by about 1 billion tons by 2012. Use of HCFCs and HFCs is projected to add the equivalent of 2 billion to 3 billion tons of carbon dioxide emissions to the atmosphere by 2015, U.N. climate experts said in a recent report. The CFCs they replace also would have added that much.

"But now the question is, who's going to ensure that the replacements are not going to cause global warming?" said Alexander von Bismarck, campaigns director for the Environmental Investigation Agency, a nonprofit watchdog group in London and Washington. "It's shocking that so far nobody's taking responsibility. A massive opportunity to help stave off climate change is currently being cast aside," he said.

The U.N. report says the atmosphere could be spared the equivalent of one billion tons of carbon dioxide emissions if countries used ammonia, hydrocarbons, carbon dioxide or other ozone-friendly chemicals, rather than HCFCs and HFCs, in foams and refrigerants. Such alternatives are more common in Europe.

"This potential of not using greenhouse gases is not fully used," said Horisberger, the Swiss official. "It's because of many reasons — technical, big commercial interests."

Industry is split over how to replace CFCs and HCFCs. One of the biggest producers of fluorine-based refrigerants, Honeywell International Inc., says it is discontinuing its use of "the older technology, environmentally unfriendly CFC and HCFC refrigerants," and replacing those chlorine-containing chemicals with HFCs in retrofits and in new equipment.

Industry representatives cite safety and energy efficiency problems with the use of ammonia and hydrocarbons, which mainly involves propane gas. "If there's a leak in a residential line, it can ignite — you have a potential bomb," said Stephen Yurek, general counsel for the Air-Conditioning and Refrigeration Institute. It represents North American makers of equipment for homes, businesses and transportation.

Manufacturers also say they could not meet U.S. energy efficiency requirements that took effect this year if they

used those chemicals. "The technology just isn't there," Yurek said.

A 2002 study prepared for an industry coalition that encourages use of HCFCs and HFCs says the safety measures and higher energy bills required by some alternatives would cost U.S. consumers hundreds of millions of dollars a year.

"We're saying efficiency is just as important as the refrigerant being used," Yurek said. "If it's going to increase the amount of energy used to operate a piece of equipment, you're actually worse off because you're going to be pumping more CO2 (carbon dioxide) into the atmosphere."

The Montreal Protocol has been powered by a global fund run by the United Nations and the World Bank. On average, more than $150 million is spent a year to help developing nations comply with the treaty by phasing out CFCs. The fund pays the costs for companies to switch from CFCs to HCFCs, HFCs and other chemicals commonly used in air conditioners, semiconductors, foams, fire extinguishers, hair spray, and roof and wall insulation. The biggest beneficiaries are companies in seven countries: China, India, Venezuela, Argentina, Mexico, Romania and North Korea.

Meanwhile, consumers in the U.S. and elsewhere continue to snap up products that would cost more if HCFCs and HFCs were already eliminated. Under the Montreal treaty, industrial countries have until 2030 and developing countries until 2040 to quit using HCFCs and HFCs.

"It is true that there will be a significant growth over the next 10 years of HCFC production and consumption in the developing countries," said Lambert Kuijpers, a Dutch nuclear physicist and a lead author of the U.N. report. "This will also contribute to global warming in a so far unprecedented way, if it will occur as anticipated."

That is a touchy subject for supporters of the Montreal agreement. Few want to acknowledge anything could be wrong with a treaty that is on track to fix at least one major environmental problem.

"You have to put it into historical perspective. Hydrocarbon technology wasn't ready. ... It was still being tested in the early 1990s. And only gradually that technology became mature and became accepted," said Sheng Hsuo Lang, the fund's deputy chief officer. "In hindsight, you can say, 'Why didn't you wait?' Or you can take action right away."

The United States signed the Montreal Protocol, but has not ratified the Kyoto Treaty.

More on the Net:

Montreal Protocol: http://ozone.unep.org/index.asp

Kyoto Protocol:
http://unfccc.int/essential_background/kyoto_protocol/background/items/1351.php

Multilateral Fund: http://www.multilateralfund.org

This topic, to track the consistence in requirements between the important international agreements in the field of air pollution, was suggested for discussions within EURASAP community by Dr. Antoaneta Yotova, NIMH, Bulgaria (Antoaneta.Iotova@meteo.bg). Please, send your vies to her and to the Newsletter Editor (Ekaterina.Batchvarova@eurasap.org). As a result from such a discussion, respective amendment(s) or additional articles can be recommended for consideration to the Protocol's Secretariat.

CONFERENCE ON CLİMATE CHANGE AND THE MİDDLE EAST
20 - 23 november 2006, Suleyman Demirel conference hall, Istanbul Technical University, Istanbul, Turkey

Conference website: http://www.climatechange_middleeast.itu.edu.tr

Yurdanur S. UNAL, Symposium Chair

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GKSS SUMMER SCHOOL
"PERSISTENT POLLUTION: PAST, PRESENT AND FUTURE"
9–18 May 2007, Hunting castle Göhrde near Lüneburg, Germany

Objective

Persistent Pollution is one of the key features of the „Anthropocene". This current era is characterized by growing impacts of human activities on the Earth's system which are equal or even higher than the natural forcing. Although anthropogenic releases of acidifying gases and heavy metals into the atmosphere and hydrosphere can be dated back to

ancient times, the „Chemical Anthropocene" may be considered as the time period from around 1950 to today where the impact of man-made persistent pollution reaches a global dimension. The Fifth GKSS School of Environmental Research focuses on Persistent Organic Pollutants (POPs), Heavy Metals and Aerosols and offers courses on

- Description, comparison and assessment of anthropogenic environmental change
- Causes and consequences on different time scales
- Long-term hazards and impacts on human society
- Modelling of transport, transformation and deposition from regional to global scales.

For further information, please visit the School homepage
http://coast.gkss.de/events/5thschool/

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