Irish Meteorological Society

Newsletter Spring 2001

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Editors : Evelyn Cusack & Phil Stokes.

Contributions : Seamus Walsh, Peter Barry, Paddy McMorrow, Peter Lennon, Aidan Nulty, Colm Faherty and Sheila O'Mahony.

Irish Meteorological Society

Constitution

1. Name

The name of the society shall be the Irish Meteorological Society

2. Objects

The objects of the society are:
(a) the promotion of an interest in meteorology in Ireland.
(b) the dissemination of meteorological knowledge, pure and applied.

3. Membership

Membership is open to all who have an interest in meteorology, ranging from those whose scientific speciality is meteorology or a related area to those whose work or leisure activities lead to a desire to be well informed about weather and climate.
Honorary membership shall be granted at the discretion of the committee.

4. Activities

(a) The society shall organise an Annual Guest Lecture.
(b) A series of ordinary lectures may be presented, the frequency and location depending on the interest shown.
(c) Lectures for specialised groups may be organised.
(d) A periodic bulletin shall be published to keep members informed of the society's activities and of recent developments in meteorology.
(e) Such other activities as the committee feels appropriate shall be organised.

5. Committee

The committee shall consist of a President, Vice-President, Secretary, Assistant-Secretary, Treasurer, Assistant-Treasurer and six ordinary committee members, all of whom shall be elected at an Annual General Meeting.
The committee may co-opt extra members as required.

6. Finances

The annual membership subscription shall be determined yearly by the committee.
No member shall derive a profit from the Society and in the event of dissolution, any assets shall be donated to some organisation of a similar character.

Rules

1. An A.G.M. shall be held not later than 30th April, of which a minimum of 30 days notice shall be given.

2 Each member of the committee shall be elected for a two year term and may be re-elected for a maximum of two terms in succession.
The elections shall be staggered so that half the committee is (re)elected at the A.G.M. each year.

3. No part of the Constitution or Rules shall be amended or annulled unless:

(a) A written proposal to amend or annul, signed by at least 10 members, is presented to the Secretary at the A.G.M.
(b) All members having being notified by the Secretary, the proposal is carried by a majority of votes cast. Postal ballots will count.

Proposals which have been carried become effective when the Secretary has informed the members.

4. Every paid-up and every honorary member shall have one vote.

5. Annual subscription shall be paid by January 1st.

6. The committee shall meet at least twice a year. Six members shall constitute a quorum.

Irish Meteorological Society

Committee 2000-2001

President Dr. Gerry Mills
Secretary Ms Evelyn Cusack
Treasurer Ms Joanna Donnelly
Ms Jane Bruton
Mr. Michael Walsh
Mr Eddy Graham
Mr Cathal Kennedy
Dr. Tom O'Connor
Dr. Tony Scott

<u>Elected 2000, in office until 2002. (re-electable in 2002 until 2004)</u>
Mr Michael Walsh

<u>Elected 1999, in office until 2001. (re-electable in 2001 until 2003)</u>
Ms Jane Bruton, Ms Joanna Donnelly and Mr Cathal Kennedy.

<u>Elected 1998, in office until 2000 - re-elected in 2000 until 2002</u>
Dr T. Scott, Mr E. Graham, Dr G Mills & Dr T. O Connor.

<u>Elected 1997, re-elected in 1999, in office until 2001.</u>
Ms E. Cusack

<u>Elected 1996, re-elected in 1998, retired in 2000.</u>
Ms P Stokes, Mr D. Fitzgerald, Dr. J Sweeney

There are a number of vacancies on the committee.

Irish Meteorological Society

"Oceans of Opportunity"

by

Yvonne Shields

Director, Marine Science Technology & Innovation Division

Marine Institute

Room G32 Earlsfort Terrace, NUI, Dublin

8 p.m. Friday 2nd March, 2001

Members of the Public are Welcome to Attend

The Marine Institute is the national state agency with responsibility for co-ordinating marine research and development. The agency was established in 1994 and has approx. 130 staff at four locations. The Marine STI Division is based in Dublin and Galway and it plays a key role in the following activities

1. Supporting national marine policy formulation
2. Stimulating marine RTDI (research, technology, development & innovation)
3. Providing key technical services to support marine RTDI through its Technical Support Base in Galway, Research Vessel Operations in Galway and the Marine Data Centre in Dublin.

The Division comprises six sections:

* Marine Technology
* Marine Tourism & Leisure
* Research Vessel Operations
* National Marine Data Centre
* PR & Communications
* Information Policy & Planning

This talk, entitled " Oceans of Opportunity", will address the non-fishing related aspects of the marine sector in Ireland focusing mainly on the work of the Marine Science Technology & Innovation Division.

Secretaries report for IMS 1999-2000

The following is the list of activities of the IMS for the 1999-2000 season.

1999 One Day Meeting - Saturday 24th April 1998, Doyle Tara Hotel.
'Meteorology and Sustainable Development'

Firstly the balance between natural resources and human needs was outlined. Then Climate as a natural resource was discussed. With these ideas in mind sustainable, techniques in building, food production and other commercial activities was briefly reviewed.

'Balancing natural resources and human need.' by Prof Ted Farrell, Environmental Resource Management, UCD

'Climate as a Natural Resource' by Dr. G Mills, UCD

'Sustainable Architecture' by Prof. J Owen Lewis, UCD
'Sustainable Agriculture' by Dr. Noel Culleton, Teagasc
'Sustainable Enterprise.' by Dr. Pat Freyne, Director, University Industrial Program. UCD. 16-00pm : AGM

Field Trip, 29th May, 1999.

A lively group of 30 society members and friends had a very interesting trip to Strokestown Park House which included the Famine Museum. As arranged the head gardener, Mr John O'Driscoll gave us a tour of the gardens which are currently undergoing restoration. From past to present or rather the 1850'ies to the 1950'ies we toured the Lanesborough Power Station with our hard hats and all. A jump way back then to prehistory and the Corlea Bog.

We entertained ourselves for the second year running with a whist drive on the train to and from Dublin. The bridge players among us attempted to control and set standards for the sometimes unruly bunch. We salute Kathleen Fitzgerald for her second consecutive victory but surely she is getting a little tired of those nice Met Eireann pens kindly donated by the Commercial Division. I would suggest that any serious contenders for this year's title(?) get in training now!

Annual Dinner, 8pm, 22-01-2000,

Zafraan Restaurant, Dublin 2. (6770999)
The Irish Meteorological Soc.'s annual dinner was held in the
Zafraan restaurant on the corner between George's street and Lower Stephen's street. Twenty society members and friends attended. The atmosphere was good and the food was delicious. Thanks to Ms Joanna Donnelly for expert organization.

Irish Meteorological Society

'Is it Possible to Understand Dynamic Meteorology?'

by

Anders Persson

Meteorologist in European Centre for Medium-range Weather Forecasting (ECMWF)

Room G32 Earlsfort Terrace, NUI, Dublin

8 p.m. Friday 16th February, 2001

Members of the Public are Welcome to Attend

In the 1960's Anders Persson passed the university exams in maths and theoretical physics, but had enormous problems with meteorology. But he wanted to become a forecaster, so he learned everything by heart and passed in the last minute. Since then he has, apart from forecasting for all scales, from TREND forecasts at Malmo airport to ten day forecasts for the Swedish ice breaking fleet, been trying to understand what he learnt by heart. This drew him into educational activities, both at SMHI and ECMWF, having one foot with the practitioners, and one foot with the theoreticians, a rather demeaning position, but rewarding if you can stand the cross-fire! services.

Lecture season from October 1999 to February 2000.

'HURRICANE MITCH AND THE IRISH ARMY RESPONSE IN HONDURAS' by COMDT ALAN WOOLHEAD

'ALL YOU WANTED TO KNOW ABOUT HURRICANES BUT WERE AFRAID TO ASK' by Ms Phil Stokes, SMO, Met Éireann.

VENUE : Auditorium, Cathal Brugha Barracks Rathmines, Dublin 6

Dr. Woolhead delivered a fascinating insight into the work carried out by the Irish Army in helping the thousands of people whose lives were devastated by Hurricane Mitch. This was a massive Category Four/Five Hurricane which wreaked havoc as it scored a direct hit over the Honduras.

Ms Stokes gave a comprehensive and beautifully illustrated and delivered introduction to Hurricanes; their nomenclature, tracks, spawning grounds etc. which had the large audience enthralled.

It was a privilige (and a novelty) for the Society to be guests of Dr Woolhead and the Irish Army in the Cathal Brugha Barracks in Rathmines.

Friday, 11th February, 2000

VENUE : G 32, *UCD, Earlsfort Terrace, Dublin.*

'THE WEATHER DOWN UNDER' by Ann Farrell.

A large and attentive audience enjoyed Ann's tour de force on Australia's climate. She delivered a magnificently illustrated talk on the climate of Australia with particular emphasis on forecasting.Topics covered included tropical cyclones, severe thunderstorms, El Nino and La Nina, Ozone depletion, drought etc.

Ann Farrell joined the Bureau of Meteorology, Australia in 1988 and is currently on furlough from the Australian Bureau and is working as a meteorologist in CAFO, Met Eireann. Her Father is from Waterford City and emigrated to Australia in the 1940's and lives in Brisbane.

NEWSLETTERS

There was one newsletter this season titled Spring 2000. Another is planned for Summer which for the most part will consist of the glossy booklet celebrating 50years of WMO kindly supplied (on request) by them for our members.

Thanks to ....

Many thanks to Kieran Commins who maintains a web site and keeps the IMS on the Information Super Highway. It can be seen at http://indigo.ie/~kcommins/metsco1.htm

Mr E. Graham is now working in Canada and is unable to attend our meetings over the next two years but he has a website for our perusal.
http://members.aol.com/juneandeddie/index.html

Thanks to NUI Dublin (UCD) and Dr. Tony Scott for the use of the lecture theatre at Earlsfort Terrace.

I wish to thank all the members of the committee who helped through the year in particular Mr. Denis Fitzgerald and Dr. G. Mills for entirely organizing today's meeting.

Ms. Phil Stokes also as acting assistant Sec. has devoted long hours to the Society. UNFORTUNATELY FOR THE SOCIETY MS STOKES, DR. JOHN SWEENEY AND MR FITZGERALDS' TERM OF OFFICE IS UP THIS YEAR. WE SINCERELY THANK THEM FOR ALL THEIR WORK DURING THE LAST (LONG) FOUR YEARS.

Dr. Sweeney as President of the IMS from 1997 to 1999 carried out his role in an exemplory fashion. He combined effectively a serious scientific mission to promote Meteorology in Ireland with charm and wit. He will be missed but I hope he will continue to take an active part in the Society's activities.
May I lead the assembly in a round of applause for Dr. John Sweeney.

Met Éireann has continued to allow the society to use their facilities and for this we are most grateful. Without the assistance of Met Éireann, it would not be possible for our Society to operate.

Our thanks goes to the staff who have helped with mail, postage and printing. In particular without the expert help of Ms. Sheila O'Mahony and Mr. Colm Faherty the newsletter would not have been produced.

We also thank Mr Brendan McWilliams who covers these events in his Weather Eye column in The Irish Times.
And finally a welcome to all new members and a continuing thank you for the support of the Society to existing members.

Evelyn Cusack
Evelyn
Secretary

Irish Meteorological Society - Treasurer's report

Yearly statement of accounts

For year ending 31-March 2000

Bank of Ireland Accounts :

C/A Balance carried over from end of March 1999:	IR 1167.06
S/A Balance carried over from end of March 1999:	IR 705.06
Total assets at end of March 1999 carried over:	IR 1872.12

C/A Balance at the end of March 2000:	IR 938.63
S/A Balance at the end of March 2000:	IR 305.06
Cheques/Cash in hand at end of March 2000:	IR 586.00
Total assets at end of March 1998:	IR 1829.69
Decrease in funds, in year ending Mar'00 over year ending Mar'99:	IR 42.43
Increase due Income vs Expenditure	

EXPENDITURE		**IR£**
March 1999	Expenses covered 1998/1999	893.83
June 1999	Bank Fee	16.57
June 1999	Field Trip expenses	150.00
Sept 1999	Bank Fee	7.41
Dec 1999	Bank Fee	5.56
March 2000	Bank Fee	6.07
Total Expenditure		1079.44

INCOME		**IR£**
May 1999	Subs	38.00
June 1999	1999 Field tripsubs	194.00
Oct 1999	1999 Lodgement	68.00
Jan 2000	Subs 2000	40.00
Jan 2000	Subs 2000	63.00
March 2000	Subs 2000	12.00
March 2000	Subs 2000	36.00
April 2000	Subs 2000	586.00
Total Income		1037.00
Total Income less Expenditure		-42.44

Compiled by: Treasurer

The Road Ice Prediction System

By

Séamus Walsh

For the past five year Met Éireann, in co-operation with the National Roads Authority (NRA), has been providing weather forecasts to Local Authorities during the 'winter' road maintenance period. These forecasts, which provide information on road surface conditions and temperatures, are a valuable aid to road maintenance personnel. Forecasts are provided for approximately 50 locations around the country. At each of these locations the NRA has installed an automatic weather station, which takes reading once every hour of wind speed, air and dew point temperature and also road surface and depth temperatures. These reading are transmitted to a computer in Met Éireann where they are used to monitor the road conditions and to prepare the forecasts for the following night.

Figure 1. Location of the 48 Roadside weather stations.

Met Éireann uses Vaisala's IceBreak model to produce the forecast road surface conditions. This is a heat-balance model which requires as input forecasts of air and dew point temperature, wind speed, cloud amount and type, and rainfall amounts - all in three hourly intervals over a twenty four hour period.

Direct model output of these forecast parameters from Met Éireann's limited area atmospheric model is provided to the forecaster for each location, the data is checked and amended before the IceBreak model is run. The model output consists of forecast road surface temperatures at hourly intervals over the 24 hour period and a colour-coded forecast road surface state e.g. dry, wet, frost, ice etc. A viewer allows the forecast and observed data to be displayed in a user-friendly environment. (See Figure 2)

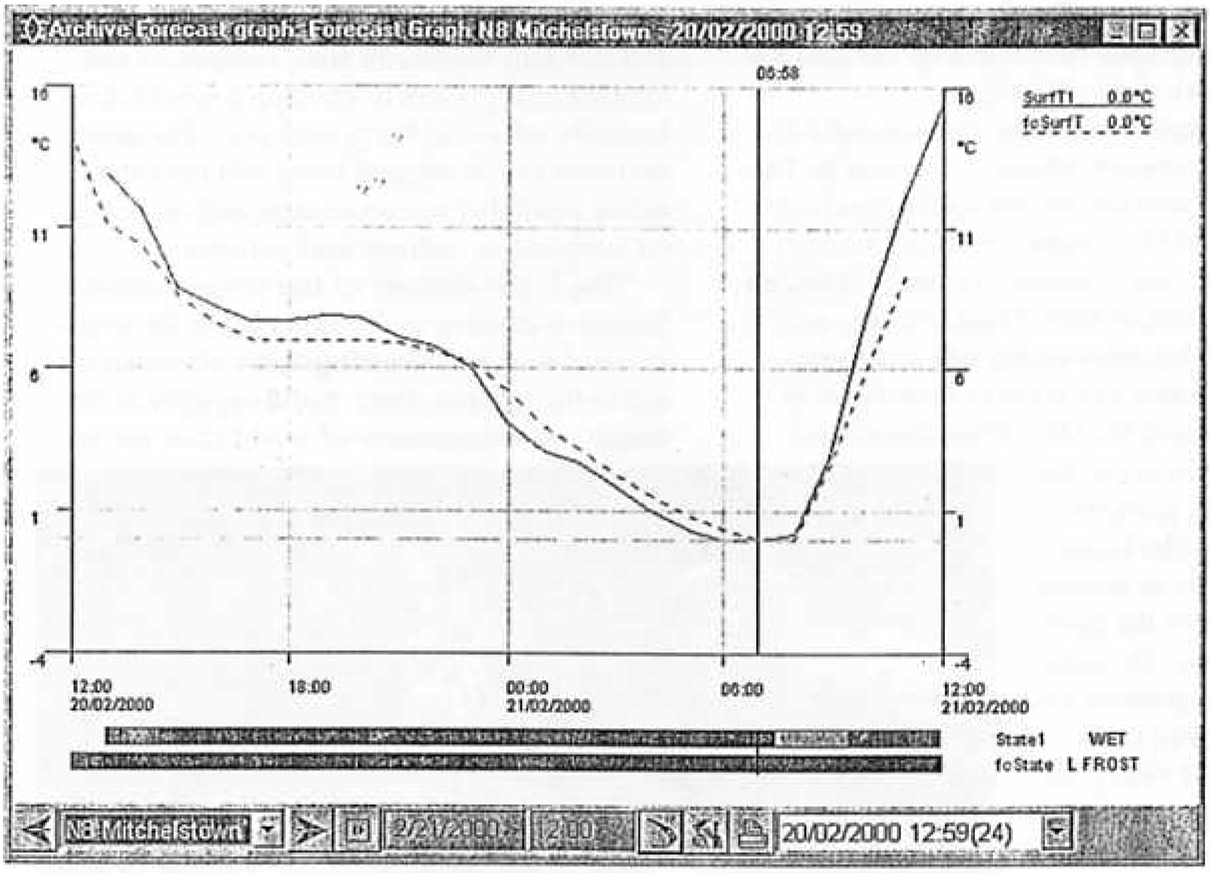


Figure 2: Display of forecast surface temperature (dashed) versus actual values (solid) for the forecast site at Mitchelstown.

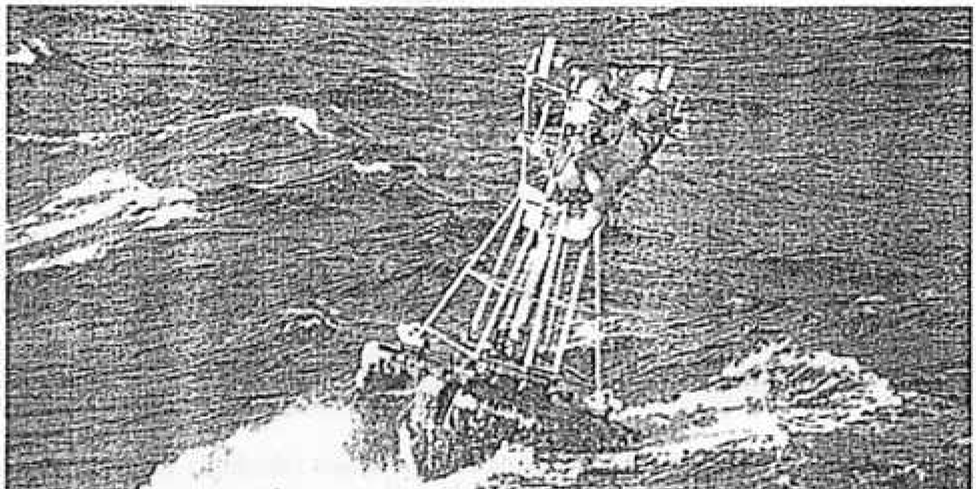
The forecasts produced are for the specific road sensor sites, with only approximately 50 of these throughout the entire country, there are large gaps in the road network. To overcome this the road network has been thermally mapped. This is a technique which identifies the pattern of temperature variation across roads in different weather conditions. So from the forecast minimum temperature at a particular road sensor site, a thermal map can be drawn of expected minima over a much larger area.

Irish Marine Data Buoy Network Improves Forecasts

The Met. Office, the Marine Institute in Ireland, Met Éireann, and the Irish Department of Marine and Natural Resources launched the Irish Marine Data Buoy Network on October 20, 2000. It is designed to improve weather forecasts and increase safety at sea. The network will provide essential data for marine weather forecasts, shipping bulletins and gale and swell warnings. The first of five buoys, 'MI 1', will be deployed next week by the Irish Research Vessel, Celtic Voyager.

The concept is based on the successful K-series buoy network which is operated by The Met. Office who are providing the first two buoys that will be used to establish the Irish network. Dr. Jim Caughey, Technical Director, at The Met. Office said: "This is a very successful collaboration which will add significantly to the data available to forecasters in both Ireland and the UK. It has also forged strong links between the Irish and UK partners."

"'MI 1'will be located west of the Aran Islands, where some of the severest conditions the North Atlantic can produce have recently proven treacherous", said Mr Fahey, the Irish Minister for the Marine and Natural Resources at the launch. "Our aim is to maximise safety and minimise risk at sea. The data buoy will provide crucial observations of wind, wave and general weather conditions that will help us achieve this", he said.



The network will be further developed over the next few years, with the second buoy deployed east of Dublin in early 2001.

"These regular weather observations will further improve our forecasts, provide vital input to our weather prediction models, and increase our knowledge of our marine climate", said Declan Murphy, Director of Met Éireann.

The Marine Institute also launched a promotional campaign today "Oh Buoy - Watch Out!" It targets seafarers who will need to give the buoys, (height 6m x width 3m) a 500m berth. The campaign aims to raise awareness among national and international fishermen, shipowners, yachtsmen and naval vessels.

The project also includes a major R&D component. The Met. Office and the Marine Institute will work with Irish companies and international players to develop a new technologically advanced buoy next year. The newly designed and developed buoy will have the added capability to collect data such as seawater temperature, salinity and currents.

"The R &D element of this project allows Ireland to develop niche expertise in the acquisition of real-time oceanographic observations, and in the medium-term, build capacity in the design and manufacture of world class marine weather buoys", said Yvonne Shields, Director of Science Technology & Innovation, at the Marine Institute.

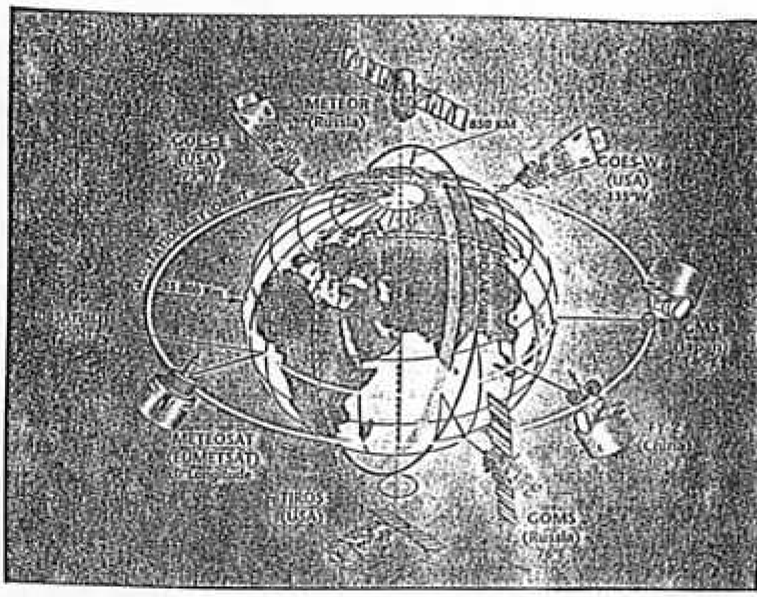
The Irish Marine Data Buoy Network is based on a recommendation of the Fishing Vessel Safety Review Group. The Met. Office in Britain has worked closely with the Marine Institute, Met Éireann and the British Department of the Marine and Natural Resources to successfully develop this initiative.

Uwe Ulbrich on "Why we need more satellites!"

In the old monastery at Walberberg, halfway between the cities of Cologne and Bonn,monks gathered in order to be close to the Creator. 500 years later, members from science and business community met here to go soaring into higher spheres as well. Reading the attendance list was like taking a glance at the "Who is Who" of weather and climate. The question was: what should a modern satellite system do / be capable of doing?
This brainstorming seemed highly necessary, because a number of the gains and advantages of new technology are still unused, with scientific work more often on the side of jeopardy than not. Data sets are riddled by gigantic gaps of time and space, with the operational system still indebted to tradition.
The forecast of phenomena like volcano activities or earthquakes are still "terra incognita".

Data from space cannot be done without, but the dilemma is hard to solve. For single users, satellites have become too expensive. Multinational organizations distribute the financial burden but, in terms of power and mobility, act more like aircraft carriers.
The unproductivitv is furthermore enhanced by the stop-and-go of scientific programs due to changing political priorities.
Meteosat-7 is still a model of the first generation. The second generation satellite will be launched in 2002 and will operate in orbit until the year 2012.
It is still unclear if there will be a follow-up satellite by 2009. This concept was born in the late 80s and early 90s. However, it doesn't take into account the dramatic developments in the field of technology of the last 20 years.

The EUMETSAT Polar System has a bit more time, because the launch of METOP-1the first of three satellites, will not take place before 2005.
But problems are similar:.the development of next generation satellites tries to realize the needs and wishes of users. 25 years ago, the amount of data was overwhelming, computers were chronically slow. Meanwhile, the situation has changed – systems are better now, but we need new data.
Mesoscalic phenomena can be simulated by high resolution models, but the input still has to be transformed into parameters and cannot be assembled by observations/measurements.
The nowcasters and numerical forecasters are united in these kinds of problems they share with most of their colleagues, for it is exactly the mesoscalic systems that cause those phenomena that make us rack our brains at the daily forecasts and warnings.
Squall lines, hail, heavy rain, small-range-storms and tornadoes. What do we expect from continuous cosmic observation? We need vertical profiles of temperature and humidity in order to recognize zones of instability, we need data of air pressure variation/changes with a resolution of 5 km every 10 to 30 minutes, the development of turbulence and icing in clouds, as well as CAT, temperature and moisture on the surface.
Seasonal and ocean process forecast needs all of this and more. Information from within the oceans are very rare and unsuitable for modeling. But it is precisely in these fields of work that we can get an idea of the fantastic possibilities at hand
It has become possible, by a new combination of



measurements, observations and models, to forecast climatic anomalies that are due to El Nino
Last not least, observation and forecasting of environmental pollution
due to anthropogenic activity, volcanic activity and biomass burning as well as smog are at the center of attention.
To me, the IABM represents an important link between science, technology and the public. Our meteorologists distribute information, explain phenomena, offer forecasts and warnings and create publicity. It is still a bridge from the ivory tower down to earth.

Uwe Ulbrich is a broadcast Meteorologist with N-TV (Berlin) and is a member of IABM, the International Association of Broadcast Meteorologists.

World Meteorological Day 23rd March 2001
Volunteers for Weather, Climate and Water
Message from Prof. Godwin O.P. Obasi Secretary-General of WMO

World Meteorological Day commemorates the entry into force, on 23 March 1950, of the Convention of the World Meteorological Organization. Each year, WMO celebrates the Day by focusing on a theme of interest to humanity. The theme of World Meteorological Day 2001—"Volunteers for weather, climate and water"—was chosen to recognize all voluntary contributions, including those of individuals, governments, academic institutions and civil society, including religious groups and schools to the advancement of the sciences of meteorology and hydrology and to the operational activities of WMO and the National Meteorological and Hydrological Services (NMHSs). The theme also coincides with the UN-designated International Year of the Volunteers in 2001. In calling for the work of volunteers to be honoured, the international community wished to give broader recognition and greater prominence to the vital contributions of volunteers to the socio-economic development of nations, as well as to enhance the recognition, networking and promotion of voluntary service worldwide. It is therefore appropriate, at the beginning of the new millennium and following the celebration of the 50th anniversary of WMO in the year 2000, for WMO to join the world community in paying tribute to the volunteers who have been making significant contributions to meteorology, hydrology and the related geophysical sciences.

No history of meteorology would be complete without reference to voluntary and cooperative observers. Since the very early days of their sciences, meteorologists and hydrologists around the world have been assisted, especially in their operational work, by networks of volunteers. The activities of the volunteers range from activities such as carrying out rainfall observations to taking responsibility for entire synoptic, climatological or agrometeorological stations, and to the promotion of the sciences. In most countries, the contributions from such volunteers are integrated within the activities of NMHSs. Such contributions find applications in weather-sensitive sectors such as agriculture, water-resources management, aviation and shipping.

The individual volunteers, irrespective of their professional activities and training, are all united in their common fascination with meteorological and hydrological phenomena. Perseverance and commitment are two of the most common personal characteristics of volunteers. It is not uncommon to come across volunteers with more than 50 years of service, or individuals forming part of the second or third generation of volunteers.

Some NMHSs have specialized units to deal with volunteers in general. Extending a long tradition of amateur science, some enthusiastic volunteers appear to be indistinguishable from professional meteorologists as they use sophisticated meteorological instruments and equipment in their weather station, publish annual summaries and descriptive climatological studies and participate in the activities of meteorological societies. In recognition of the dedication and contribution of long-serving volunteers, many NMHSs present certificates and awards to individuals and institutions.

Nowadays NMHSs use highly sophisticated equipment, facilities and models in the preparation of weather forecasts, climate prediction and related products. However, ground-, air- or ocean-based voluntary observations continue to be useful, because they provide essential inputs, especially from data- sparse and often remote and inaccessible areas to operational and scientific meteorological and hydrological activities.

In this respect, governments through the NMHSs, make important voluntary contributions to the work of WMO. A unique feature of WMO is that each NMHS of its 185 Members contributes voluntarily to the scientific and operational work of the Organization by sharing its observations, encouraging standardization, exchanging data and making available its expertise to the regional associations and technical commissions. This is explained by the fact that, as weather and climate know no national boundaries, international cooperation on a global scale is considered essential for the development of meteorology and hydrology, as well as for reaping the benefits from their applications.

Recognizing the interdependency of all countries in relation to meteorological and hydrological activities, WMO Member countries adopted Resolution 40 at the Twelfth World Meteorological Congress in 1995. The resolution provides a unique framework for the free and unrestricted exchange of meteorological data and products on a regular basis between nations through WMO's World Weather Watch. This system comprises a network of national, regional and global centres maintained voluntarily by WMO Member countries. Other similar programmes include the World Hydrological Cycle Observing System and the Global Atmosphere Watch, which make available meteorological, hydrological and environmental data and products to each NMHS on an equal basis, limited only to its technical capability of communicating with the system. The data and products also enable all nations to fulfil their obligations under international conventions, such as those on climate change and desertification. Similarly, Resolution 25 of the Thirteenth World Meteorological Congress in 1999 provides for the free exchange of hydrological data and products among Member countries.

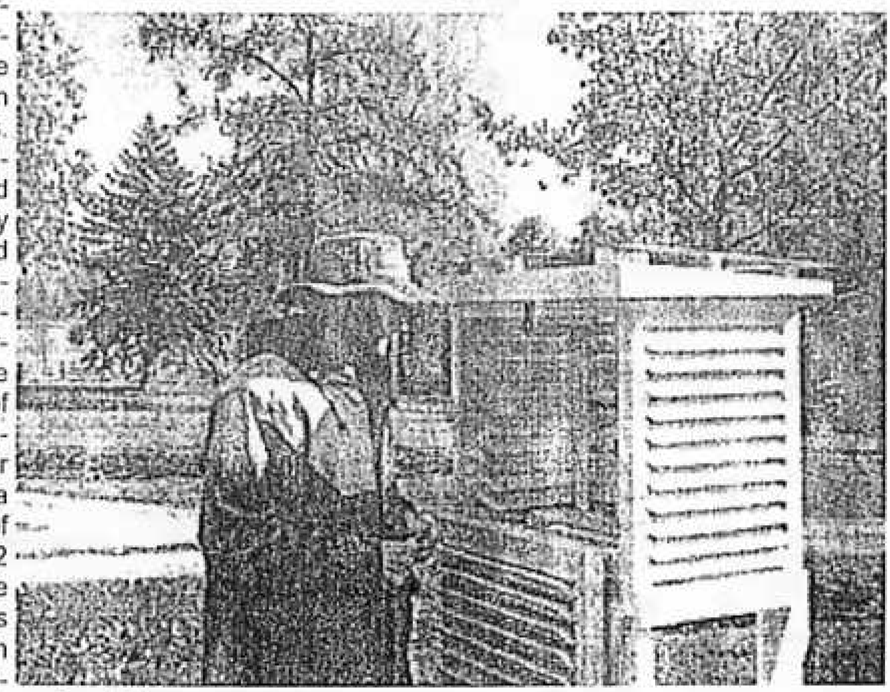
Other major sources of regular data for operational and research purposes, arranged voluntarily and for mutual benefit through NMHSs, include those from satellites, commercial aircraft and ships. Since the early days of commercial aviation, observations from aircraft have proved to be extremely valuable for improved weather forecasts and safety of air navigation.

Similarly, over the oceans, ships' personnel, often in difficult and dangerous situations, utilize their expertise to make observations and pass on the results to the appropriate centres. Indeed, these data make a vital contribution to weather forecasting and to marine safety and efficiency. They also serve as historical data needed for planning and design, and contribute substantially to our understanding of atmosphere-ocean interaction and climate change. They are also essential for the development of long-range, and seasonal to interannual forecasts, and are of particular importance for predicting phenomena such as El Niño. At the beginning of this year, over 6 700 vessels from 52 countries were participating in the WMO Voluntary Observing Ships (VOS) Programme, under which ships are recruited by National Meteorological Services to record and transmit real-time meteorological and oceanographic observations, including air pressure, air temperature, sea-surface temperature, wind and sea-state.

The data or "readings" obtained by these networks of volunteers and cooperative observers from various institutions, public or private, contribute to the effort of the NMHSs in support of sustainable development. The data, especially if part of a long series, also make a valuable contribution to studies of the climate, especially at local level and over oceans, as well as to our understanding of human influence on climate and natural processes affecting the atmosphere, land and the oceans.

Volunteers in many countries also contribute in ensuring more effective preparedness against hazardous weather conditions such as tropical cyclones, tornadoes and blizzards at local and national levels. At times, the success of crucial forecasts during extreme weather events may benefit from the availability of critical ground-based observations provided by volunteers. An example of this is in the use of volunteer storm-spotters who render a worthwhile service as they provide on-the-scene, up-to-date information that complement other data from radars and satellites. This information is often reported to meteorologists through a network of amateur radio operators. The concerted effort and solidarity that are so often seen in extreme weather events or in the event of other natural disasters are, in many respects, reinforced by the fact that certain critical jobs, from amateur radio operators to firemen, are also carried out by volunteers.

In some countries of Central America, when risk levels increase, volunteer observers are asked to measure rainfall and report the results every hour to a forecasting centre. Once rainfall exceeds a critical threshold, the levels of the river and its tributaries are measured. As the rainfall is measured consis-



tently, a rise in river level helps to confirm the geographic extent and the amount of the precipitation. When the river exceeds its critical flooding level, the forecasting centre notifies the local emergency committee which issues a public warning and activates an emergency plan. These community early warning systems have the advantage of being simple to operate and are effective in raising the awareness of rural communities to the risk of natural disasters.

WMO's role in coordinating the voluntary collaboration of its Member countries on a global scale is unique. It has been responsible for some of the best examples of international cooperation. For example, its pioneering role in the global coordination of geophysical, including meteorological, experiments has contributed to remarkable advancements in areas such as weather forecasting, climate science and ozone monitoring. The experiments include the International Geophysical Year (1957/1958), the Global Atmosphere Research Programme's Atlantic Tropical Experiment (GATE, 1974), the Global Weather Experiment (1978/1979), the Alpine Experiment (1982), and the Coupled Ocean-Atmosphere Response Experiment (1992-1993) within the Tropical Ocean and Global Atmosphere (TOGA) project (1985-1994).

A number of other mechanisms that assist in ensuring important voluntary contributions to the advancement of the sciences of meteorology and hydrology, their applications to socio-economic development and to the development of NMHSs have been established.

METEOROLOGICAL STATIONS
Scale 0 50 100 Km
Malin Head
Milford
Glenveagh
Speenoge
Letterkenny (Magherenan)
Glenties
Glencolumbkille
Ballyshannon
Belmullet
Glenamoy
Bellacorrick (Moneynierin)
Markree Castle
Clones
Dundalk (Annaskeagh WW)
Ballinamore
Newport (Furnace)
Straide
Ardee (Boharnamoe)
Kells
Claremorris
Aasleagh Lodge
Ballinrobe (Creagh)
Lanesboro (Doire Dharog)
Mullingar 11
Warrenstown
Dunsany
Moam Valley
Connemara National Park
Tuam Sugar factory
Tuam (Belclare)
Cloosh Forest
Derrygreenagh
Carna
Galway
UCG
Athenry (Mellowes Agr. Coll.)
Lullymore (Agri. Inst.)
Boora
Clonsast
Birr
Carron
Kilmacurra Park
Rathdrum
Carlow (Oak Park)
Shannon Airport
Castleconnell
Kilkenny
Dundrum
Littleton 11
Enniscorthy
Hospital (Voc. Sch.)
Clonroche
Ardfert
(Clash)
Tralee
Rathluirc Forest
Mooncoin (Silverspring)
John. F. Kennedy Park (Ballysop)
Johnstown Castle
Rosslare
Waterford (Tycor)
Waterford Airport
Carne (Churchtown)
Fermoy
Mallow
Coolnakilla
Killarney (St. Finan's Hospital) (Muckross House)
Dungarvan
Valentia Observatory
Cork (Clover Hill)
UCC
Ballinacurra
Cork Airport
Roche's Point
Glengarriff (Ilnacullin)
Clonakilty
Sherkin Island
Dublin Airport
Kinsealy
DUBLIN AREA
Howth
Glasnevin
Phoenix Park
Merrion Square
Rathfarnham (St. Columba Coll.)
Casement Aerodrome
Scale 0 5 10 Km
KEY
Synoptic station
Anemograph station
Climatological station
Station with sunshine recorder only
Station with sunshine recorder & raingauge

Amongst these is the way the WMO/UNEP Intergovernmental Panel on Climate Change (IPCC) accomplishes its tasks, which in itself highlights the spirit of voluntarily international collaboration and cooperation. Established jointly by WMO and UNEP in 1988, there are currently upwards of 3 000 scientists and other experts from around the world voluntarily providing expertise for research, drafting, reviewing and finalizing IPCC reports on various aspects of climate change. These scientists/experts straddle a large number of disciplines such as climatology, water supply, agriculture, oceanography, forestry, sustainable development, equity issues and costing methodologies. Over recent years, the level of participation by scientists and other experts from developing countries and those with economies-in-transition has increased steadily, enhancing commitment to IPCC findings.

Another major initiative unique to WMO and which contributes to global cooperation among NMHSs within the WMO community is the WMO Voluntary Cooperation Programme (VCP). Members volunteer to assist each other to enhance capabilities in the implementation of WMO scientific and technical Programmes. To ensure that all NMHSs are able to participate fully in WMO Programmes for the benefit of all Member countries, the VCP coordinates an important exchange of technology and know-how from countries with more developed NMHSs.

In the context of non-governmental organizations, national and regional meteorological and hydrological societies also make considerable voluntary contributions to the advancement of meteorology and hydrology worldwide. While many of the societies have small numbers of dedicated staff to help them, they all benefit from the participation of motivated, altruistic, yet experienced, scientists in activities related to the science of meteorology and hydrology and their applications to socio-economic development. These activities invariably involve, among others, developing and disseminating knowledge of meteorology, hydrology and related sciences; and promoting and advancing the sciences among the public, academic researchers, the media and the public.

Within the UN System, WMO also collaborates with the UN Volunteer Programme. United Nations Volunteers (UNVs) with key professional skills have been regularly assigned to WMO projects throughout the world for many years. UNV specialists have contributed a wide range of expertise to projects implemented by WMO in developing countries. At various times over the past decade, hydrologists, hydrogeologists, oceanographers, water ecologists, meteorologists, agrometeorologists, aeronautical forecasters, telecommunications experts and energy technicians from countries in Africa, Asia and the South Pacific have offered their services as volunteers.

It is my hope that, as we move forward into this new millennium, the volunteers for weather, climate and water will extend and reinforce their collaboration with the NMHSs and WMO in contributing to the protection of life and property against natural disasters, in safeguarding the environment and in enhancing the economic and social well-being of all sectors of society. The theme also provides an opportunity for governments, civil society, the private sector, the general public and the media to appreciate the important contributions that volunteers make to society in general and to sciences such as meteorology and hydrology, in particular. WMO will continue to enhance such collaboration and encourage the relevant individuals and institutions to further develop such voluntary work for the benefit of future generations

Climat and Rainfall Network in Ireland

by Peter Barry, PMO Climate and Observations Division

In addition to its Synoptic Network of 13 manned stations, Met Éireann Eireann has an extensive network of Climat and Rainfall stations staffed by mainly voluntary observers. Without this network, it would not be possible to get a clear picture of the Climate of Ireland and any changes that may be occurring therein.

The network comprises over 85 Climat stations and over 600 Rainfall Stations, a small number of which are run by Teagasc, ESB, Local Authorities, Garda etc. In the main, we rely on enthusiastic private individuals. Each day, seven days a week, fifty-two weeks a year, these observers take readings at 0900UTC. The Rainfall observers measure the rainfall of the previous 24 hours and at the end of each month they send a card containing the daily readings for that month to the Climat and Observations Division here in Glasnevin. In the case of the Climat observers, in addition to daily rainfall readings, they take various temperatures readings, i.e. dry and wet bulb temperatures, daily maximum, minimum and grass minimum values, while soil and earth temperatures are read a some stations. Other Climat stations also measure daily sunshine. They also transmit this data to us at the end of each month.

Continuity of observations at these stations is vital in order to monitor climate change. Some of these stations have been in situ for over 50 years, indeed a few - Phoenix Park and Markree Castle in Co. Sligo for example - have records going back well over 100 years.

Another area in which the data from these stations is very important is in the area of Climate enquiries. Each day the Enquiry Desk receive requests from various bodies - legal and insurance, Consulting Engineers, the Construction industry, Local Authorities, education and research, etc - as well as the general public for weather information and statistical data which we have readily available, thanks in no small way to our Climat and Rainfall Network

THE WEATHER OF 2000

Rainfall totals above normal after very wet autumn; temperature and sunshine a little above normal

Rainfall totals for the year were above normal everywhere except in the extreme south. While it was drier than normal during the first half of the year in most places, especially in the south, very wet weather between mid-September and mid-December brought annual totals above normal. It was the seventh successive year that was warmer than normal, on this occasion by around half a degree. Despite being a wet year it was also a sunny one almost everywhere; at most stations it was the sunniest year since 1995 but at a couple of stations it was the sunniest for over 25 years.

Rainfall totals for the year varied between 835mm at Dublin Airport and 1768mm at Valentia Observatory, with percentage of normal values between 93% at Cork Airport and 126% at Valentia. While it was the driest year since 1992 at Cork Airport, it was the wettest at Rosslare since 1966. Although very wet at Valentia Observatory, it was not as wet as some recent years there; four of its wettest seven years in over a century of observations at the station have been measured since 1994. The first half of the year was exceptionally dry in the south and southeast, with less than 75% of normal rainfall here for the January to June period. In contrast, it was the wettest autumn *(September to November)* on record at a number of stations, with over 60 consecutive days of rain in parts of the west and southwest. Some heavy daily falls were measured at this time also: Dublin (Phoenix Park) measured 76.2mm on November 5th, its highest daily fall for November in over a century and a half of record. The annual total number of wetdays *(days with at least 1mm rainfall)* was above normal everywhere. There were between 150 and 190 wetdays over most of the country, with between 220 and 235 wetdays in the west and southwest.

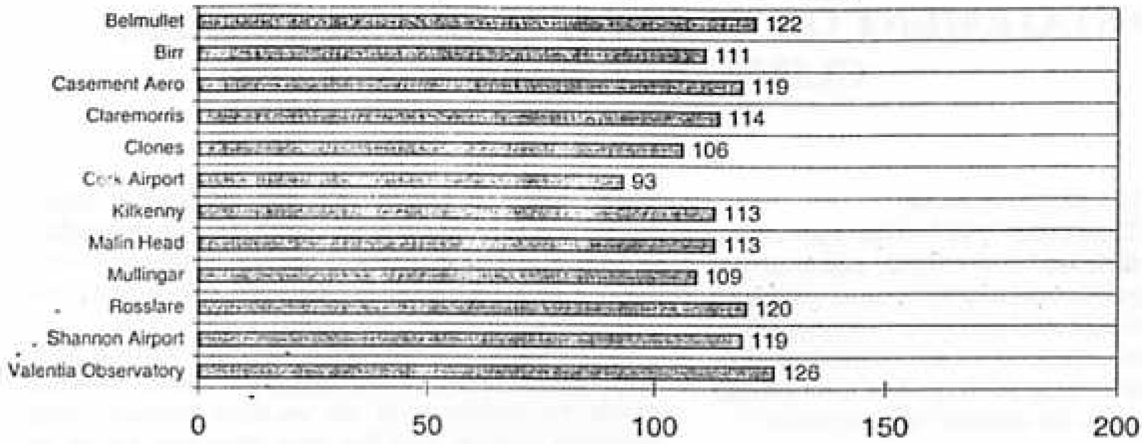
Mean air temperatures for the year varied between 8.6°C at Connaught Airport and 11.0°C at Shannon Airport. They were around half a degree above normal everywhere, making it the seventh successive year with mean temperatures above the 1961 to1990 average. The warmest months relative to normal were January, February, March, August and September, while both April and October were cooler than normal everywhere. While the summer was warmer than normal, there were few hot days, with the highest temperature of the year, 27.6°C, measured at both Casement Aerodrome on June 18th and Shannon Airport on July 22nd. Until the last week of the year, the lowest air temperatures of 2000 were measured during early April, but lower values were recorded during a spell of very frosty weather between the 26th and 30th of December. Claremorris measured the lowest air temperature of the year during this period,
-12.9°C on December 30th, while the lowest grass minimum temperature of -12.5°C was measured at Kilkenny on December 27th.

Sunshine totals for the year were above normal almost everywhere. Totals ranged from 1319 hours at Clones to 1727 hours at Rosslare, with percentage of normal values between 96% of normal at both Birr and Belmullet and 111% at Clones. Malin Head had its sunniest year since 1974, while at Shannon Airport the annual total of 1427 hours was its highest since 1968. May, August and, despite being very wet, October were sunnier than normal everywhere, while only in June were sunshine totals below normal at every station. Summer was relatively sunny despite the dull June. Belmullet measured the highest daily value of the year on consecutive days, 15.1 hours on July 21st and 22nd.

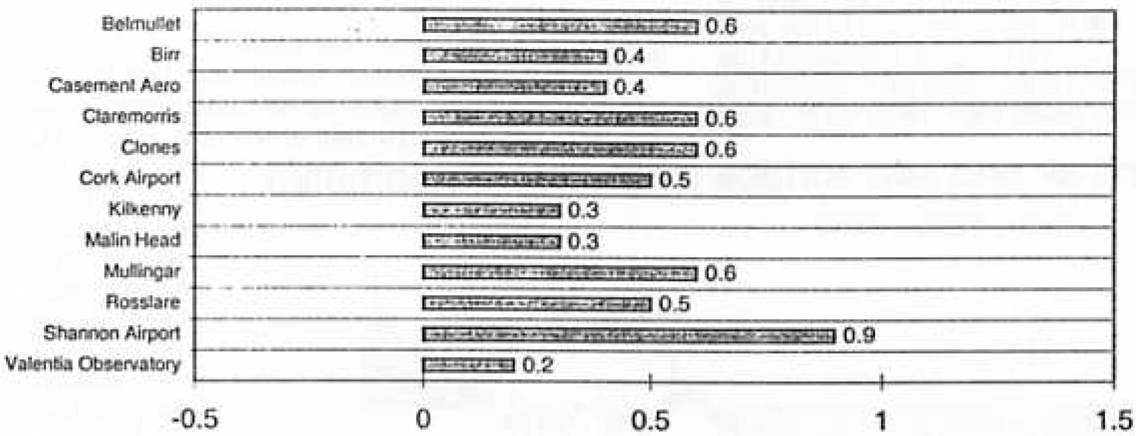
Mean annual wind speeds were below normal at most stations; Cork Airport's mean value of 9.7 knots *(11.2 m.p.h.)* was its lowest since 1976. Belmullet recorded the highest gust of the year, 82 knots *(94 m.p.h.)* on February 6th.

(Issued by the Climatology and Observations Division of Met Éireann on Tuesday 2nd January 2001. This report is based on preliminary data from the synoptic weather stations operated by Met Éireann.)

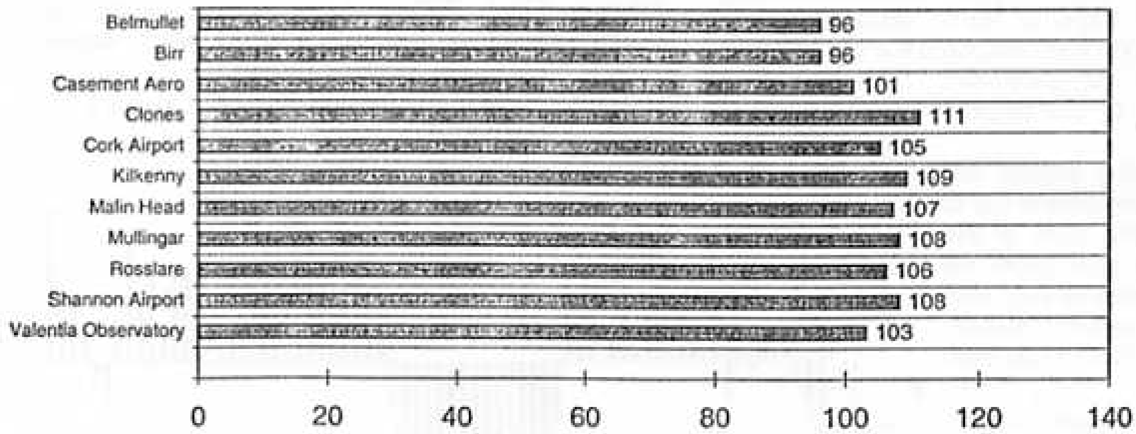
Rainfall *(% of normal for period 1961-1990)*



Temperature *(°C difference from normal for period 1961-1990)*



Sunshine *(% of normal for period 1961-1990)*



YEAR 2000

WMO STATEMENT ON THE STATUS OF THE GLOBAL CLIMATE IN 2000

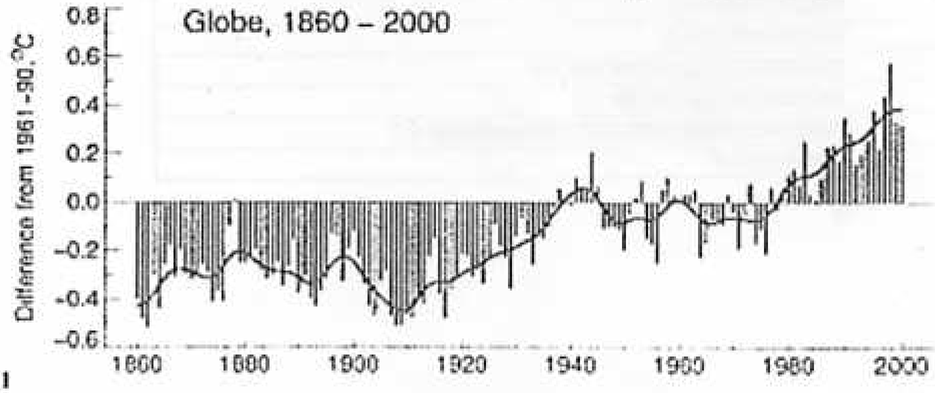
Summary of the global climate

Geneva, 19 December 2000--*The year 2000 was much like those of the 1990's, some areas of the globe experienced extreme heat, extreme cold, extreme rainfall and extreme drought while many others experienced near normal conditions, but when averaged together the global climate continues to be warmer than normal.*

Global Temperatures in 2000: Similar to 1999-Warm Trend Continues

The global average surface temperature is likely to be about 0.32°C above the climatological average for the period 1961-1990. This is similar to 1999, which was the 5th warmest year in the past 140 years, according to records maintained by Members of the World Meteorological Organization (WMO). The warmer years were 1998, 1997, 1995 and 1990. The ten warmest years have all occurred since 1983, with eight of these occurring since 1990. The year 2000 has continued the run of warm years in spite of the persistent cooling influence of the tropical Pacific La Niña.

Annual land air and sea surface temperature anomalies



Graph 1

As a new century begins, the global mean temperature is 0.6°C above those at the start of the 20th century. The year 2000 will be the 22nd consecutive year with the global mean surface temperature above the 1961-1990 normal (see graph 1).

Most of the non-tropical Northern Hemisphere experienced above average temperatures in each season. However, the eastern tropical Pacific was colder than usual throughout most of the year as La Niña was strong at the beginning of the year, weakened during July and August and showed signs of reappearing at year's end **(see graph 2).** The remainder of the tropics and the non-tropical Southern Hemisphere had a variety of anomalies, with a predominance of warmth.

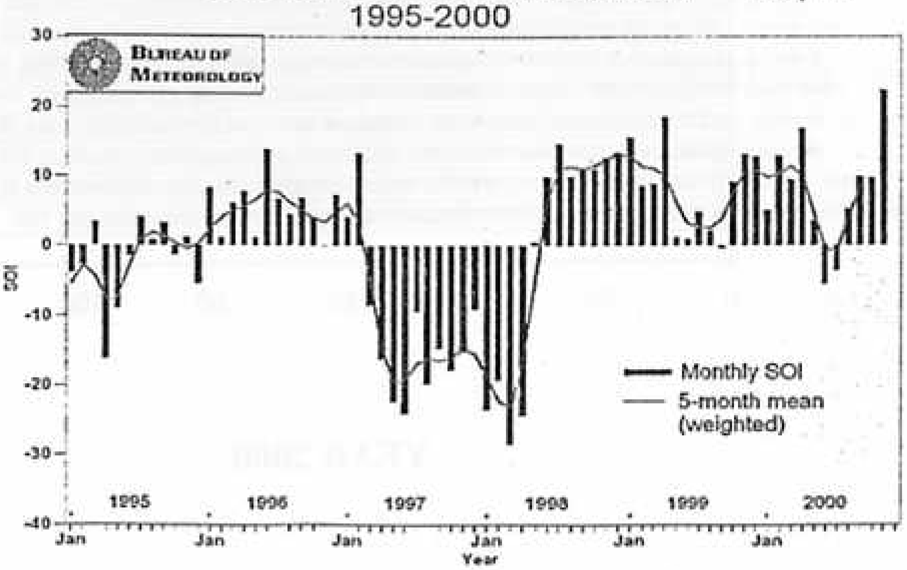
In the atmospheric layer from the surface to 8 km altitude, routine temperature measurements made by instruments on weather balloons and satellites showed that the year 2000 was similar to 1999 in being very close to the 1979-1990 average. In the lower stratosphere (8 km to 12 km altitude), 2000 was slightly less cold than 1999 (the coldest year in the 36-year record) but was still nearly 1° C colder than the 1979-1990 average.

Precipitation Patterns (see graph 3)

Precipitation patterns throughout the tropics were dominated by typical La Niña conditions during the first half and at the end of the year. Indonesia, the tropical Indian Ocean and western tropical Pacific all experienced greatly enhanced precipitation during the two periods, while the central tropical Pacific experienced virtually no rainfall. Other regions influenced by La Niña included Australia, north-east South America and southern Africa, which experi-

Southern Oscillation Index (SOI) 1995-2000

Graph 2



enced enhanced precipitation during the periods. Enhanced monsoonal precipitation also affected southern Asia. Conversely, La Niña contributed to below-normal precipitation over equatorial east Africa and along the Gulf Coast of the United States.

Hurricanes, Typhoons and Floods

During the year 2000, the Atlantic experienced an above average number of hurricanes and tropical storms (15, the average is 10), while the Pacific experienced only 22 storms, which is below the average of approximately 28. Several of these storms produced extreme amounts of precipitation, flooding and damage. Most notable were hurricanes Keith and Gordon causing severe damage in Central America and tropical storm Leslie producing excessive amounts of precipitation in Florida in the United States. In the Pacific, Typhoon Saomai caused record breaking rainfall over parts of Japan, Typhoon Prapiroon struck the coast of the Korean peninsula bringing over 30 hours of relentless rainfall, and two major typhoons made landfall on Viet Nam resulting in extreme rains over the SE Asian area. One major cyclone formed over the Bay of Bengal and struck the southern Indian peninsula in late November causing severe property damage from rainfall and wind. Arguably the most devastating cyclones of the year were Eline, Gloriaand Hudah which struck Madagascar, Mozambique and parts of southern Africa causing severe flooding and loss of life. Finally cyclone Steve caused major damage and record flooding in Australia in late February.

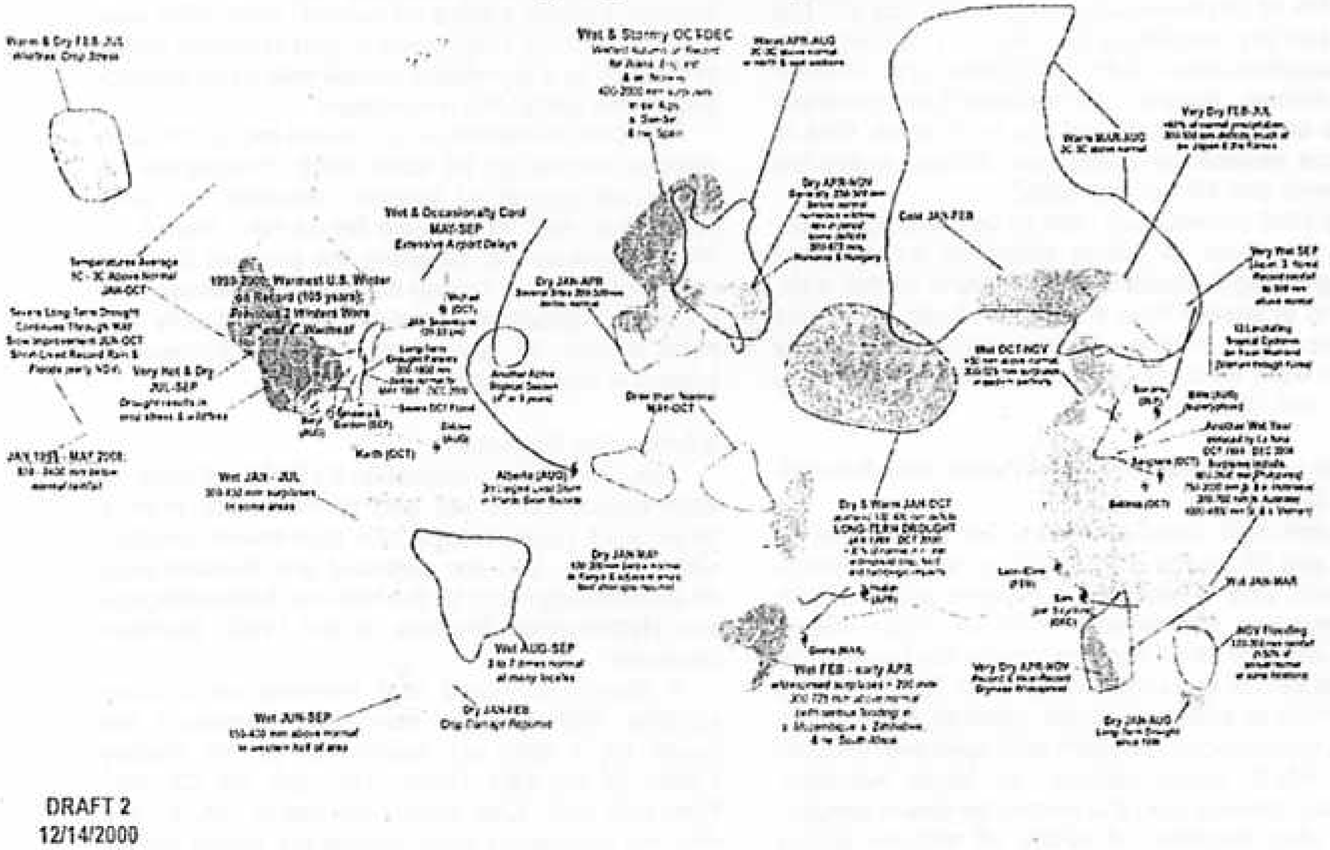
Severe rains resulting in flooding occurred in several other areas of the world as well. Most notably, severe flooding occurred in southern Switzerland and north-eastern Italy in October, in Colombia from June to August, and in India, Bangladesh, Cambodia, Thailand, Laos and Viet Nam from monsoon rainfall, all resulting in loss of life and severe property damage. More than 10 million people were affected in India alone with over 650 deaths. Flooding and mudslides also caused damage and loss of life in Central and South America in May and June. Torrential rains triggered mudslides killing thirteen people in Guatemala. In Nicaragua, the Rama River rose 4.5 meters and spilled over its banks on June 21, flooding most of Rama City, a town of 10,000 people. In Australia, extensive areas experienced one of their wettest-ever January-April periods, with record rainfall and flooding in many locations. Some parts of western Queensland in Australia received over 400 mm of rain in February, when their normal annual rainall is 200-300 mm. Heavy rain in November caused widespread flooding over central and north-west New South Wales and south-west Queensland affecting one third of New South Wales.

Heat Waves, Drought and Fires

Major droughts affected much of southeastern Europe, the Middle East, and central Asia through

Graph 3

2000 Climate Highlights and Episodic Events



northern China. Especially hard hit were Bulgaria, the Islamic Republic of Iran, Iraq, Afghanistan and parts of China. This was the worst drought in over 30 years in the Islamic Republic of Iran destroying crops and killing livestock. In North America, months of above average temperature coincided with below normal precipitation through northern Mexico and much of the southern and western regions of the United States leading to one of the worst wildfire seasons in the past 50 years. Severe to extreme drought covered 36% of the USA by the end of August.

A scorching heat wave gripped much of southern Europe during June and July, breaking many century-old records. The heat wave claimed numerous lives across the region as temperatures exceeded 43°C in locations across Turkey, Greece, Romania and Italy. In Bulgaria, 100-year records for daily maximum temperature were broken at more than 75% of all observation stations on July 5th. The warm and dry conditions also led to 1,400 wildfires that consumed more than 58,000 hectares destroying 73 homes. Greece also suffered from hundreds of fires during the height of the heat wave. One of the most devastated areas was Samos where fire consumed one-fifth of the island.

The third consecutive year of below normal rainfall in the Horn of Africa countries exacerbated existing drought conditions over much of the area, resulting in severe food shortages. Tens of millions of people were affected by this drought. Especially hard hit were Ethiopia, and parts of Kenya, Somalia, Eritrea and Djibouti.

Cold Waves, National Temperature and Precipitation Anomalies

Severe cold conditions affected large parts of China and Mongolia from January through February. Over one million people were affected with economic loss estimated at over 30 million dollars US. In January and February severe cold conditions affected part of India resulting in over 300 deaths. In May, much of western Russia, centred at the Volga region, experienced a severe cold spell with temperatures 4-5°C below normal. In South America, Paraguay experienced the lowest minimum temperatures ever recorded at nearly all stations during June and July.

In England, the year 2000 is likely to be among the 20 warmest years in the past 342 years of observations. Norway will likely record the third warmest year since measurements started in 1866. In the United States of America, the year is expected to rank between the 7th and 12th warmest since 1895. Records in Canada indicate that 2000 will be the 6th warmest, at 1.1°C above normal. Japan recorded its 5th warmest year in its 103-year record. After six months of generally cooler than average temperatures, unusual warmth developed across parts of Australia in July and continued into the Southern Hemisphere spring. Visitors to the Olympic Games in Sydney experienced an exceptionally warm September as temperatures averaged more than 5°C above normal along a broad belt of central and eastern Australia. But, despite the spring warmth, annual temperatures are expected to be below average in Australia for the first time since 1984. New Zealand experienced a cool summer in contrast to their second warmest winter in the past 140 years.

April 2000 was the wettest April in the 235-year monthly England and Wales precipitation series. October and November 2000 each had the highest ever daily England and Wales precipitation recorded in that calendar month in a 70-year record. Sustained above-average rainfall from September through November 2000 led to major flooding in many parts of England and Wales. It was the wettest autumn in the 235-year record and also the wettest 3-month period on record. June 2000 was the wettest June in 80 years in part of central Chile, in contrast to a significant rainfall deficit that characterized the rest of the wet season.

The first thunderstorm on record moved through Barrow, Alaska, on 20 June 2000. Thunderstorms are more typical of warmer climates. In early November, 692 mm of rain fell at Hilo, Hawaii, in one 24-hour period, breaking the previous 24-hour record of 566 mm. During the Northern Hemisphere summer, Canada experienced its first deadly tornado in over 14 years and, in a rare incident, a hurricane struck land in Newfoundland.

Information Sources

This preliminary information for 2000 is based on observations up to the end of November from a network of ships, buoys and land-based weather stations. The data are collected and disseminated on a continuing basis by the National Meteorological and Hydrological Services of the WMO Member countries.

It should be noted that following established practice, WMO's global temperature analyses are based on a data set maintained by the Hadley Centre of the Met Office, UK, and the Climatic Research Unit, East Anglia University, UK. In this data set departures from normal are based on the most recent WMO climatological standard normals period 1961-1990. Another authoritative global surface temperature data set is maintained by the USA Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) in which departures from normal are based on the full period of record dating back to 1880. Results from these two data sets are comparable; both project that 2000 will be the fifth warmest year globally.

More extensive, updated information will be made available in the annual **WMO Statement on the Status of the Global Climate in 2000**, to be published in late March 2001.

How to Set Your Barometer

A lot of households around the country have, over the years, either received as a present or bought a barometer which typically hangs on the wall. The following are the basic facts concerning these typical household **ANEROID BAROMETERS.** 'Aneroid' literally means without liquid, and the aneroid barometer, invented in 1843, has become the popular 'household' instrument because of its ease of use and low cost when compared to the mercury type barometer. It usually has a circular dial with various 'weather words' written around the circumference. Incidentally, these weather words, such as 'Rain', 'Stormy', 'Fair' can be quite misleading at times because although these weather patterns are typical of either low or high pressure situations, it does not always follow that fair weather occurs when the pressure is high or that stormy weather occurs when pressure is low.

1. The main pointer on the dial indicates the pressure, shown by the figures around the outside of the dial. The pressure is almost always marked in inches (antique or american usually) or hectoPascals and the next page contains a table which gives the conversion between them. (Some barometers might give the pressure in millimetres - see second table).

2. The single movable pointer (which overlies the main pointer) is usually gold or shiny and is controlled by a knurled nut. This measures the change of pressure since it was last set. So, if you move the single pointer to cover the main pointer, then the difference between them when you next examine the barometer, shows the pressure change in that time. It is a good idea to set the single pointer to coincide with the main pointer whenever you look at the instrument as in this way you can detect when a fall changes into a rise and vice versa.

3. The adjustment of the main pointer is carried out by inserting a small screwdriver into a small screw which is accessible from the back of the instrument. By turning this screw, the main pointer can be set at any given value so as to coincide with the actual pressure prevailing at the time you set the instrument. Be careful that you support the instrument properly while adjusting the pointer and treat it with care so that it cannot fall to the floor as the mechanism is very sensitive and can easily be put out of order.

4. Most barometers tend to be hung in the hall, and in general this is quite a good idea as long as it is not exposed to sudden changes of temperature. The barometer should be positioned so that it is not subject to direct heating of any kind, either by radiators or fires in the winter, or from direct sunlight in the summer.

5. In general, it is advisable to give the instrument a light tap with the finger before reading it as there is usually some slight friction in the moving parts. this is especially important when adjusting the main pointer because it may not fix on the required pressure value immediatly and may do with 2 or 3 further adjustments, tapping the glass lightly in between each adjustment. (only stop when the pointer stops moving off the pressure value when you tap it)

6. The adjustment of mercury type barometers is more complicated and should not be attempted unless you have some knowledge of how the instrument works.

The next question is the setting of the barometer, some manufacturers recommend that allowance should be made for height of the barometer above sea level. It is recommended that all barometers be set to read sea level pressure. this means that if your barometer was at sea level it would read this value. After all the main points of interest are related to changes in the barometric pressure. It is the actual location of the various pressure systems and related wind flow which determine the weather in any given area, rather than the actual pressure value in one given spot. (All pressures given on meteorological charts displayed on television are sea level pressures).

TABLE FOR CONVERTING HECTOPASCALS TO INCHES					
hPa	Inches	hPa	Inches	hPa	Inches
960	28.35	990	29.23	1020	30.12
961	28.38	991	29.26	1021	30.15
962	28.41	992	29.29	1022	30.18
963	28.44	993	29.32	1023	30.21
964	28.47	994	29.35	1024	30.24
965	28.50	995	29.38	1025	30.27
966	28.53	996	29.41	1026	30.30
967	28.56	997	29.44	1027	30.33
968	28.59	998	29.47	1028	30.36.
969	28.61	999	29.50	1029	30.39
970	28.64	1000	29.53	1030	30.42
971	28.67	1001	29.56	1031	30.45
972	28.70	1002	29.59	1032	30.47
973	28.73	1003	29.62	1033	30.50
974	28.76	1004	29.65	1034	30.53
975	28.79	1005	29.68	1035	30.56
976	28.82	1006	29.71	1036	30.59
977	28.85	1007	29.74	1037	30.62
978	28.88	1008	29.77	1038	30.65
979	28.91	1009	29.80	1039	30.68
980	28.94	1010	29.83	1040	30.71
981	28.97	1011	29.85	1041	30.74
982	29.00	1012	29.88	1042	30.77
983	29.03	1013	29.91	1043	30.80
984	29.06	1014	29.94	1044	30.83
985	29.09	1015	29.97	1045	30.86
986	29.12	1016	30.00	1046	30.89
987	29.15	1017	30.03	1047	30.92
988	29.18	1018	30.06	1048	30.95
989	29.21	1019	30.09	1049	30.98

In order to obtain a fairly accurate sea level pressure for your locality it would be best to phone Met Eireann on a settled day when the pressure is not changing rapidly. This is usually the case when winds are light. State your locality and ask for the current sea level pressure in your district in HectoPascals or inches. Set your barometer straight away by using a small screwdriver in the screw located in the rear of the barometer.

TABLE FOR CONVERTING PRESSURE IN MILLIMETRES TO INCHES TO HECTOPASCALS		
(mms)	(ins)	(hPa)
700	27.56	933
705	27.76	940
710	27.95	947
715	28.15	953
725	28.56	967
730	28.73	973
735	28.94	980
740	29.15	987
745	29.32	993
750	29.53	1000
755	29.74	1007
760	29.91	1013
765	30.12	1020
770	30.33	1027
775	30.50	1033
780	30.71	1040
785	30.92	1047
790	31.13	1053

Notes:

1. 1 millimetre is approximately equal to 0.04 inches and 1.35 hectoPascals
2. An average deep winter depression would give pressure down to around 960 to 980 hectoPascals whilst anticyclones would normally give values of around 1020 to 1040 hectoPascals at any time of the year. Extreme systems may occasionally go beyond these limits.
3. HectoPascals were formarly known as millibars but when it was changed, they only changed the name not the units.

PRELIMINARY INFORMATION - Earthquake - India - 2001

DATE :	26 January 2001
ORIGIN TIME :	03:16 41sUTC
LATITUDE :	23.40 Degrees North
LONGITUDE :	70.32 Degrees East
DEPTH :	23.6 km
MAGNITUDE :	7.9 Ms

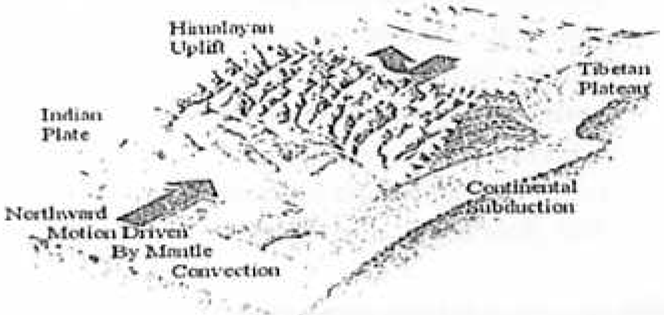
The earthquake occurred at 08:46 local time and was felt across most of India and Pakistan, including the cities of Karachi, (360 km to the north west), Bombay, (580 km to the south east) and Delhi, (880 km to the north east). Casualties have been reported as far from the epicentre as the city of Surat (500 km to the south east). Damage was particularly severe in the town of Bhuj (pop 150,000), much of which has been destroyed. Damage also occurred in the city of Ahmedabad, 220 km east of the epicentre, and in many other places. At the time of writing, the estimated death toll is 20,000, but this is likely to rise as communications are restored with more isolated communities.

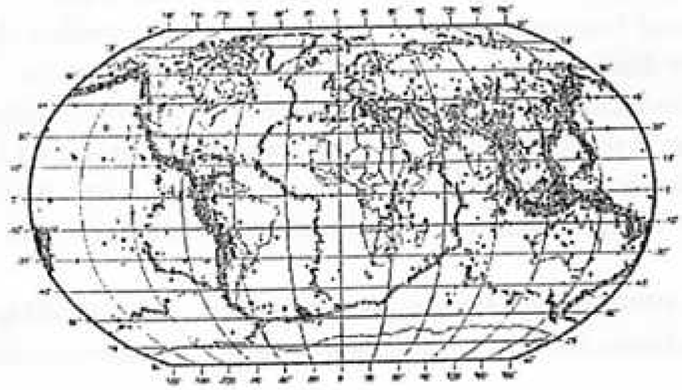
This earthquake closely resembles the 16 June 1819 Rann of Kutch event, which had a similar magnitude and probably the same epicentre. The 1819 earthquake killed over 2,000 people in Bhuj alone; the total death toll for this event is not recorded. The earthquake of 26 January 2001 is an example of how historical earthquakes can be repeated, and how one can estimate future hazard by looking at the past. The 1819 earthquake is particularly famous for its effects on the landscape; a 9 m vertical displacement was caused by the faulting, the resulting feature being known as the Allah Bund - the Wall of God.

An earthquake also occurred in the same area on 21 July 1956; on this occasion the magnitude was 6.5 and 156 were killed. The recent earthquake was about 100 times more powerful than the 1956 event, and the population of the region has increased considerably since then - so it should not be surprising that the casualty figures are so high.

The most recent earthquake disaster in India was the Latur (also called Maharashtra or Killari) earthquake of 29 September 1993, which killed an estimated 11,000 people. The epicentre of the 1993 earthquake was 870 km to the SE of the Gujarat earthquake.

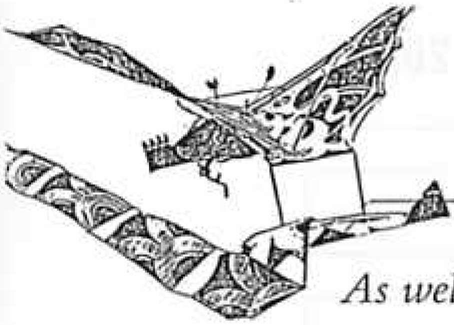
The 26 January 2001 earthquake is the largest (in magnitude terms) in India since the 15 August 1950 earthquake, which had a magnitude of 8.5, but occurred in a remote area on the Assam-Tibet border, and so only caused 1,500 deaths.The highest recorded earthquake death toll in the region was 30,000 killed by the 30 May 1935 Quetta earthquake in Pakistan.





The cause of the earthquake is ultimately related to the fact that the Indian crustal plate is moving northwards at a rate of about 1 cm per year, pushing into the Eurasian plate. This process of collision is what has produced the Himalayan mountain range, and is responsible for the high seismicity along the Himalayas. However, the stresses also affect the Indian subcontinent, and can produce occasional large earthquakes where there are significant faults and other weaknesses in the crust.

British Geological Survey ; http://www.gsrg.nmh.ac.uk/



WINDS

COLLINS
WEATHER
THE ULTIMATE GUIDE TO THE ELEMENTS

As well as the major wind systems, there are smaller-scale winds that cause localized weather patterns.

Global air-flow patterns give rise to the principal wind systems, :h as the trade winds, the :sterlies, and the polar :terlies They also luence some smaller scale nds such as monsoons.

ONSOON SEASONS

ıny areas experience mon- ›ns, including the south- stern United States and ıile, but the strongest ›nsoons occur in southern ıa, northern Australia, and ica. Monsoons bring ›ious amounts of rain and ı cause massive flooding. vastating floods have killed ›usands of people in Bangla- h, India, and Southeast Asia.

The most dramatic mon- ›n occurs in India. In winter, en the Sun is relatively low :he sky, the air over Siberia ›rth of the Tibetan Plateau) cools dramatically, producing strong high pressure. This, in turn, creates winds that blow southeast over India and out to sea, dissipating clouds and rain.

In summer, this high pressure weakens significantly and an area of low pressure develops over northern India. This draws warm, moist air in from the Indian Ocean, which, in turn, produces heavy rain.

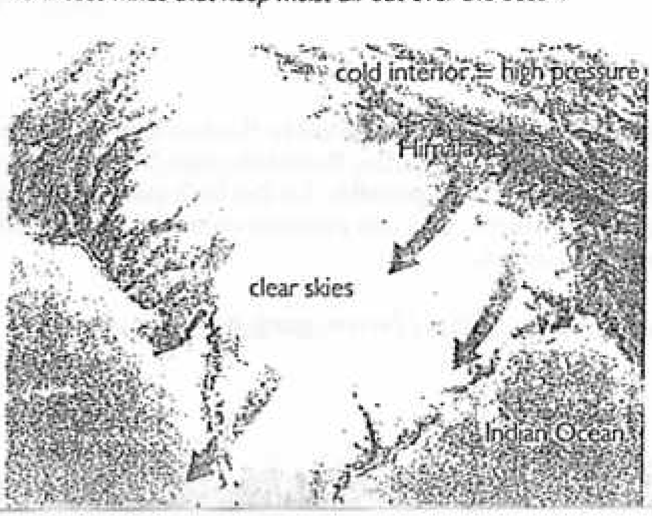
THE CHINOOK, *a famous downslope wind that occurs in North America, has created this unusual cloud formation (left). A Chinese dragon kite (above).*

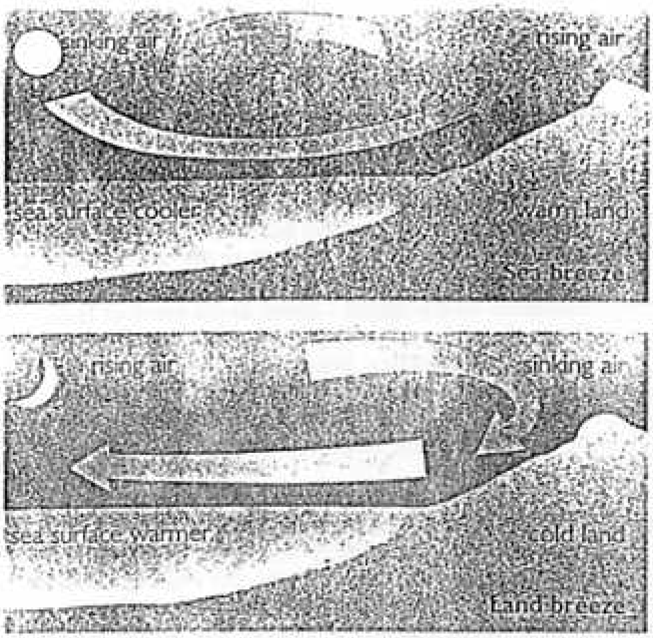
When the moist air reaches the Himalayas, more precipitation occurs as the mountains lift the air. By the time the air reaches the northern side of the range, it has dried out and a rain shadow results (see p. 36). Overall, the monsoon resembles a large-scale version of a sea breeze in summer and a land breeze in winter (see below).

Similar wind shifts, or monsoons, occur in other areas. In the southwestern United States, for example, a monsoon that occurs in late summer and early fall brings moist air in from the Gulf of California. This produces heavy rainfall, which can cause flash flooding in desert areas.

: SUMMER MONSOON *in India occurs when low pressure ·the Tibetan Plateau draws in warm, moist air from the sea.*

IN WINTER, *intense high pressure in Siberia creates strong northeast winds that keep moist air out over the ocean.*





SEA AND LAND BREEZES *occur as a result of temperature differences between coastal waters and the adjacent landmass.*

OVER INDIA *In this satellite image of India, a sea breeze has suppressed cloud development around the coast.*

The oldest voice in the world is the wind.

Donald Culross Peattie (1898–1964), American author and biologist

Local Winds

Small-scale winds occur as a result of localized differences in pressure or temperature, or the interaction of large-scale winds with local landmasses.

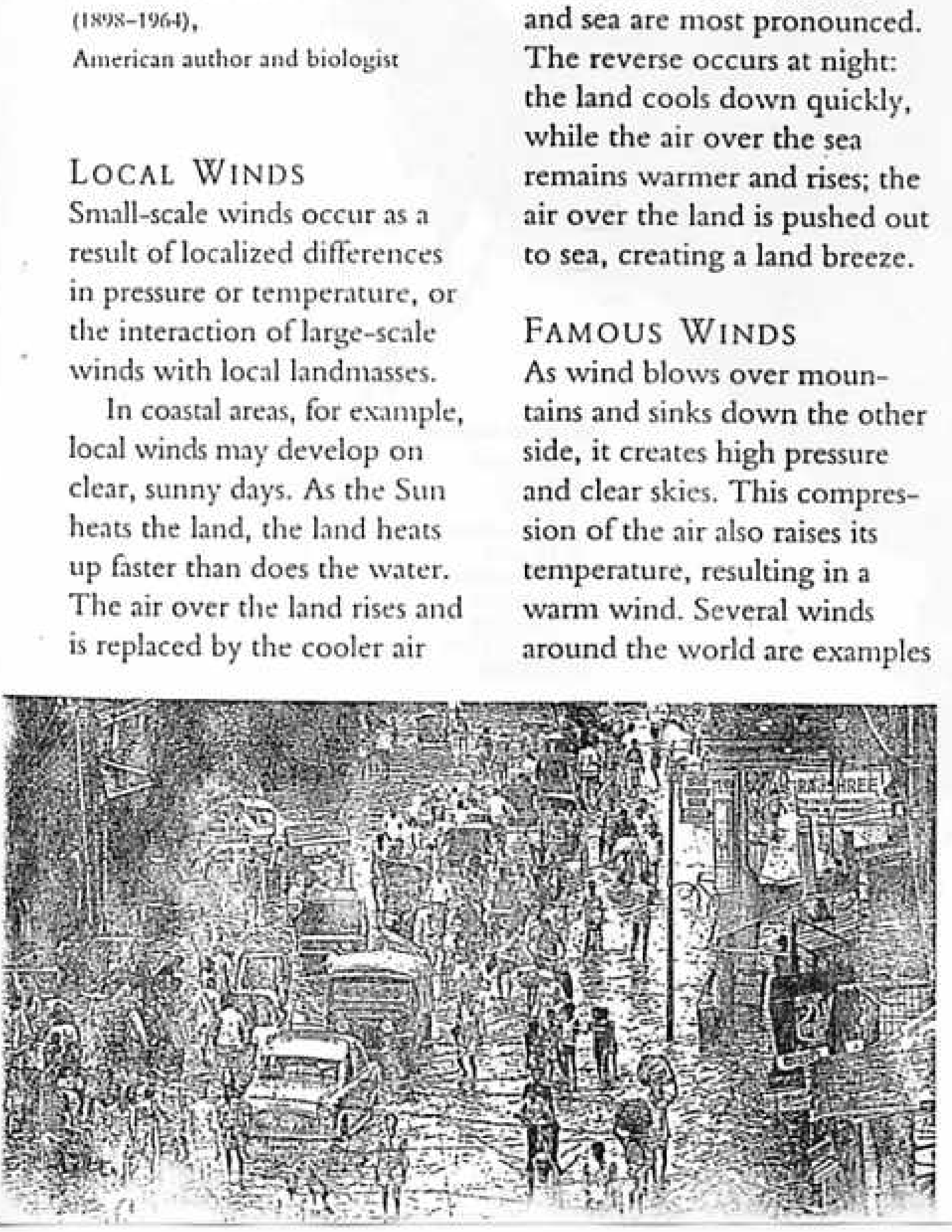
In coastal areas, for example, local winds may develop on clear, sunny days. As the Sun heats the land, the land heats up faster than does the water. The air over the land rises and is replaced by the cooler air from the sea. This circulation is called a sea breeze, and it generally occurs in spring and summer, when differences in temperature between land and sea are most pronounced. The reverse occurs at night: the land cools down quickly, while the air over the sea remains warmer and rises; the air over the land is pushed out to sea, creating a land breeze.

Famous Winds

As wind blows over mountains and sinks down the other side, it creates high pressure and clear skies. This compression of the air also raises its temperature, resulting in a warm wind. Several winds around the world are examples of warm downslope winds, including the chinook on the east side of the Rocky Mountains and the foehn in Switzerland. These winds can rapidly melt snow and enhance the rain-shadow effect (see p. 36).

Wind forced through valleys will strengthen, just as narrowing the end of a hose will create a more powerful jet of water. In the south of France, a wind formed by the Rhône Valley, known as the mistral, brings cold, dry, and squally conditions from the north.

Other winds result when intense heating of inland areas creates low pressure. A famous example is the sirocco. This brings hot, dry winds to the Mediterranean from the Sahara Desert. These winds pick up moisture from the sea, and, by the time they reach Europe, they are warm and humid. The khamsin, which also originates in the Sahara, brings hot, dry air to southern Egypt, and often devastates crops.



THE WORLD WEATHER GUIDE
arce and C.G.Smith

India is a large country, nearly half the size of the United States. It extends from 8° to 33° N, and includes vast plains like the Ganges valley and high mountains like the Himalayas – the highest in the world.

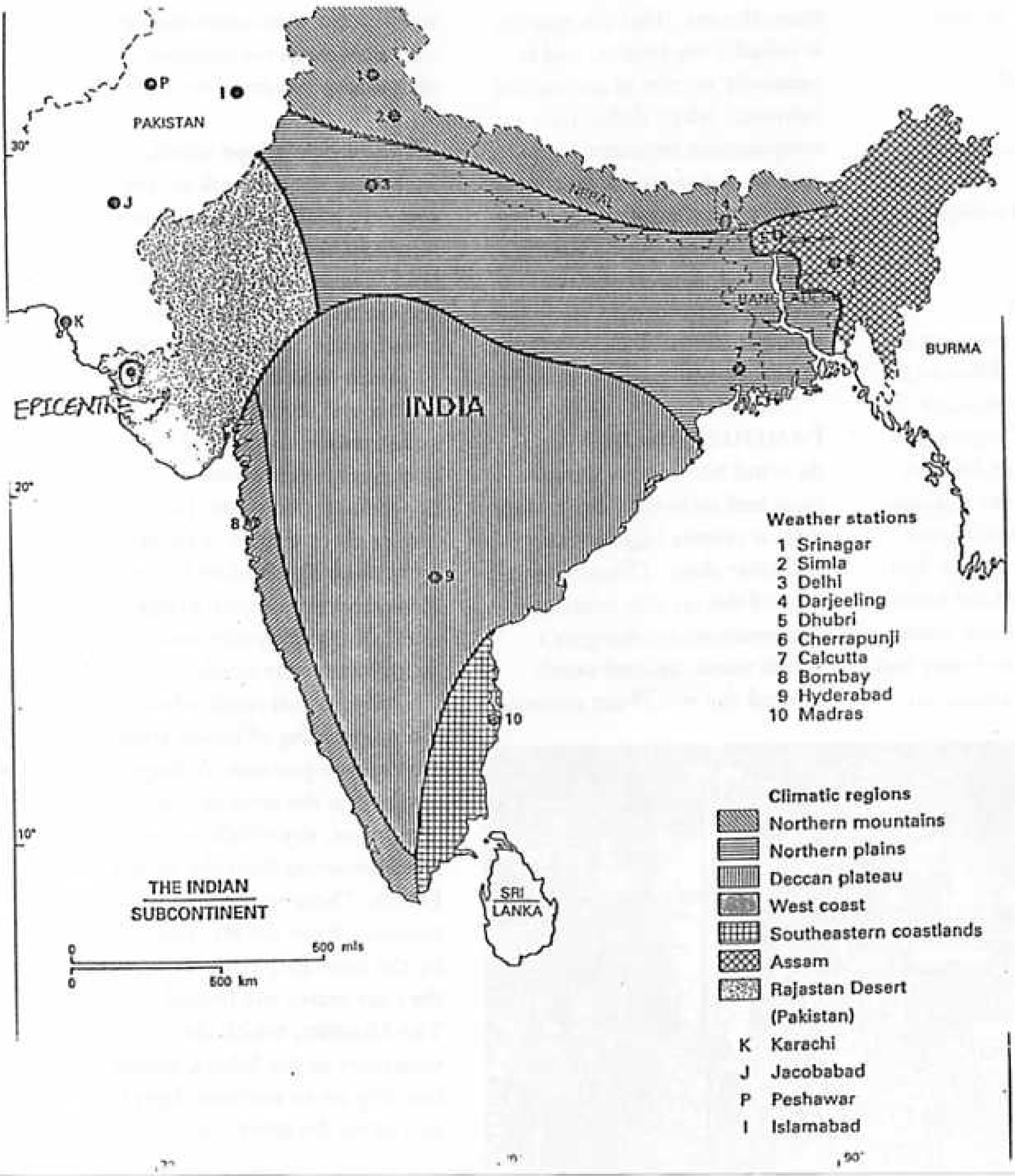
The wide variety in the terrain means a wide variety of climatic conditions. These range from permanent snowfields to tropical coastlands; from areas of virtual desert in the northwest plains to fertile, intensively cultivated rice fields in the northeast.

The climate of India is dominated by the great wind system known as the Asiatic monsoon. This is completely unlike the prevailing wind system that operates in many countries, i.e., a wind that prevails from the same direction throughout the year. The monsoon reverses direction at certain times of the year. For some months it will blow steadily from the southwest; for other months, from the northeast.

From June to October the country is influenced by the moist, rain-bearing monsoon from the southwest. On some mountain ranges, facing the sea, rainfall can be very heavy indeed. The coolest, driest time over most of the country is from December to February when light northerly winds bring clear skies and little rain. From March to May the climate becomes hotter and hotter and the drought continues. The rains only come when the wind turns again to the southwest.

On average, the arrival of the rains – the 'burst of the monsoon' as it is called – comes to the south of India during late May or early June. It will reach the north about six weeks later. Some years, the rains will be torrential. Other years they may be light or locally variable; in this case, the monsoon will be said to have 'failed'. Results for food crops can, of course, be disastrous.

India can be conveniently divided into seven climatic regions: the northern mountains or Himalayas, the northern plains from the Ganges delta to just northwest of Delhi, the Rajastan Desert, the Deccan plateau, the west coast, the southeast coastlands, and Assam in the extreme northeast of the country.



E NORTHERN MOUNTAINS

region includes the Himalayas and their foot-
Here some rain can occur all the year round. In
r light rain or snow is brought by disturbances
ling from the west. The main rainy season,
ver, is from July to October during the southwest
oon. Winters are pleasant and cool at lower levels
but it can get quite hot before the 'burst' of the monsoon. At intermediate levels, from 6000 to 8000 ft (1800 to 2430 m), the summer climate is very pleasant and cool. Kashmir (see table for Srinagar) and hill stations such as Simla and Darjeeling are popular refuges from the heat of the plains.

Simla 7224 ft (2202 m) 31°06′ N 77°10′ E 30 years — INDIA

Month	Temp °F Highest recorded	Temp °F Average daily max.	Temp °F Average daily min.	Temp °F Lowest recorded	Temp °C Highest recorded	Temp °C Average daily max.	Temp °C Average daily min.	Temp °C Lowest recorded	Relative humidity 0800 hours %	Relative humidity 1630 hours %	Precipitation Average monthly in	Precipitation Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
J	63	47	36	15	17	8	2	−9	49	59	2.4	61	4	J
F	67	45	37	18	19	9	3	−8	49	61	2.7	69	5	F
M	73	57	44	22	24	14	7	−6	38	43	2.4	61	5	M
A	83	65	52	32	28	18	11	0	36	35	2.1	53	4	A
M	86	72	58	40	30	22	14	4	40	35	2.6	66	5	M
J	87	73	61	46	31	23	16	8	60	59	6.9	175	10	J
J	82	69	60	50	28	21	16	10	83	87	16.7	424	20	J
A	78	67	59	52	26	19	15	11	91	91	17.1	434	19	A
S	76	67	57	41	24	19	14	5	73	77	6.3	160	9	S
O	75	63	51	39	24	17	11	4	47	52	1.3	33	2	O
N	67	57	45	32	19	14	7	0	36	44	0.5	13	1	N
D	68	51	40	21	20	11	4	−6	38	55	1.1	28	2	D

Darjeeling 7431 ft (2265 m) 27°03′ N 88°16′ E 25 years

Month	Temp °F Highest recorded	Temp °F Average daily max.	Temp °F Average daily min.	Temp °F Lowest recorded	Temp °C Highest recorded	Temp °C Average daily max.	Temp °C Average daily min.	Temp °C Lowest recorded	Relative humidity 0800 hours %	Relative humidity 1630 hours %	Precipitation Average monthly in	Precipitation Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
	51	47	35	27	16	8	2	−3	82	84	0.5	13	1	J
	52	48	36	28	17	9	2	−2	84	80	1.1	28	3	F
	74	57	42	31	23	14	6	−1	75	70	1.7	43	4	M
	73	62	49	34	24	17	9	1	81	75	4.1	104	7	A
	77	64	53	42	25	18	12	6	90	85	8.5	216	14	M
	76	65	56	47	24	18	13	8	95	91	23.3	589	21	J
	77	66	58	48	25	19	14	9	97	92	31.4	798	26	J
	77	65	57	51	25	18	14	11	96	93	25.1	638	24	A
	[illegible]7	64	55	50	25	18	13	10	94	92	17.6	447	17	S
	[illegible]4	61	50	40	23	16	10	4	89	85	5.1	130	5	O
	[illegible]7	54	42	36	19	12	6	2	79	79	0.9	23	1	N
	[illegible]	49	37	30	17	9	3	−1	78	78	0.3	8	1	D

Srinagar (Kashmir) 5205 ft (1587 m) 34°05′ N 74°50′ E 30 years — INDIA

Month	Temp °F Highest recorded	Temp °F Average daily max.	Temp °F Average daily min.	Temp °F Lowest recorded	Temp °C Highest recorded	Temp °C Average daily max.	Temp °C Average daily min.	Temp °C Lowest recorded	Relative humidity 0800 hours %	Relative humidity 1630 hours %	Precipitation Average monthly in	Precipitation Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
J	56	41	28	8	13	5	−2	−13	90	76	2.9	74	6	J
F	69	45	30	6	21	7	−1	−14	88	63	2.8	71	6	F
M	78	57	38	23	26	14	3	−5	84	57	3.6	91	7	M
A	88	66	45	33	31	19	7	1	79	52	3.7	94	8	A
M	96	76	52	37	36	24	11	3	71	43	2.4	61	5	M
J	99	85	58	45	37	29	14	7	67	40	1.4	36	3	J
J	99	88	65	52	37	31	18	11	73	46	2.3	58	5	J
A	97	87	64	51	36	31	18	11	78	49	2.4	61	5	A
S	95	83	54	40	35	28	12	4	76	43	1.5	38	3	S
O	93	72	41	29	34	22	5	−2	78	48	1.2	31	3	O
N	74	60	31	18	23	16	−1	−8	82	51	0.4	10	1	N
D	63	48	28	13	17	9	−2	−11	88	63	1.3	33	3	D

NORTHERN PLAINS

ding from the Punjab to the Ganges delta, this
ding region is everywhere hot and generally dry
March until June. Some occasional
derstorms occur at this season, more particularly
east. With the arrival of the main monsoon
in July temperatures drop a little in the more
y weather but the high humidity causes this
to be almost as unpleasant as the preceding
son and the nights are particularly sticky.
all decreases from east to west and to the west
orthwest of Delhi conditions verge on desert.
g the winter season from December to February
ather is generally sunny and dry. The nights
rly mornings can feel quite chilly but the days
rm and pleasant. Some light rain may occur in
st and no part of the region is completely dry at
ne. The contrast between the wetter east and
vest is well shown by comparing the climatic
for Calcutta and Delhi.

THE RAJASTAN DESERT

This is the eastern part of what before the partition of India used to be called the Thar or Great Indian Desert. Here the climate is similar to that found in the Sind province of Pakistan to the west and the conditions round the year are well illustrated by the climatic table for Jacobabad in Pakistan on p. 370. Annual rainfall is almost everywhere below 20 in (500 mm) per year and in many places only half this. This area is one of the hottest parts of the world from May to July and the arrival of the monsoon with some light rain and more cloud makes very little difference to temperatures, so that July, August and September are unpleasantly hot and humid. The cool season from November to March is warm, sunny and dry.

THE WORLD WEATHER GUIDE

E.A.Pearce and C.G.Smith

Calcutta 21 ft (6 m) 22°32′ N 88°20′ E 60 years — INDIA

Month	Temp °F Highest recorded	Temp °F Average daily max.	Temp °F Average daily min.	Temp °F Lowest recorded	Temp °C Highest recorded	Temp °C Average daily max.	Temp °C Average daily min.	Temp °C Lowest recorded	Relative humidity 0800 hours %	Relative humidity 1730 hours %	Precipitation Average monthly in	Precipitation Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
J	89	80	55	44	32	27	13	7	85	52	0.4	10	0.8	J
F	98	84	59	46	37	29	15	8	82	45	1.2	31	2	F
M	104	93	69	50	40	34	21	10	79	46	1.4	36	2	M
A	107	97	75	61	42	36	24	16	76	56	1.7	43	3	A
M	108	96	77	65	42	36	25	18	77	62	5.5	140	7	M
J	111	92	79	70	44	33	26	21	82	75	11.7	297	13	J
J	98	89	79	73	37	32	26	23	86	80	12.8	325	18	J
A	96	89	78	74	36	32	26	23	88	82	12.9	328	18	A
S	97	90	78	72	36	32	26	22	86	81	9.9	252	13	S
O	96	89	74	63	36	32	24	17	85	72	4.5	114	6	O
N	92	84	64	51	33	29	18	11	79	65	0.8	20	1	N
D	87	79	55	45	31	26	13	7	80	55	0.2	5	0.3	D

Delhi 714 ft (218 m) 28°35′ N 77°12′ E 10 years — INDIA

Month	Temp °F Highest recorded	Temp °F Average daily max.	Temp °F Average daily min.	Temp °F Lowest recorded	Temp °C Highest recorded	Temp °C Average daily max.	Temp °C Average daily min.	Temp °C Lowest recorded	Relative humidity 0800 hours %	Relative humidity 1630 hours %	Precipitation Average monthly in	Precipitation Average monthly mm	Average no. days with 0.1 in + (25 mm +)	
J	84	70	44	31	29	21	7	−1	72	41	0.9	23	2	J
F	89	75	49	32	32	24	9	0	67	35	0.7	18	2	F
M	103	87	58	45	39	31	14	7	49	23	0.5	13	1	M
A	114	97	68	53	46	36	20	12	35	19	0.3	8	1	A
M	115	105	79	65	46	41	26	18	35	20	0.5	13	2	M
J	115	102	83	66	46	39	28	19	53	36	2.9	74	4	J
J	113	96	81	71	45	36	27	22	75	59	7.1	180	8	J
A	104	93	79	72	40	34	26	22	80	64	6.8	173	8	A
S	105	93	75	64	41	34	24	18	72	51	4.6	117	4	S
O	103	93	65	51	39	34	18	11	56	32	0.4	10	1	O
N	93	84	52	41	34	29	11	5	51	31	0.1	3	0.2	N
D	83	73	46	34	28	23	8	1	69	42	0.4	10	1	D

THE WEST COAST

his consists of a narrow coastal plain backed by a ep mountain barrier, the Western Ghats. Rainfall is undant and heavy during the southwest monsoon ason. The heat can be very oppressive because of the umidity throughout the year, particularly in the hot ason. Some hill stations in the Western Ghats have a pleasant climate during the hot season, but are very cloudy and wet during the monsoon. Towards the south some rain can occur at any time of the year and the monsoon arrives earlier.

The table for Bombay is representative of conditions at sea level.

mbay 37 ft (11 m) 18°54' N 72°49' E 60 years — INDIA

	Temperature °F Highest recorded	°F Average daily max.	°F Average daily min.	°F Lowest recorded	Temperature °C Highest recorded	°C Average daily max.	°C Average daily min.	°C Lowest recorded	Relative humidity 0800 hours %	Relative humidity 1600 hours %	Precipitation Average monthly in	Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
	94	83	67	53	34	28	19	12	70	61	0.1	2.5	0.2	J
	97	83	67	53	36	28	19	12	71	62	0.1	2.5	0.2	F
	101	86	72	62	38	30	22	17	73	65	0.1	2.5	0.1	M
	100	89	76	65	38	32	24	20	75	67	0	0	0.1	A
	96	91	80	73	36	33	27	23	74	68	0.7	18	1	M
	99	89	79	70	37	32	26	21	79	77	19.1	485	14	J
	96	85	77	72	36	29	25	22	83	83	24.3	617	21	J
	90	85	76	72	32	29	24	22	83	81	13.4	340	19	A
	95	85	76	71	35	29	24	22	85	78	10.4	264	13	S
	97	89	76	70	36	32	24	21	81	71	2.5	64	3	O
	96	89	73	64	36	32	23	18	73	64	0.5	13	1	N
	94	87	69	53	34	31	21	13	70	62	0.1	2.5	0.1	D

THE DECCAN PENINSULA

The interior of the centre and south is a low plateau with a different climate from that of the coastlands. The three main seasonal divisions of the year apply equally well here, but rainfall is generally moderate compared with the coastlands and, in the northwest, rather low. On occasions, during the hot season, temperatures can approach those of the northern plains. Altitude is the main control on temperature, but towards the south even the cool season is typically tropical in temperature when warm sunny days are moderated by dry heat and pleasant cool evenings (see the table for Hyderabad).

Hyderabad 1778 ft (541 m) 17°26' N 78°27' E 30 years — INDIA

	Temperature °F Highest recorded	°F Average daily max.	°F Average daily min.	°F Lowest recorded	Temperature °C Highest recorded	°C Average daily max.	°C Average daily min.	°C Lowest recorded	Relative humidity 0830 hours %	Relative humidity 1730 hours %	Precipitation Average monthly in	Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
J	95	84	60	47	35	29	16	8	73	41	0.3	8	0.5	J
F	99	89	64	52	37	32	18	11	64	34	0.4	10	1	F
M	106	97	70	60	41	36	21	16	54	27	0.5	13	1	M
A	110	101	76	61	43	38	24	16	53	34	1.2	31	2	A
M	112	104	80	67	44	40	27	19	52	35	1.1	28	2	M
J	111	95	76	64	44	35	24	18	70	55	4.4	112	7	J
J	99	87	73	67	37	31	23	19	81	65	6.0	152	11	J
A	97	87	73	67	36	31	23	19	80	68	5.3	135	10	A
S	97	87	72	64	36	31	22	18	81	70	6.5	165	9	S
O	97	88	69	57	36	31	21	14	72	53	2.5	64	4	O
N	92	84	63	46	33	29	17	8	71	45	1.1	28	2	N
D	92	83	59	46	33	28	15	8	73	41	0.3	8	0.4	D

HE SOUTHEAST COASTLANDS

ere the main rains do not occur until the period ctober to December, and are often associated with opical storms or cyclones developing in the Bay of engal. Because of the lack of cloud, the period of the uthwest monsoon from June to September can be y unpleasant since temperature and humidity are gh.

The east coast north of Banda has its main rainy season at the time of the southwest monsoon, but this area is occasionally affected by very heavy rain and strong winds caused by tropical cyclones between July to November (see the table for Madras).

IDIA — Madras 51 ft (16 m) 13°04' N 80°15' E 60 years

Temperature °F Highest recorded	°F Average daily max.	°F Average daily min.	°F Lowest recorded	Temperature °C Highest recorded	°C Average daily max.	°C Average daily min.	°C Lowest recorded	Relative humidity 0800 hours %	Relative humidity 1700 hours %	Precipitation Average monthly in	Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
91	85	67	57	33	29	19	14	87	67	1.4	36	2	J
98	88	68	59	37	31	20	15	83	66	0.4	10	0.7	F
102	91	72	62	39	33	22	17	80	67	0.3	8	0.4	M
109	95	78	68	43	35	26	20	74	72	0.6	15	0.9	A
113	101	82	70	45	38	28	21	63	67	1.0	25	1	M
110	100	81	69	43	38	27	21	59	61	1.9	48	4	J
106	96	79	71	41	36	26	22	63	62	3.6	91	7	J
104	95	78	69	40	35	26	21	71	66	4.6	117	8	A
102	94	77	69	39	34	25	21	75	70	4.7	119	7	S
102	90	75	62	39	32	24	17	83	73	12.0	305	11	O
94	85	72	59	34	29	22	15	86	75	14.0	356	11	N
91	84	69	57	33	29	21	14	87	72	5.5	140	5	D

ASSAM OR THE EXTREME NORTHEAST

This area is almost detached from the rest of India by Bangladesh. It is a region of plains and mountainous tracts. Its climate is similar to that of the northern plains and Himalayas, depending on altitude. Here some significant rainfall can occur in the period March to May but the main rainy season from June to October is, in places, very wet indeed and Cherrapunji at an altitude of 4300 ft (1300 m) has the distinction of being one of the three wettest places in the world with an annual rainfall averaging 425 in (10,800 mm)!

The table for Dhubri is representative of the lowlands.

Cherrapunji 4309 ft (1313 m) 25°15' N 91°44' E 35 years — INDIA

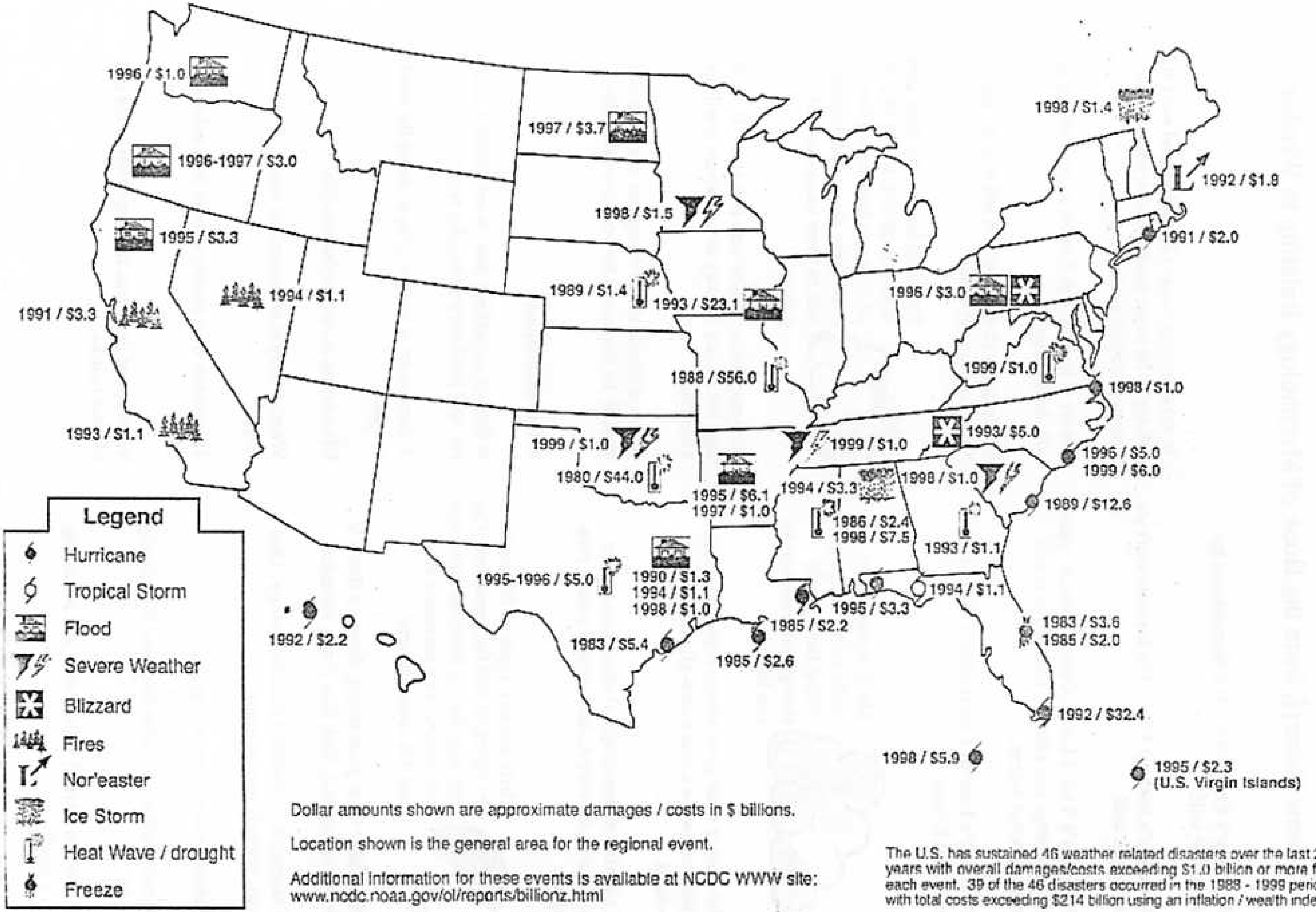
	Temperature °F Highest recorded	°F Average daily max.	°F Average daily min.	°F Lowest recorded	Temperature °C Highest recorded	°C Average daily max.	°C Average daily min.	°C Lowest recorded	Relative humidity 0830 hours %	Relative humidity 1730 hours %	Precipitation Average monthly in	Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
J	80	60	46	34	27	16	8	1	66	72	0.7	18	1	J
F	84	62	49	33	29	17	9	1	63	70	2.1	53	3	F
M	87	69	55	33	31	21	13	1	61	62	7.3	185	7	M
A	83	71	59	39	28	22	15	4	77	69	26.2	666	16	A
M	82	72	61	38	28	22	16	3	82	84	50.4	1280	22	M
J	82	72	64	53	28	22	18	12	91	90	106.1	2695	25	J
J	83	72	65	53	28	22	18	12	93	92	96.3	2446	27	J
A	83	73	65	56	28	23	18	13	92	91	70.1	1781	26	A
S	84	73	65	55	29	23	18	13	87	87	43.3	1100	19	S
O	83	72	61	51	29	22	16	11	76	84	19.4	493	9	O
N	80	67	54	44	27	19	12	7	64	80	2.7	69	2	N
D	74	62	48	39	23	17	9	4	63	79	0.5	13	0.7	D

INDIA — Dhubri 115 ft (35 m) 26°01' N 89°59' E 32 years

	Temperature °F Highest recorded	°F Average daily max.	°F Average daily min.	°F Lowest recorded	Temperature °C Highest recorded	°C Average daily max.	°C Average daily min.	°C Lowest recorded	Relative humidity 0800 hours %	Relative humidity 1730 hours %	Precipitation Average monthly in	Average monthly mm	Average no. days with 0.1 in + (2.5 mm +)	
J	81	74	53	43	27	23	12	6	90	59	0.3	8	1	J
F	90	78	56	37	32	26	13	3	84	54	0.7	18	1	F
M	101	86	63	50	38	30	17	10	75	41	1.8	46	3	M
A	103	87	70	54	39	31	21	12	79	49	5.1	130	8	A
M	103	86	73	63	39	30	23	17	86	75	14.7	373	15	M
J	96	86	76	69	36	30	24	21	91	83	23.8	605	18	J
J	95	86	78	73	35	30	26	23	91	83	17.1	434	16	J
A	94	86	79	72	34	30	26	22	90	83	13.5	343	15	A
S	95	85	77	69	35	29	25	21	91	83	14.5	368	13	S
O	92	85	73	62	33	29	23	17	88	75	4.6	117	5	O
N	88	80	64	53	31	27	18	12	86	71	0.3	8	1	N
D	80	74	55	46	27	23	13	8	89	67	0.1	3	0	D

The earthquake took place during the dry season with sunny skies by day and maxima of 80 to 90 degF. The nights are clear and cool with minima in the fifties F.

1980 - 1999



Dollar amounts shown are approximate damages / costs in $ billions.

Location shown is the general area for the regional event.

Additional information for these events is available at NCDC WWW site:
www.ncdc.noaa.gov/ol/reports/billionz.html

The U.S. has sustained 46 weather related disasters over the last 20 years with overall damages/costs exceeding $1.0 billion or more for each event. 39 of the 46 disasters occurred in the 1988 - 1999 period with total costs exceeding $214 billion using an inflation / wealth index.

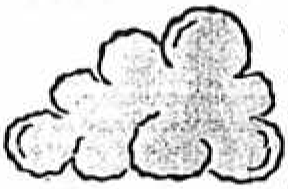
Some Excerpts from the Book of Murphology Relating to Weather

Murphy's First Law ; If a forecast can go wrong, it will.

Murphy's Second Law : If a forecast can't go wrong, it will.

Murphy's Third Law : Once a forecast starts to go wrong, any attempt toimprove it will make it even worse.

Murphy's Law of Concreting : You never pour but it rains.



The forecaster who can smile when things go wrong has already thought of someone he can blame.

No matter what goes wrong with a forecast, there is always some know-all who knew it would.

Complex meteorological situations always yield simple, easy-to-understand wrong forecasts.

There are two types of forecaster, the optimist and the pessimist. The optimist always believes tomorrow will be dry. The pessimist fears that this might be true.

No matter what goes wrong during a live TV weather forecast, look like it was intended.

Teamwork is essential in meteorology. That way, nobody gets blamed.

Nature abhors meteorologists.

In meteorology, he who hesitates is probably right.

When you haven't a clue what you are doing, do it neatly.

In meteorology. an easily understood workable fallacy is far more useful than a complex incomprehensible truth.

To err is human, but it takes a computer to really foul things up.

A computer does what you tell it to do, not what you want it to do.

By using bigger and more powerful computers, it will be possible to produce wrong forecasts even faster than before, and to three extra decimal places.

You may know which way that storm is heading, but there's no way to tell where it will go after that.

Never attribute to the computer what can adequately be explained by your own stupidity.

A few definitions ;

A drug is something that, when injected into a rat, will produce a scientific report.

A committee is twelve people doing the work of one.

Cleanliness is next to impossible.

When a body is immersed in water, the phone rings.

The person who snores always falls asleep first.

Wind speed increases in proportion to the cost of your hairdo.

Obj: METEOSAT7 NIT: 5-FEB-2001 14:30 Dat_Nam: IR_CAL Enh: IR_MASK
Proj: NONE Lon: 0.00 Lat: 0.00
Met Eireann VAX-SAT/B Version: 1.2.4