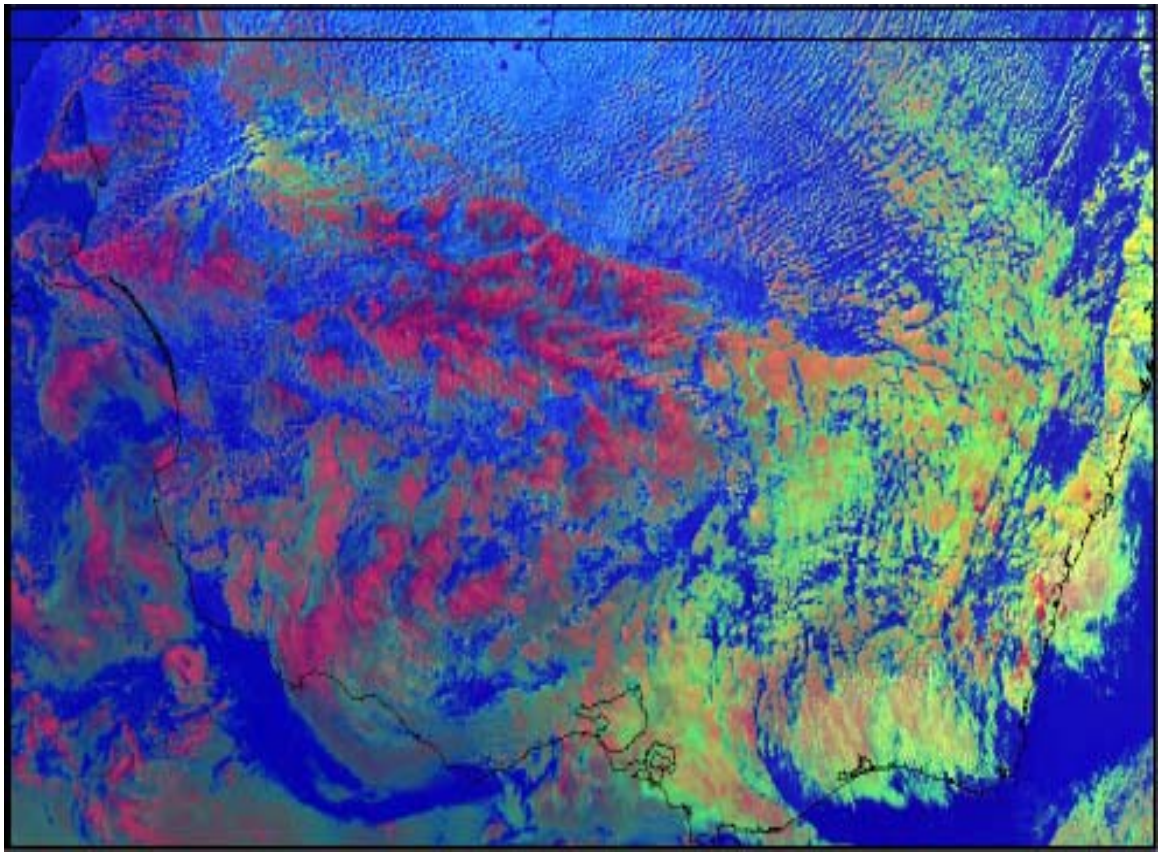
Australian Management Consolidated Pty. Ltd.
A.C.N. 007-387-331 / A.B.N. 85-007-387-331

THE RECENT AUSTRALIAN BUSHFIRES RAINFALL AND ENVIRONMENT



SUBMISSION TO THE COAG BUSHFIRE INQUIRY CONCERNING THE RECENT AUSTRALIAN BUSHFIRES

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November 2003

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27 November 2003

COAG Bushfire Inquiry
Department of the Prime Minister and Cabinet
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SUBMISSION TO THE COAG BUSHFIRE INQUIRY CONCERNING THE RECENT AUSTRALIAN BUSHFIRES

ABSTRACT

This submission concerns with the environmental, management and scientific issues concerning the recent Australian bushfires and refers to the failure of the Victorian, the New South Wales and the ACT Governments and agencies to study and understand the latest scientific findings in relation to the causes of increase in fire hazard and declining rainfall in the Victorian Alps and the Snowy Mountains. In particular, the most recent technologies and research in respect to climate change, inadvertent weather modification and loss of rainfall caused by air pollution have been ignored. The unwillingness or inability of the Rural Fire Authorities, NSW National Parks and Wildlife Service and Victorian Department of Sustainability and Environment officers to consider and to embrace the latest and most advanced scientific methods to prevent, reduce and control bushfires by rainfall enhancement will be addressed in this submission.

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1. Introduction

Australia's fire hazard conditions vary from season to season and to great extent are determined by the quantity and timing of natural rainfall and snowfall in the Victorian Alps, the Snowy Mountains and the Great Dividing Ranges of eastern Australia.

The amount of natural rainfall and snowfall and the amount of moisture on the ground is directly related to the frequency and intensity of fire season.

Wet forest conditions caused by additional rainfall and snowfall can substantially prevent fire hazard conditions and reduce the frequency of fires and their intensity. Fires started in wet forest conditions are more easily controlled and so to is their capacity to cause loss, damage and injury.

Our research reveals that over the last decades there has been a substantial reduction of natural rainfall and snowfall in the Victorian Alps, the Snowy Mountains and the Great Dividing Ranges of eastern Australia which has resulted in severe fire hazard conditions and water shortages. Research with which Australian Management Consolidated Pty. Ltd. (AMC) has been involved shows that the frequency and severity of bushfire events can be prevented and controlled by the application of rainfall enhancement.

The costs of controlled burning in National Parks, State Forests and private properties amounts to $ Millions each year and cause a large number of uncontrolled fires, air and water pollution that can cause injury to firefighters and others with an increase in respiratory and skin illnesses, risk of heart and asthma attacks, allergies, property and environmental damage to local residents and to those residing hundreds kilometers downwind from air pollution sources.

Prof. Daniel Rosenfeld have discovered and published in referred journals scientific evidence that additional air pollution from forest fires, urban and industrial developments causes a reduction of rainfall downwind from air pollution sources and increase in lightning strikes, which can create further fire hazards.

Our company has provided scientific advice to the New South Wales, and the Victorian Fire, Emergency and Environment Authorities and Ministers Bob Debus, Sherryl Garbutt and John Thwaites, but they and Commissioners Phil Koperberg and Bruce Esplin refuse to meet with our company representatives and to consider proposed actions. Their neglect could result in the Governments and their agencies being hold liable for damage caused by their neglect.

2. The Scientific Findings

Our company in conjunction with Prof. Daniel Rosenfeld of the Hebrew University of Jerusalem has, since **May 1999,** been researching rainfall and snowfall reduction in the Victorian Alps, the Snowy Mountains and the Great Dividing Ranges of eastern Australia and our research has revealed the impact of air pollution on levels of rainfall and snowfall, subsequent increase in lightning strikes and associated increases in fire hazardous conditions.

Our findings are based on new scientific and technological methodology recently developed by Prof. Daniel Rosenfeld and which has been endorsed and adopted by the National Aeronautics and Space Administration (NASA) and the National Space Development Agency of Japan (NASDA) to measure the microphysical structures of clouds through satellite observations. The inadvertent weather modification caused by human made air pollution has been found to be the main cause of drought and fire hazard in many areas around the world, and in April 2003 the 8th World Meteorological Organization Conference on Weather Modification accepted and endorsed our scientific findings in section 3.3.5 of its report to the United Nations (**page 26**).

The satellite observations and measurements on board of the National Aeronautics and Space Administration (NASA) and the National Space Development Agency of Japan (NASDA), Tropical Rainfall Measuring Mission (TRMM), showed that warm and cold rain-forming processes in the Maritime Convective (MC) clouds and the Continental Convective (CC) clouds are sensitive to air pollution.

The sources of air pollution affecting rainfall and snowfall precipitation in the Victorian Alps, the Snowy Mountains and the Great Dividing Ranges are forest fires, urban and industrial air pollution originating in Melbourne, Geelong, Adelaide, the La Trobe Valley and Port Augusta power stations, Port Pirie lead smelter in southeastern Australia and air pollution of Sydney, Brisbane and power stations in the Hunter Valley, southeastern and central Queensland which in turn affect rainfall in the Great Dividing Ranges of eastern Australia.

The physical measurements indicates that air pollution affecting rain processes reduce the levels of natural precipitation of individual Maritime Convective and Continental Convective clouds to the level of total suppression. Thus, clouds that could be expected to produce substantial rainfall and snowfall yield little precipitation or none at all.

The principles of the methodology are described in a paper by Rosenfeld and Lensky (1998): "Spaceborne sensed insights into precipitation formation processes in continental and maritime clouds*". The Bulletin of American Meteorological Society, 79, 2457-2476.* **(1)**

Another paper by Prof. Rosenfeld identifies direct evidence that precipitation is inhibited in clouds affected by smoke and was a major cause of uncontrollable fires in Borneo Indonesia in 1998: *Rosenfeld D., 1999*: "TRMM Observed First Direct Evidence of Smoke from Forest Fires Inhibiting Rainfall"*. Geophysical Research Letters. October 15, 1999*. **(2)** In recognition of the significance of these finding both NASA and the American Geophysical Union issued a joint press release on 5 October 1999. **(page35)**

A third paper by Prof. Rosenfeld, entitled "Suppression of Rain and Snow by Urban and Industrial Air Pollution" was published on the 10 March 2000, by the American Association for the Advancement of Science (AAAS) in the *Science* journal **(3)** and focuses on south-eastern Australia and shows the following:

a. Pollution tracks are clearly visible in the clouds and can be pinpointed to urban and industrial developments, and individual pollution sources, such as power stations, smelters and refineries as seen in **Figure 1**.

Satellite Image of south-eastern Australia with urban and industrial air pollution tracks emanating from Adelaide, Melbourne, Port Pirie lead smelter, Geelong refinery, Port Augusta, La Trobe Valley and Hunter Valley power stations, Portland aluminum smelter.

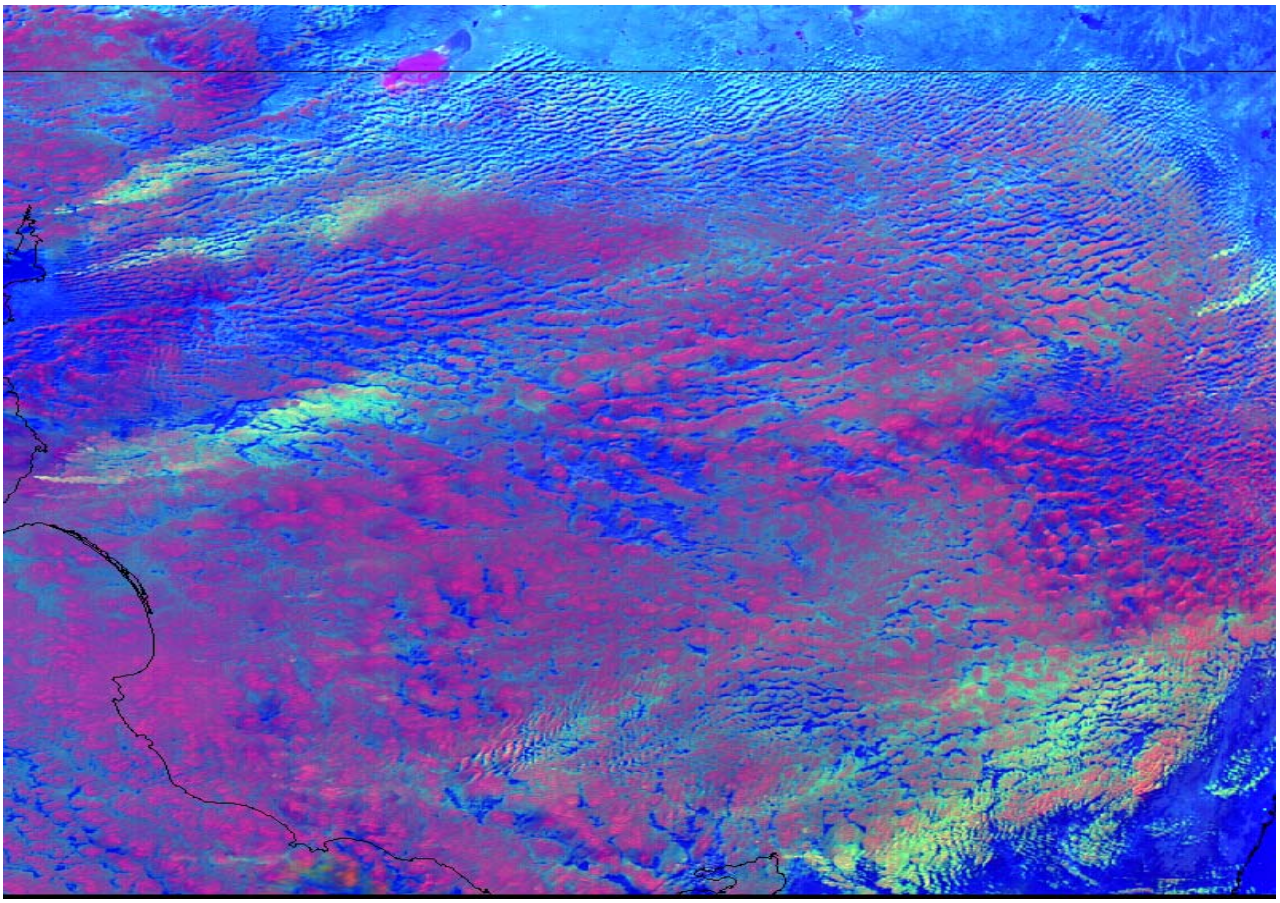


Figure 1

b. The precipitation from clouds impacted by the pollution is markedly inhibited, to the point of total suppression.

c. The pollution inhibits the production of snow in the clouds and it is estimated that precipitation in the Snowy Mountains and the Victorian Alps is reduced by at least 30% on average each year.

d. That urban and industrial air pollution causes substantial reductions of rainfall and snowfall and, as a consequence, substantial increase in fire hazard conditions in the Victorian Alps, the Snowy Mountains and the Great Dividing Ranges.

Our company estimates that in addition to substantial increase in fire hazard in the Victorian Alps and the Snowy Mountains the rainfall and snowfall loss resulting in reduction of inflow into the reservoirs and rivers in those areas is at least 5,000, 000 ML per annum.

A fourth paper by Prof. Ramanathan, Prof. Cruetzen et al. (2001) **(4)** published in *Science* entitled: "Aerosols, Climate, and the Hydrological Cycle" shows that this kind of air pollution is very extensive, and has a major precipitation suppression effect and cause of fire hazard over the most populated areas in both developed and developing countries.

A fifth paper by Prof. Rosenfeld reporting results of sounding of CC clouds (*Nature,* 2000), **(5)** is entitled "Convective Clouds with Sustained Highly Supercooled Liquid Water Until –38^{o}C". Aircraft measurements of supercooled liquid water content indicate the presence of a huge amount of liquid water up to height of 9 to 10 km. This seems to be a common feature of deep vigorous convective clouds in many continental parts of the world (including Australia). Because of failure to reach the coalescence threshold, the potential rainfall yields from such clouds remains unrealized resulting in reduced or complete absence of precipitation. However, these clouds are often the source of damaging hailstorms (Sydney 1999) and lightning.

A sixth paper published in *Geophysical Research Letters* by Prof. Khain A., (2001), **(6)** entitled: "Simulating convective clouds with sustained supercooled liquid water down to –37.5°C using a spectral microphysics model" shows a huge amount of liquid water in convective clouds (1.8 gm-3 at –37.5°C) is predicted by a numerical cloud model that allows explicit microphysical processes and turbulent effects to be simulated.

A seventh paper by Prof. Rosenfeld describes the effect of desert dust on cloud micro-physical structures and precipitation entitled "Desert dust suppressing precipitation: A possible desertification feedback loop" published in *Proceedings of the National Academy of Science (PNAS)* on 22 May 2001, **(7)**.

The satellite methodology of Rosenfeld also revealed that glaciogenic seeding (seeding with an ice forming agent, typically silver iodide) created and increased ice precipitation in clouds over west Texas (Woodley et al., 2000) **(8)**, published in *Jour. of Weather Mod*. Vol.32, (37-52), entitled "Identification of a Seeding Signature in Texas Using Multi-Spectral Satellite Imagery"**.**

A ninth paper by Prof. Rosenfeld published in *Science* 6 September 2002 **(9),** entitled "The Role of Sea Spray in Cleansing Air Pollution over Ocean via Cloud Processes" explained the role of sea salt particles in promoting coalescence of cloud droplets and cleansing the atmosphere of the air pollution by enhancing rainfall.

Rosenfeld discovered that precipitation develops readily in clouds that form in polluted air masses over the sea. This is in contrast to the situation over land. Small sea salt particles from sea spray are responsible for the restoration of capacity to yield precipitation from the polluted clouds. This natural seeding with hygroscopic salts provides a blueprint for what might be done artificially over drought and fire-hazard affected areas.

In their next paper published in Geophysical Research Letters in October 2002, Williams, E., D. Rosenfeld, et al., 2002 **(10),** showed that under certain meteorological conditions smoky clouds produce less rainfall and more lightning that subsequently could cause further fires.

These scientific findings were published in the most prestigious scientific journals and received wide media coverage. To demonstrate the extent of the publicity, attached hereto are the references and the links to the scientific papers and reports **(Page 26).**

3. Rainfall reductions and fire hazard due to polluted clouds.

Australia is the driest continent in the world with frequent dust storms, which elevate huge quantities of soil dust and pollen to the level of clouds, and large quantities of PM 2.5 (smoke) and SO2 (gas) air pollution constantly emitted by the Australian urban and industrial developments, by coal power stations, refineries and smelters, and by forest and grass fires.

It is not difficult to appreciate that air pollution is not just disappearing downwind, but is also affecting our health, causing respiratory illnesses and, as it was recently discovered, affecting precipitation efficiency of clouds and, consequently, an increase in fire hazard conditions in remote and inaccessible areas, which are impossible to control by conventional fire fighting methods, downwind from initial air pollution sources.

The NASA satellite image of the dust storm and smoke from forest fires in NSW, Victoria and Queensland on 23 October 2002 can be seen in **Figure 2**. The Bureau of Meteorology (BoM) Rain Map for this period shows suppression of precipitation in areas affected by the dust and smoke from urban and industrial sources and from forest fires in NSW and Victoria in **Figure 3.**

Dust Storm and Fire Smoke in NSW and Qld on 23 October 2002

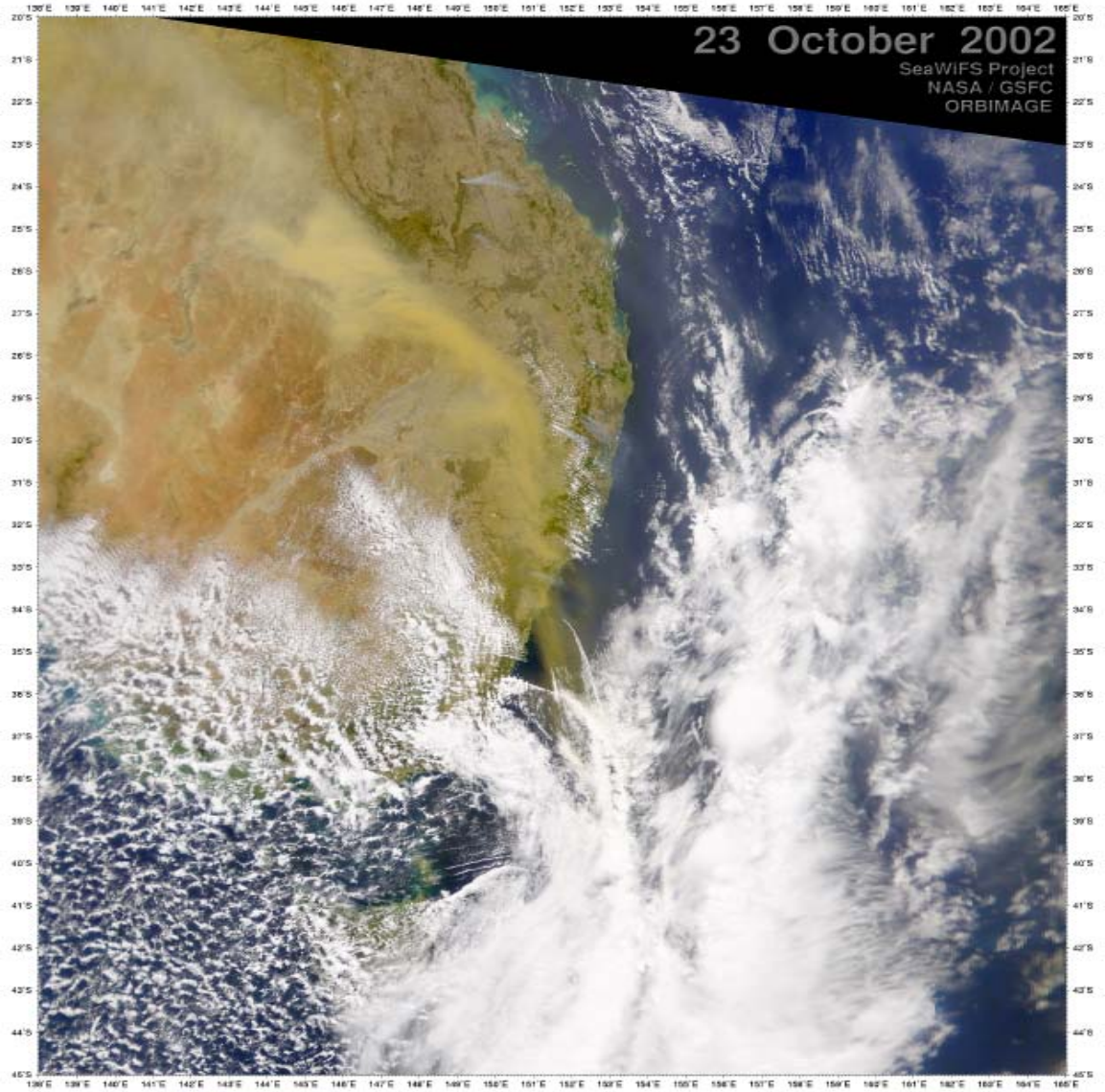


Figure 2

A vast dust storm swept across eastern Australia choking towns and cities including Sydney. Whipped up by winds blowing across drought-ravaged farmlands, the massive dust storm was the worst in about 30 years. Tens of millions of tonnes of valuable topsoil were stripped from bone-dry farms. 65 fires were burning across NSW with strong winds hampering fire fighters efforts to contain them.

The feedback loop mentioned above *(PNAS)*(Rosenfeld 2001) **(7)** springs to mind, when drought enhancing lofting of dust, which suppresses precipitation and spreads drought increasing fire hazard.

Desert dust and smoke from forest fires and urban and industrial air pollution, affects precipitation efficiency of Continental Convective (CC) clouds in some areas and Maritime Convective (MC) clouds in other areas. These clouds are responsible for up to 60% - 80% of annual precipitation west and east of Great Dividing Ranges in Queensland, New South Wales, Victoria and South Australia. The effect of air pollution is very widely spread and directly threatens Australia's National Parks and State Forests by leaving large areas of mountain forests without rainfall and ready to burn during hot fire season.

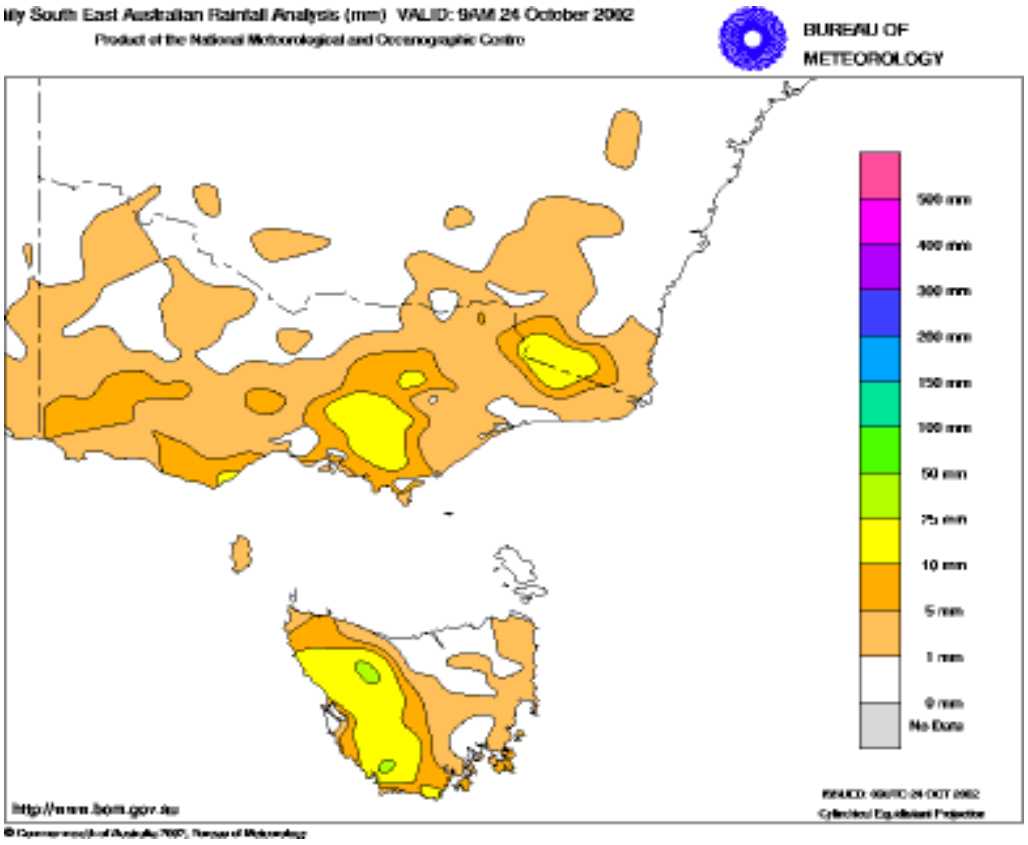


Figure 3

The NASA TRMM satellite image and observation of south-eastern Australian clouds on 21 October 1998, as seen in **Figure 4,** clearly shows Precipitation Radar (PR) measurements of substantially reduced or completely suppressed precipitation in all polluted clouds and rainfall in clouds over the areas not affected by air pollution.

Our company estimates an average annual rainfall and snowfall loss resulting in reduction of inflow into the reservoirs and rivers in the Victorian Alps and the Snowy Mountains of at least **5,000, 000 ML** and much more in catchments of the Murray-Darling Basin, and in other catchments in Queensland, New South Wales, Victoria and South Australia resulting in creation of substantial drought conditions and fire hazard in many areas awaiting to be ignited by lightning strikes and by humans, by electricity transmission lines or by mechanical equipment.

Vertical profiles of the precipitation echo intensities in non-polluted clouds and a complete lack of precipitation echo in polluted clouds as measured by the TRMM

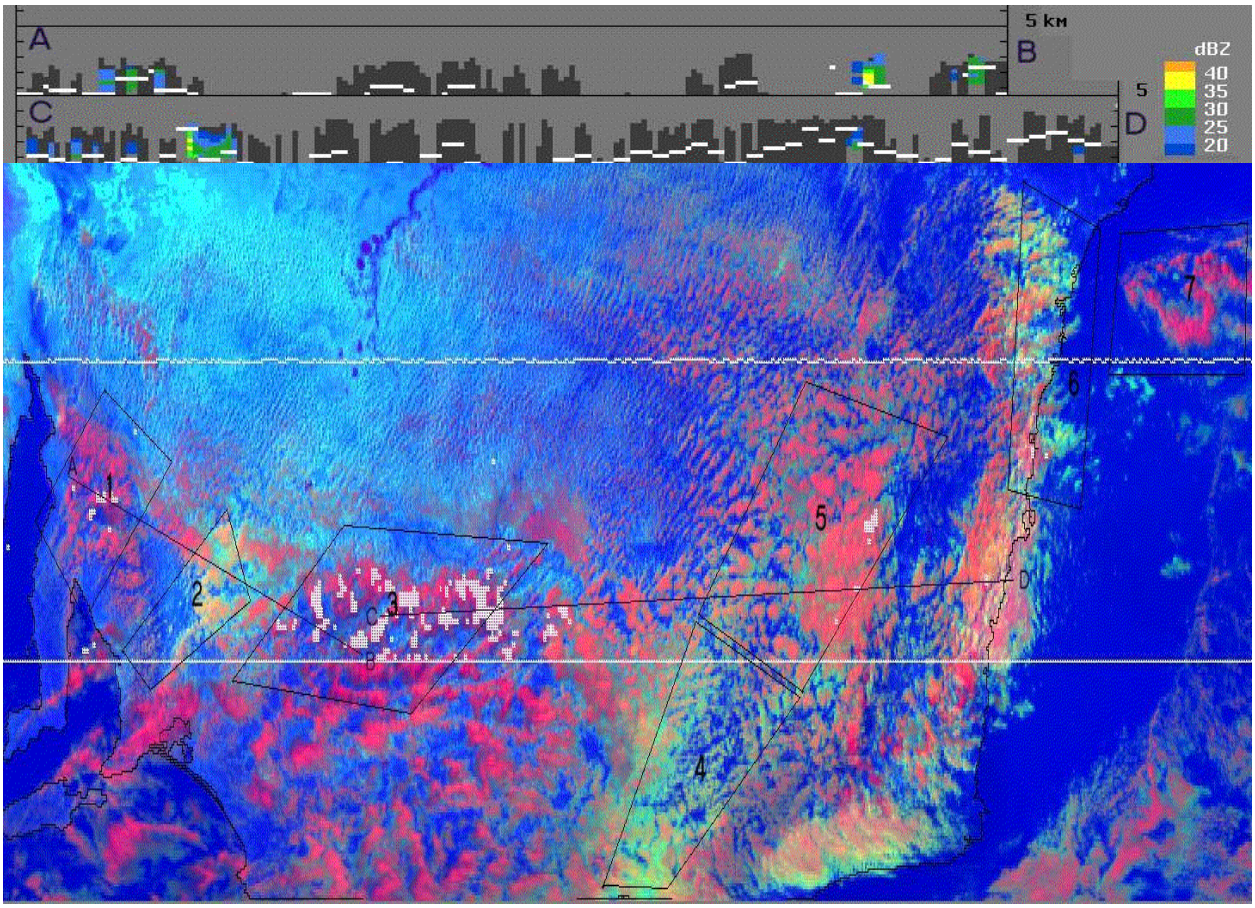


Figure 4 Rosenfeld Science 2000

The image shows pollution plumes in the clouds over southeastern Australia, on 21 Oct 1998, 04:44 UT. The two parallel lines delimit the Precipitation Radar swath of 230 km. The color of the clouds representing where yellow polluted clouds with small drops and red magenta clean air clouds with large cloud drops.

4. The Victorian Government

In June 1999 we notified Ms. Rae Moran, Department of Natural Resources and Environment of our work and of our scientific findings. We also presented Ms. Moran with copies of scientific publications as listed above.

In August 1999 we informed Dr. Harry Blustein, the Director of Science, the Victorian Environment Protection Authority (EPA) of our work and received support and assistance with access to scientific data concerning air pollution discharges of Melbourne and Victoria. In September 1999, our company and Victorian EPA agreed to cooperate and to investigate the correlation between the historical increases in air pollution over Melbourne and the La Trobe Valley and the substantial reduction of rainfall in the Victorian Alps and the Snowy Mountains over the seven decades between 1920 to 1990.

Dr. Peter McAllister, Manager of Air Quality Studies, Victorian EPA conducted a study and modeling of air pollution emissions of PM2.5 and SO2 for Melbourne see **Table 1** and Victoria see **Table 2** for the seven decades from 1920 to 1990.

Our company purchased from the Bureau of Meteorology (BoM) monthly rainfall data for the same period. Prof. Rosenfeld analyzed the data and found a strong correlation between the increase in air pollution emissions and the reduction of rainfall and snowfall in different areas down wind of Melbourne and the La Trobe Valley power stations in **Figure 5**. Prof. Rosenfeld and Dr. McAllister intended to publish a paper entitled "Possible impacts of air pollution on rainfall in south-eastern Australia, based on historical rainfall records" in early 2000, but the Bureau of Meteorology (BoM) argued that the quality of their rainfall data, which they sold to our company together with quality reassurance report, was not suitable for such a study.

After accepting a BoM suggestion to use three pairs of better quality rain gauges to research the correlation between emissions of air pollution and rainfall, Prof. Rosenfeld found reductions of winter rainfall and snowfall between 20% to 40% in certain locations of the Victorian Alps and the Snowy Mountains **Figure 6**.

After prolonged consultations with BoM staff engaged in the supervision and collection of rain gauge data, and after thorough investigation of historical files in BoM archives for the three pairs of quality rain gauge records, we later discovered that winter snowfall for the first half of the 20th Century had been substantially underestimated in the Victorian Alps and the Snowy Mountains and because of that the substantial loss of winter snowfall in the latter part of the 20th Century had been masked. The historic data of air pollution discharges showed that the quantities, the chemical content and composition of air pollution discharges over Melbourne and the La Trobe Valley was changing throughout the 20th Century **Table 1 and 2**.

The total volume of air pollution (PM 2.5 and SO2) increased until the 1970s. In 1972 the La Trobe Valley power stations introduced electrostatic precipitators and the amount of PM 2.5 air pollution decreased during 1970s by 27%. The introduction of natural gas in 1970s and 1980s, and substantial decrease in consumption of fuel oil during 1980s and 1990s, resulted in substantial decrease of SO2 emissions in Victoria. With the decrease in air pollution the level of precipitation in the Victorian Alps and the Snowy Mountains increased. However, since 1980s, with the (slow) increase in PM2.5 air pollution in Melbourne and the La Trobe Valley (7% per decade), rainfall and snowfall in the Victorian Alps and the Snowy Mountains has shown a corresponding decline.

PM-2.5 Emissions for Melbourne (Mg/yr)

Year	Brown Coal	Brown coal briquettes	Black coal	Petrol Leaded	Petrol Unleaded	Lighting Kerosene	Power Kerosene	Heating oil	ADO	IDF	Fuel oil	Wood	Total
1920	0	0	126	62	0	3	3	0	653	3	273	3918	6962
1930	0	12	192	82	0	4	4	0	857	3	320	4597	8001
1940	0	39	77	95	0	4	4	0	1002	3	342	4910	8418
1950	0	48	36	116	0	5	5	0	1223	4	400	5737	9524
1960	0	170	322	452	0	6	6	0	4748	5	495	7105	15269
1970	0	128	29	570	0	5	2	21	2611	6	972	4798	11112
1980	0	99	1	594	0	4	0	20	4132	3	434	4274	11542
1990	0	59	0	383	319	1	0	3	4235	1	216	4505	11712

SO2 Emissions for Melbourne (Mg/yr)

Year	Brown Coal	Brown coal briquettes	Black coal	Petrol Leaded	Petrol Unleaded	Lighting Kerosene	Power Kerosene	Heating oil	ADO	IDF	Fuel oil	Total
1920	0	0	2360	70	0	16	15	0	567	63	10172	13262
1930	0	108	3607	91	0	19	18	0	743	74	11934	16594
1940	0	342	1442	107	0	20	19	0	869	79	12748	15626
1950	0	422	680	130	0	23	23	0	1061	92	14893	17325
1960	0	1481	616	506	0	29	28	0	4118	114	18446	25339
1970	0	1111	551	845	0	21	8	337	2995	155	36180	42204
1980	0	861	22	1164	0	17	2	319	4317	84	16157	22942
1990	0	513	0	993	260	4	0	41	3205	29	8057	13101

Table 1 PM2.5 and SO2 Emissions for Melbourne

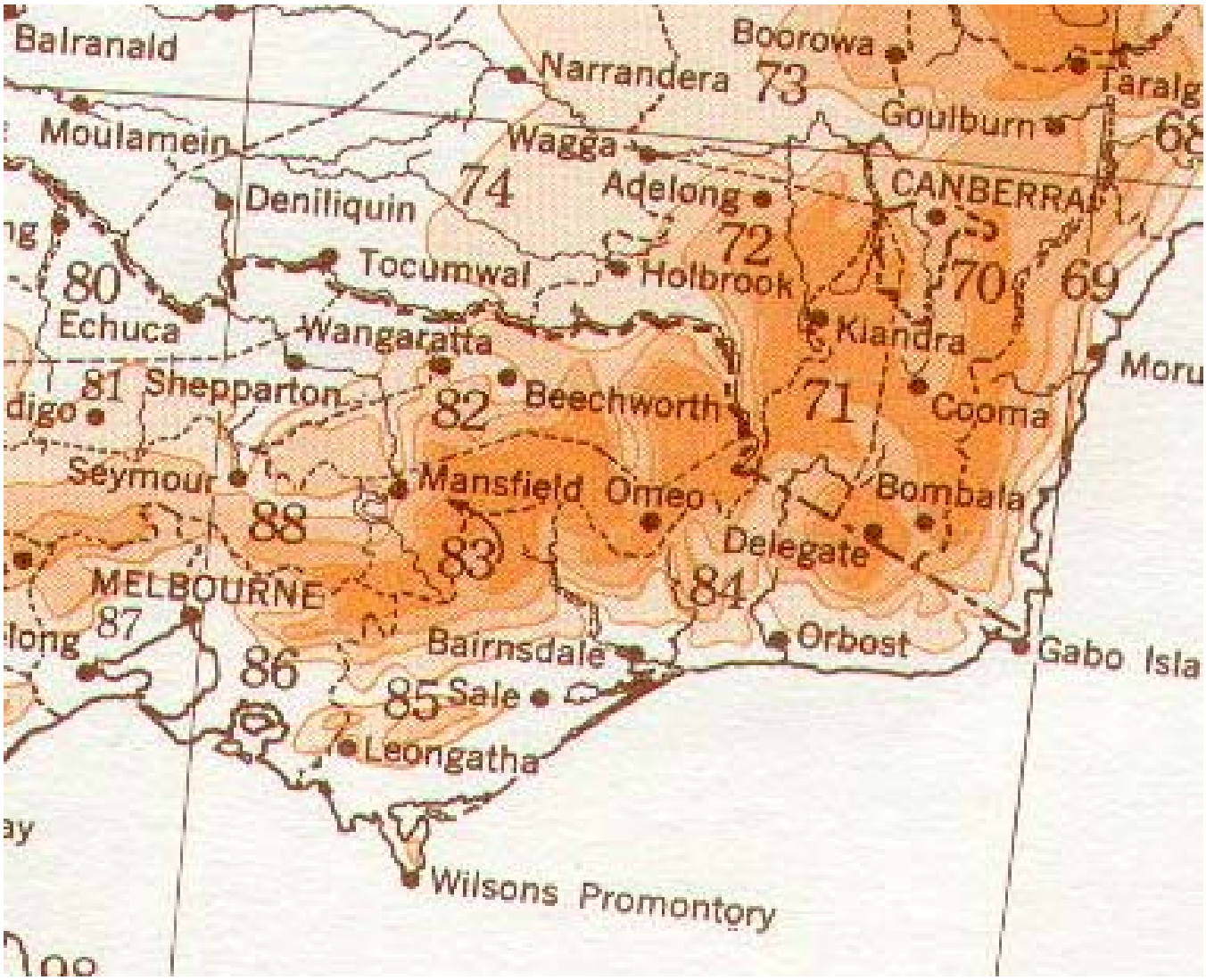
PM-2.5 Emissions for Victoria (Mg/yr)

Year	Brown Coal	Brown coal briquettes	Black coal	Petrol Leaded	Petrol Unleaded	Lighting Kerosine	Power Kerosine	Heating oil	ADO	IDF	Fuel oil	Wood	Total
1920	18	0	140	78	0	4	4	0	1307	288	759		9414
1930	351	62	214	102	0	5	5	0	1713	338	890	5746	11356
1940	992	197	85	119	0	5	5	0	2004	361	951	6138	12797
1950	510	242	40	145	0	6	6	0	2446	421	1111	7171	14049
1960	1035	851	358	565	0	8	7	0	9496	522	1376	8881	25060
1970	262	639	33	713	0	6	2	26	5221	707	2699	5998	18276
1980	372	495	1	742	0	5	1	25	8264	383	1205	5343	18817
1990	572	295	0	479	399	1	0	3	8470	131	601	5631	18572

SO2 Emissions for Victoria (Mg/yr)

Year	Brown Coal	Brown coal briquettes	Black coal	Petrol Leaded	Petrol Unleaded	Lighting Kerosine	Power Kerosine	Heating oil	ADO	IDF	Fuel oil	Total
1920	152	0	2622	87	0	20	19	0	1133	6296	25429	35759
1930	3030	540	4008	114	0	24	23	0	1486	7387	29834	46446
1940	8556	1712	1602	134	0	25	24	0	1738	7891	31870	53551
1950	14654	2108	756	163	0	29	28	0	2121	9219	37233	66312
1960	29773	7403	684	633	0	36	35	0	8236	11419	46116	104335
1970	45258	5557	613	1057	0	26	9	422	5989	15471	90450	164852
1980	64206	4304	24	1455	0	21	3	399	8633	8388	40392	127825
1990	98772	2564	0	1241	325	5	0	52	6410	2855	20142	132365

Table 2 PM2.5 and SO2 Emissions for Victoria



Map of Meteorological Districts Victoria (BoM)

Figure 5

The Victorian Alps areas 82, 83, 84 and the Snowy Mountains areas 71,72 are the main catchments of the Murray-Darling Basin Commission where Bushfires occurred during 2002-2003 fire season.

Detailed study and analysis by Prof. Rosenfeld of data from three pairs of quality rain gauges conclusively revealed rainfall reductions of 20% to 40% during the winter seasons over the period of the 20th Century **Figure 6**.

According to physical evidence of the research and investigation by our company and by Prof. Rosenfeld, we believe that urban and industrial air pollution from Melbourne and the La Trobe Valley is a major cause of increase in fire hazard conditions in the Victorian Alps and the Snowy Mountains due to rainfall and snowfall reductions there.

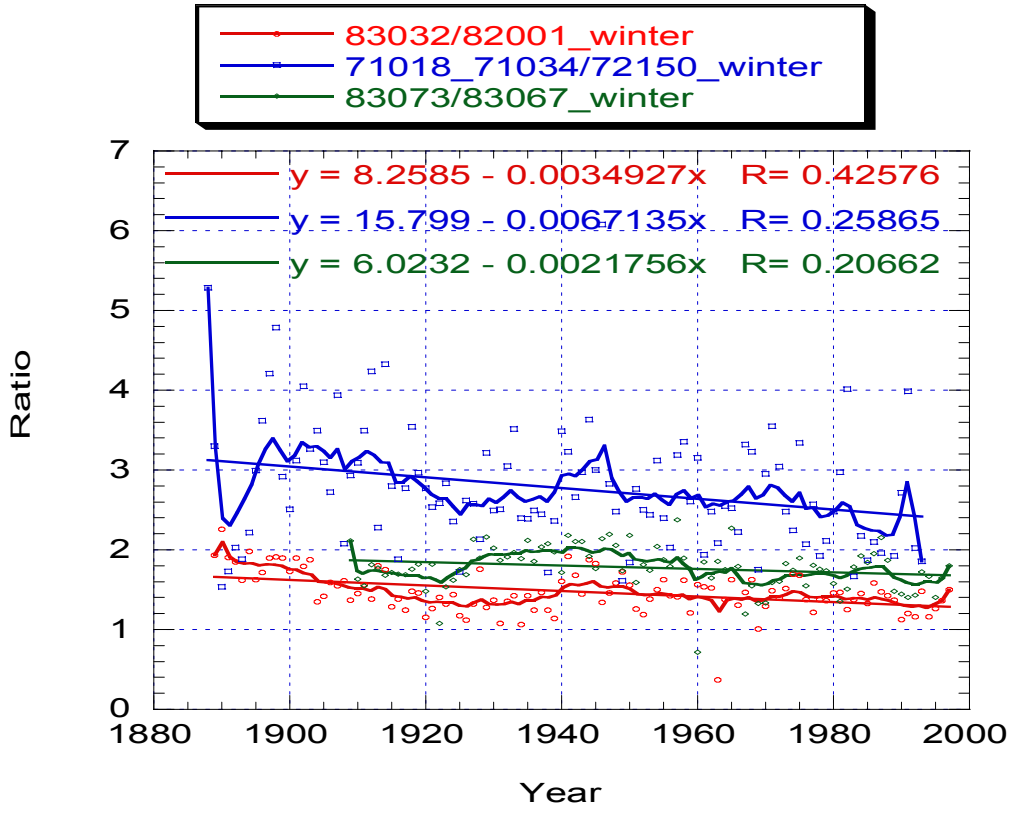


Figure 6

Rainfall trends indicating 20% to 40% reduction of orographic rainfall and snowfall in all three-quality rain gauge pairs for the 20th Century.

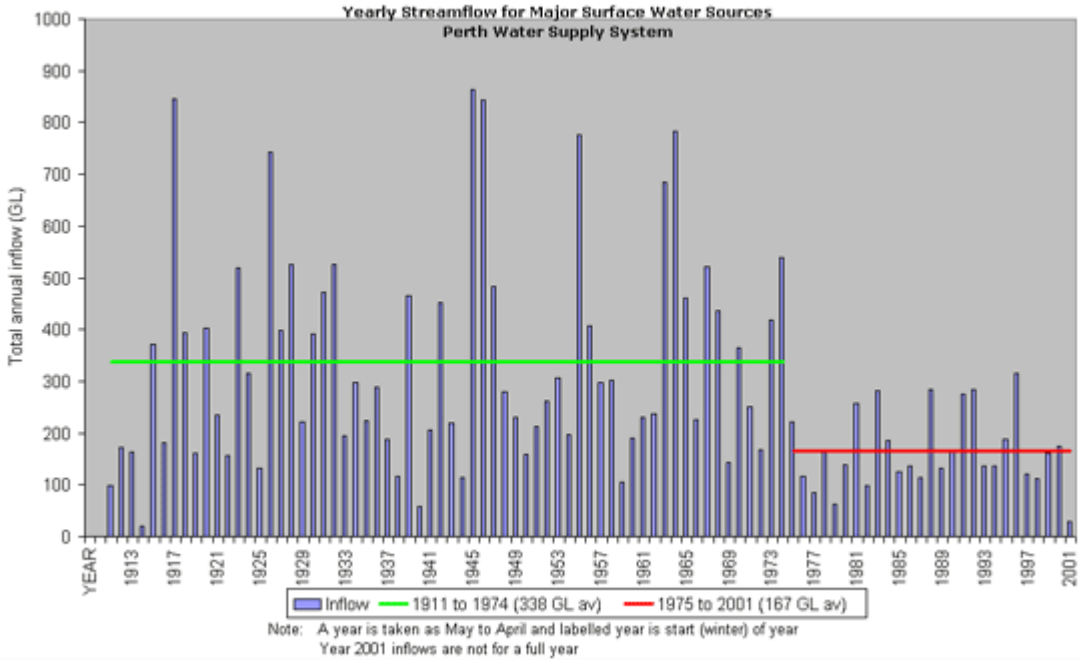
This analysis does not take in consideration a significant underestimation of winter snowfall in early half of the 20th Century as supported by the BoM Rain Gauge Inspector, Mr. Peter Dawson and therefore it is likely that the real loss is amounting to about 50% on average year, making forest unsustainably dry due to evaporation and creating a fire hazard conditions that impossible to control by conventional fire fighting measures.

From our research, we agree:

a. with (Harasymiw B., J. McGee), 1993, **(11),** in the "Draft EIS Snowy Precipitation Enhancement Project" Snowy Mountains Hydro-Electric Authority (SMHEA) that precipitation during the latter half of the 20th Century is likely have been reduced in the Snowy Mountains by 52% during the winter season compared to the earlier part of 20th Century and, we believe, that that effect is continuing into the Victorian Alps.

b. with Dr. Karl S. Kruszelnicki, Physicist from Sydney University and ABC Radio and TV Science Presenter that much of the most dangerous particulate atmospheric pollution, PM2.5 particulate matters comes from burning and smoke, and has significant effect on human health and environment **(Page 38)**.

Yearly Streamflow for Major Surface Water Sources



Click on the graph to view a full-sized version

Yearly Inflow Comparison graph

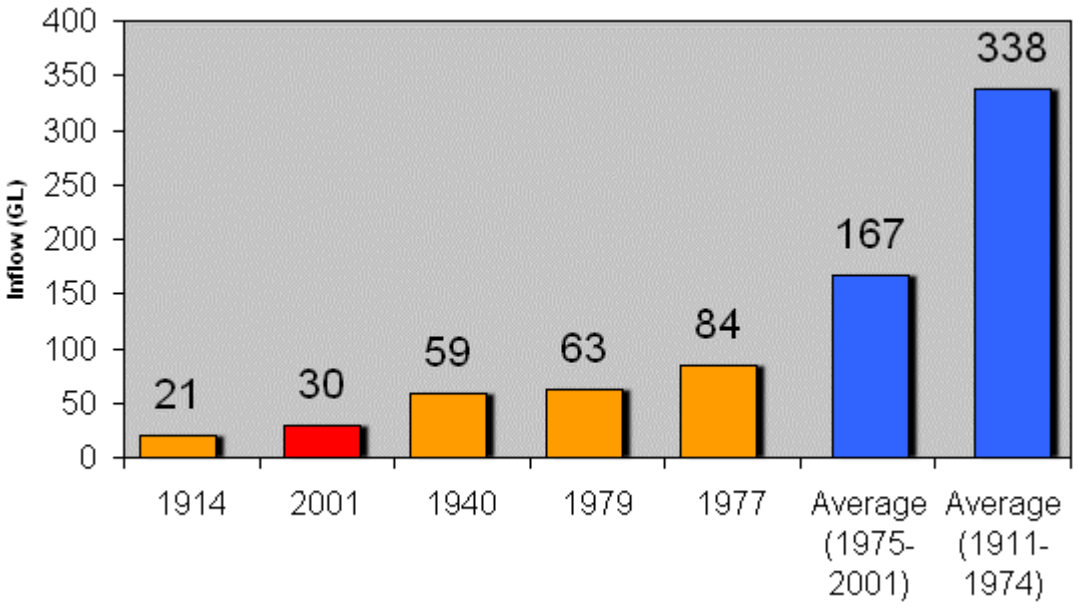


Figure 7

c. that there has been more then 50% reductions of Inflow into the Perth catchments Dams since construction of Kwinana power station in 1972 – 1976, and rapid urban, industrial and mining developments and processing along the coast of WA between Bumbury and Perth **Figure 7**.

On 28 February 2000, Dr. Peter McAllister, Manager of Air Quality Studies, Victorian EPA advised that he had been contacted by a representative of the CSIRO, who had demanded an end to scientific cooperation between the Victorian EPA and us. Dr. McAllister informed me that the reason for such demand was to prevent any Government financial support of our research and he further informed me that the CSIRO's representative was concerned that future funding for our research would be taken from the CSIRO's own budget allowance.

We believe that the Victorian Government's attitude had been influenced by the advice of Ms. Rae Moran of the Department of Natural Resources and Environment and who, while considering our research and findings was briefed by certain officers of the CSIRO and the Bureau of Meteorology, who all denied any connection between air pollution and rainfall reduction and who attempted to discredit the findings of our company and of Prof. Rosenfeld without producing any current and credible scientific evidence to support their opposition.

Ms. Moran without justification interfered in a seminar jointly presented on the 9 May 2000 by our company and by Monash University at Clayton Campus when she instructed 16 DNRE staff members (including forestry and firefighting section) to ignore our invitations and persuaded most of them not to attend.

On 6 April 2001 Ms. Moran attended a seminar addressed by Prof. Rosenfeld at Monash University, which was disrupted by Drs. Manton and Ayers of the Bureau of Meteorology and of the CSIRO, and after which, Ms. Moran became openly unaccepting of the causal relationship between air pollution and rainfall depletion in certain parts of Victoria. However, she informed me that the Victorian Government would support rain enhancement operations if our company would not identify air pollution as a major cause of rainfall reductions.

After five months of unfulfilled promises and unexplained delays in October 2000, Dr. McAllister informed me that funding of $45,000 for the initial stage of our collaborative research project had been denied by the Victorian Department of State and Regional Development (DSRD). That fact was later denied in December 2000 by Mr. Steven Nenan, Adviser to Mr. John Brumby, Treasurer.

We believe that the Victorian Government decision was influenced by the advice of Dr. Greg Ayers, Chief of the CSIRO Division Atmospheric Research and by Dr. Mike Manton, Chief of the Bureau of Meteorology Research Centre, who all denied any connection between air pollution and rainfall reduction and who, from about May 2000 had attempted to discredit the findings of our company and of Prof. Rosenfeld.

Our observations show that the impact of air pollution on rainfall is obvious in the catchments of the Thomson Dam, which is located in close proximity to the La Trobe Valley power stations with reductions in amounts of natural rainfall there from individual cloud systems measured by 30% to 100%. Pollution results in the substantial reduction and often shut-down of rainfall and snowfall processes for the entire area of the Victorian Alps, the Snowy Mountains, Central and East Gippsland including the Snowy River catchments as shown on five rain maps of SE Australia for 2002 **Figures 8, 9, 10, 11, 12**.

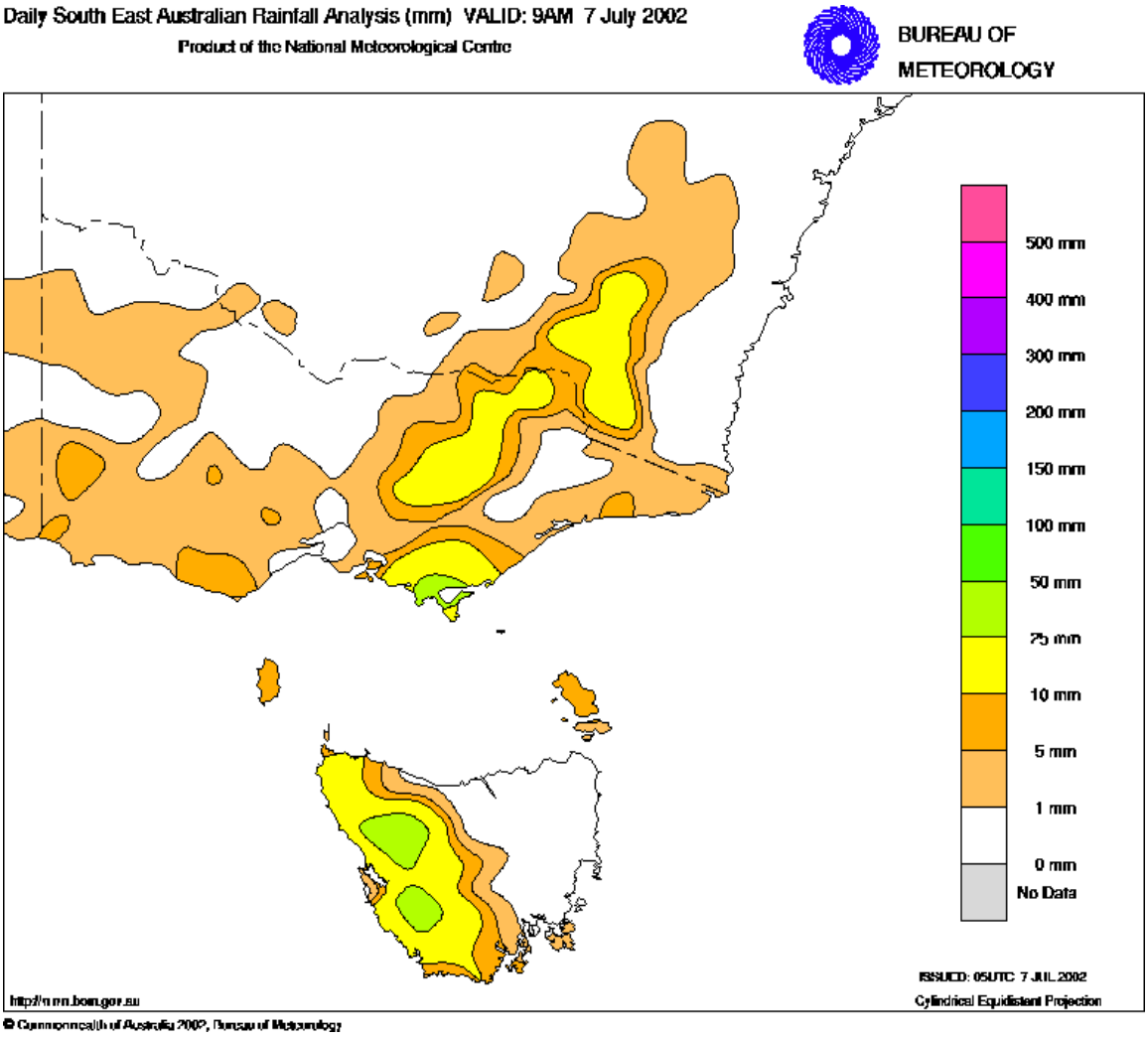


Figure 8

The Rain Map of south-eastern Australia for the period between 9.00 am 6 July 2002 to 9.00 am 7 July 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong and Melbourne. Large areas of the Victorian Alps, Central and East Gippsland have received no rainfall this day and these areas were subject to devastating fires during 2002-2003 fire season.

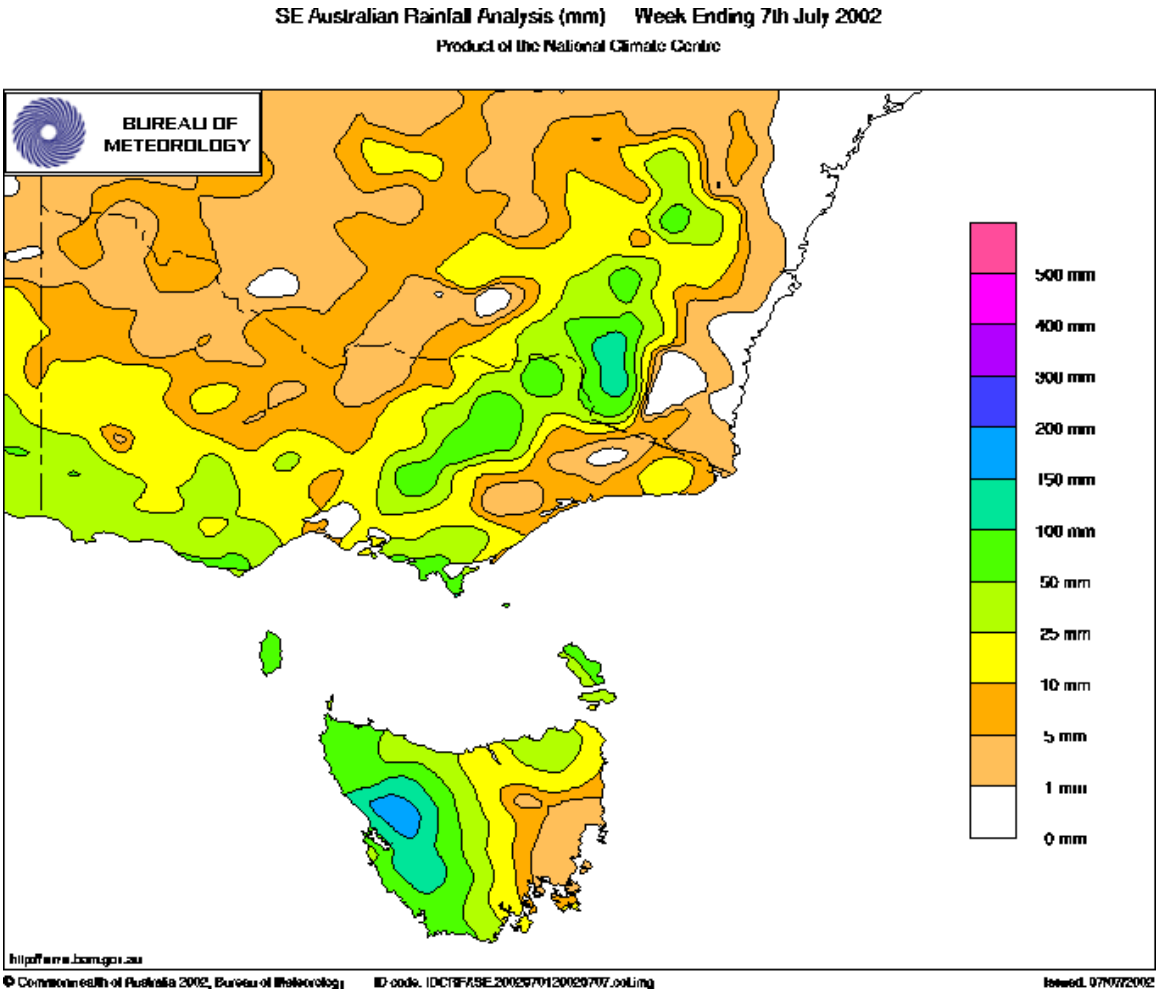


Figure 9

The Rain Map of south-eastern Australia for the period of 1 week ending 9.00 am 7 July 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong and Melbourne. Substantial rainfall is measured in unpolluted west coast of Tasmania and south-western Victoria, but only limited rainfall downwind La Trobe Valley power stations and downwind Hobart air pollution.

The Melbourne Water's main reservoir, Thomson Dam was about 36% full on 17 September 2003. Despite this, Melbourne Water has continuously ignored our representations and submissions to rectify the problem. The Melbourne Water Resources Strategy Committee, received submissions during 2002 and has decided to ignore all our representations and our comprehensive submission that rainfall over the Melbourne Water catchments and inflow into Melbourne Water reservoirs can be increased by at least 30% during an average year of rainfall enhancement and that the fire hazards in Melbourne Water catchments could be prevented. Mr. Brian Bayley, Managing Director of Melbourne Water, was personally advised that it is likely that the Melbourne Water catchments will be burnt out during the 2003-2004 fire season, which will cause further reduction of inflows in fire affected areas, but he decided to ignore our advice.

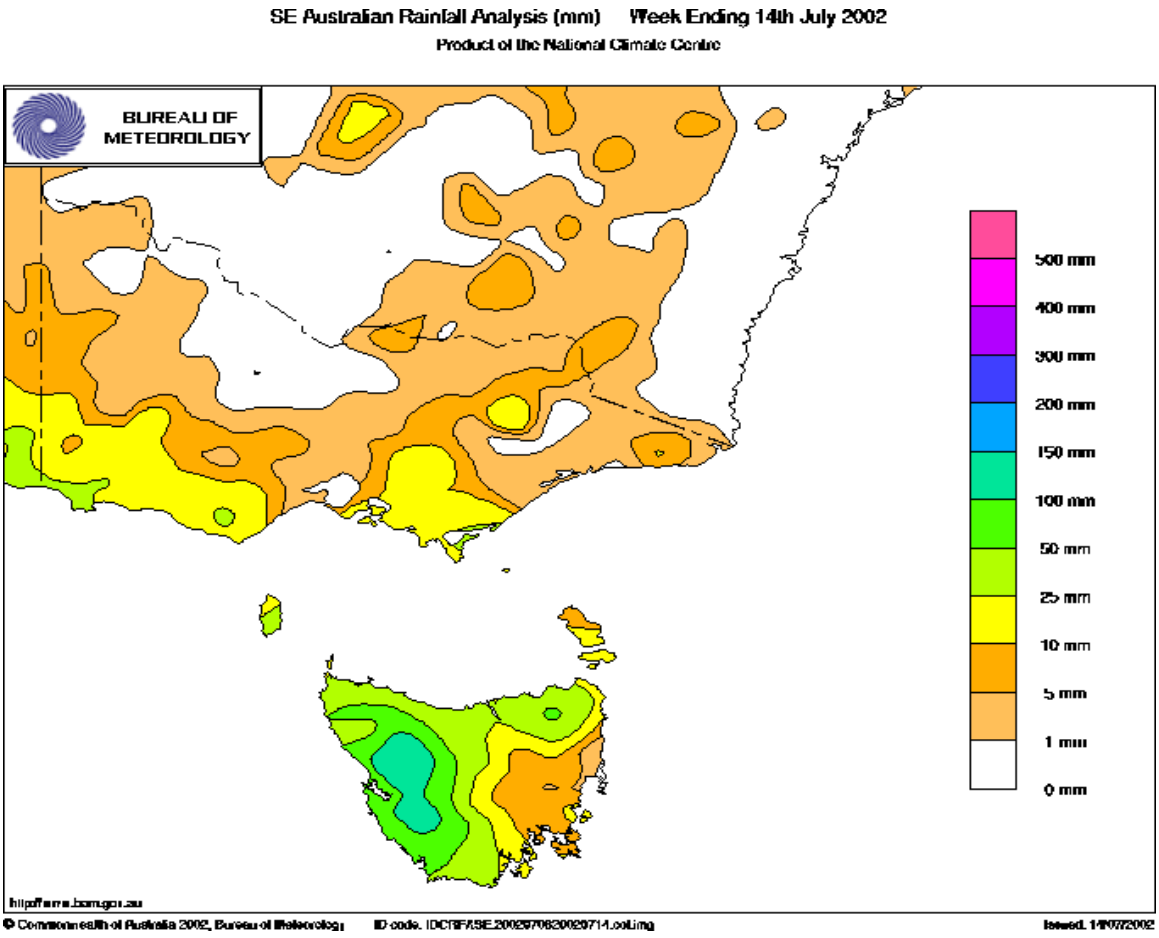


Figure 10

The Rain Map of south-eastern Australia for the period of 1 week ending 9.00 am 14 July 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong, Melbourne and Hobart air pollution.

Southern Rural Water Authority has imposed water restrictions in respect to all rivers originating in the southern slops of the Victorian Alps.

The flow of the Snowy River has been severely reduced because the 160 km long catchment of the Snowy River between Lake Jindabyne and its delta is located directly down-wind of the air pollution of the La Trobe Valley power stations. If natural rainfall and snowfall from the south-western direction, which is the main direction of rain bearing clouds during the winter season, would not have been reduced by 30% to 100%, the bushfires during 2002-2003 fire season would not have burnt 1,100,000 hectares in the Victorian Alps of East Gippsland and in the Snowy Mountains.

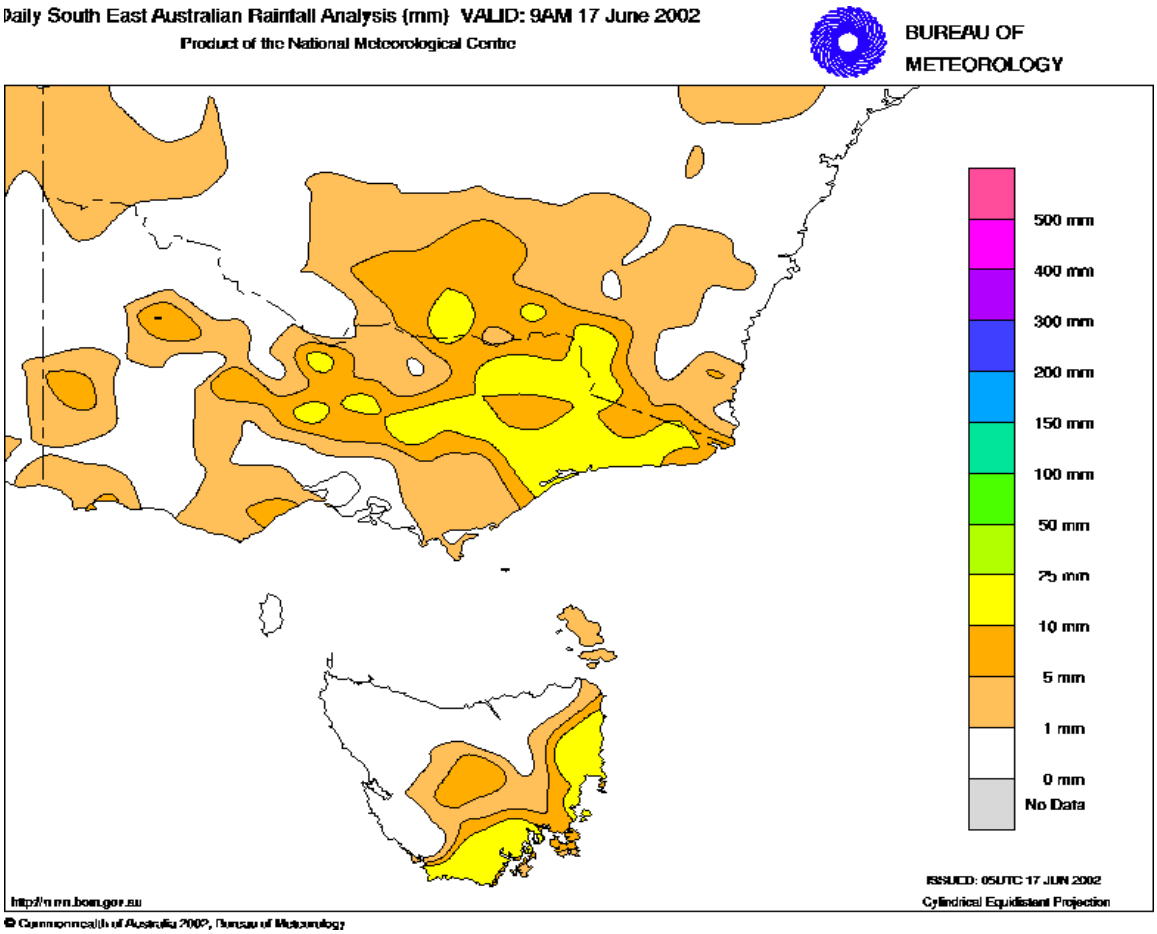


Figure 11

The Rain Map of south-eastern Australia for the period between 9.00 am 16 June 2002 and 9.00 am 17 June 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong, Melbourne and Hobart in Tasmania. The direction of rain bearing clouds during this day was unusual, south-eastern flow from the Tasman Sea.

The Goulburn-Murray Water is the largest water authority in the Murray-Darling Basin and is the authority responsible for the management of the Humes and Dartmouth reservoirs catchments. Co-operative Research Centre for Catchment Hydrology studies have shown that water run-off will be halved as burnt-out forest re-growth in the burnt Kiewa, Upper Murray and Ovens Rivers catchments which provide 38 per cent of the Murray-Darling Basin's water. The issue is critical for the Goulburn-Murray Water and the Murray-Darling Basin Commission as more than 706,000 hectares burn-out in north-east Victoria, plus additional 460,000 hectares were burnt in the Kosciuszko National Park, affecting the Murray and Murrumbidgee catchments for up to 100 years. We believe that all these fires can be prevented and controlled if the natural rainfall and snowfall from winter clouds over the Victorian Alps and the Snowy Mountains catchments is restored by means of rain enhancement.

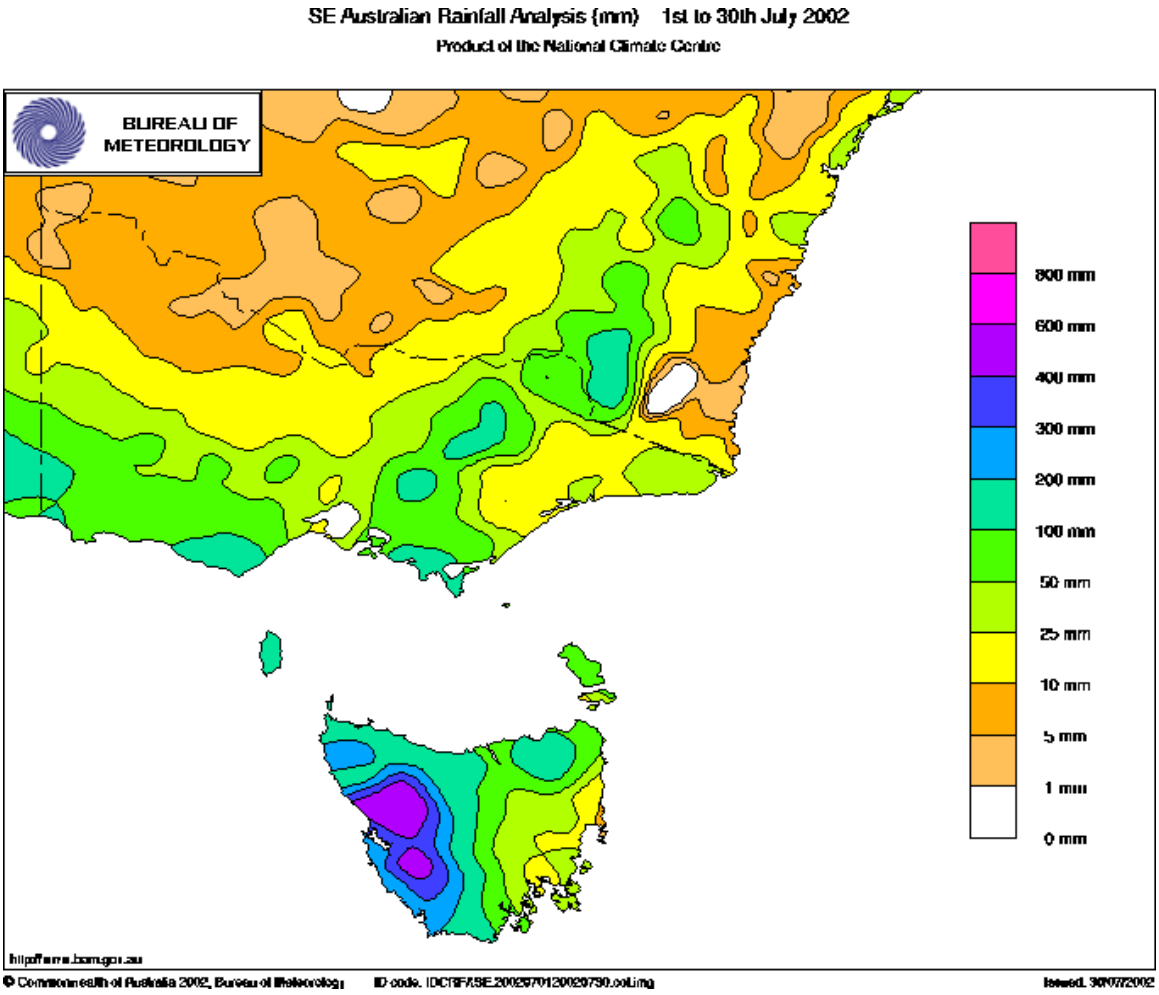


Figure 12

The Rain Map of south-eastern Australia for the period of 1 month ending 9.00 am 30 July 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong and Melbourne compare to unpolluted and rain enhanced areas of Western Tasmania.

5. The New South Wales Government

The New South Wales (NSW) Rural Fire Service and it's Commissioner, Mr. Phil Koperberg, NSW Parks and Wildlife Service, NSW EPA and their respective Ministers, Bob Debus, and Premier, Bob Carr were notified of our company's and Prof. Rosenfeld's scientific findings in 1999, 2000, 2001, 2002 and 2003. NSW is in the midst of a severe drought and fire hazard conditions, but Ministers Debus and Knowles and Mr. Koperberg are not ready to accept and to act on the best scientific advice available to them to prevent and control bushfires during 2003-2004 fire season. Our company believes that the NSW Government would profit by allocating funds to introduce projects to restore natural rainfall in NSW through scientifically proven rain enhancement programs. The cost of these programs will be only a small fraction of the economic loss presently being incurred by the NSW Government in relation to the drought and fire hazard conditions.

6. Snowy Hydro Limited

In 1993, the Snowy Mountains Hydro-Electric Authority (SMHEA) commissioned an Environmental Impact Statement (EIS) to evaluate the feasibility of increasing snow precipitation over the Snowy Mountains area. The 1993 EIS was prepared by a team of independent consultants including Dr. Joseph Warburton, Director, Desert Research Institute, Nevada USA, Dr. John Lease, Director, Water Augmentation Group, and Dr. Arlin Super, US Government Bureau of Reclamation. They concluded that cloud seeding in the catchment of the SMHEA is an economically attractive option for increasing precipitation (Harasymiw and McGee 1993)**(11)**.

Figure 13

"Windy Creek, Snowy Mountains, Checking iced-up transmission towers Hydrology Station 1959". Evidence that ample supercooled cloud water is available for cloud seeding.

The Snowy Mountains, approximately 2,500 km2 of mountain country, are the highest mountains in Australia. They offer the best topographically elevated catchment of the Murray-Darling Basin.

We believe that annual loss of snow precipitation due to air pollution in the Snowy Mountains amounts to 1,000,000 ML. Evidence of the magnitude of this loss is obvious by observation of the huge amount of supercool water in clouds that are passing through the area during the winter season without being converted into precipitation **Figure 13.**

For the reasons presented in our submission to the Department of Industry, Science and Resources (DISR) on the Corporatisation of the Snowy Mountains Hydro-Electric Authority (SMHEA) dated 26 July 2000 **(12)**, the Department of Industry Science and Resources, Electricity Reform Branch in the Supplementary EIS on the Corporatisation of the SMHEA **(13)**, recommended, in September 2000 that the Government should consider the opportunity to pursue cloud seeding in order to provide increases in the flows to the Snowy River.

7. Recommendations and Suggestions.

In 1964 the Tasmanian Hydro-Electric Corporation introduced and then successfully implemented rain-enhancement programs in Tasmania, producing significant increases in rainfall in autumn and winter. The beneficial results, in the order of 20-30% increases in rainfall, are well recognized and regarded by the scientific community and we believe is the main reason that western Tasmania is not subject to devastating and intensive fires during the fire season.

The fire hazard and water situation in the Victorian Alps, the Snowy Mountains and the Great Dividing Ranges of Eastern Australia have deteriorated greatly over the past 50 years and it is getting worse. We cannot attribute it all to climatic changes because coastal and unpolluted stations have not been similarly affected and they recorded increase in rainfall. While Australian authorities close their eyes to the problem, its cause and its potential solution, the rest of the world is accepting the reality that human activity inadvertently produces undesirable changes in the weather, especially the suppression of rainfall by air pollution **(WMO report on Page 33)**.

Prof. Rosenfeld has been a leader in the area of research and educating authorities and the public to the problem. As an example, Prof. Rosenfeld will be one of four scientists who have been invited to give lectures at the meeting of the American Geophysical Union in December 2003. Prof. Rosenfeld's talk on December 12th, which will focus on the negative effect that pollution is having on rainfall in California downwind of pollution sources, which caused devastating fires and losses during 2003 fire season, will be preceded by a news conference that will address his findings.

Prof. Rosenfeld is a world-renowned expert in the field of Cloud Physics, Meteorology and Rain Enhancement and is scientific team member of the National Aeronautics and Space Administration (NASA) and the National Space Development Agency of Japan (NASDA) and the European Space Agency (ESA) Tropical Rainfall Measuring Mission (TRMM). Among other achievements, Prof. Rosenfeld identified the cause and helped to eradicate the notorious forest fires in Indonesia in 1998.

For his achievement in cloud physics, measuring global rainfall, discovering detrimental effects of air pollution on global precipitation and, in particular, his findings concerning Australia, as published in "Science" March 2000, Prof. Rosenfeld was on the 17 January 2001 awarded the prestigious "Verner E. Soumi Award" by the American Meteorological Society.

The World Weather Modification Association awarded Prof. Rosenfeld the "Thunderbird" award for 2001 for his contribution to weather modification science and rain enhancement operations around the globe.

Increase in rainfall and snowfall will substantially reduce fire hazard conditions and amount of air pollution, and will substantially curtail incidents of forest fires resulting in reduction of insurance claims, economic loss and suffering to farmers, urban and rural communities, which they sustain every year. We recommend that the Commonwealth Government reduce fire hazard by the introduction of rain enhancement projects and the promotion of the latest and scientifically advanced atmospheric research in Australia.

We suggest that the Commonwealth Government should consider to fund cloud physics research programs into the effects of air pollution on rainfall and into increase in fire hazard conditions throughout the Victorian Alps, the Snowy Mountains and the Great Dividing Ranges.

We believe that such projects will greatly assist in combating the economic and environmental issues concerned with dwindling fresh-water resources and forest fires.

Yours faithfully,
Australian Management Consolidated Pty. Ltd.

Aron Gingis
MBA, Dip. Eng.

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9. World Meteorological Organization Report To the United Nations

ATMOSPHERIC RESEARCH AND ENVIRONMENT PROGRAMME

Report to plenary on items 3.3.1 to 3.3.5

(Submitted by the Dr A.M. Noorian, chairperson of Committee B)

References: Cg-XIV/Docs. 3.3(2), 3.3(2), CORR. 1 and B/WP 3.3(2)

Appendix*:* Draft text for inclusion in the general summary on item 3.3.

ACTION PROPOSED

It is recommended that the draft text in the Appendix be included in the general summary of the work of the session.

DRAFT TEXT FOR INCLUSION IN THE GENERAL SUMMARY OF CG-XIV

3.3 ATMOSPHERIC RESEARCH AND ENVIRONMENT PROGRAMME *(agenda item 3)*

3.3.0 Atmospheric Research and Environment Programme: the report of the president of CAS *(agenda item 3.3.0)*

3.3.1 Support to ozone and other environment-oriented conventions *(agenda item 3.3.1)*

3.3.1.1 Congress recognized that the GAW programme had a prominent role to play in monitoring of global atmospheric composition. Through the GAW ozone network, WMO was providing unique and comprehensive continuous series of non-satellite ozone measurements available. Those data are essential for the detection of long-term trends in ozone and therefore was a major contributor to the Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol. Congress endorsed continuation and further development of that activity. Furthermore, it appreciated the leading role of WMO in periodic assessments of the state of the ozone layer such as the recently published *Scientific Assessment of Ozone Depletion: 2002* and for providing the annual series of *Antarctic Ozone Hole Bulletins*. Continued support by GAW of observations and analysis for UNFCCC and Climate Agenda activities is needed. Congress also recognized the important support provided by WMO to the Convention on Long-range Transboundary Air Pollution by co-chairing the Task Force on Measurements and Modelling of EMEP.

3.3.1.2 Congress welcomed the explicit mention in the *Strategy for the Implementation of the Global Atmosphere Watch Programme (2001-2007): A Contribution to the Implementation of the WMO Long-term Plan* (GAW-142, WMO/TD-No. 1077) of the need to expand the use of GAW data for, inter alia, scientific assessments. In that regard, the recognition of GAW as the key network for atmospheric composition measurements in the Global Climate Observing System (GCOS) was emphasised since GAW was global in scope and atmospheric chemistry data were critical to the assessment of climate change. Congress, also, urged CAS, in cooperation with relevant programmes and agencies, to investigate the possibility of conducting more periodic assessments for some of the greenhouse gases and aerosols. Such assessments would provide important information to both the IPCC and the Parties to the UNFCCC.

3.3.2 Global Atmosphere Watch *(agenda item 3.3.2)*

3.3.2.1 Congress expressed its satisfaction with the development of GAW, which was created in 1989 to encompass the existing WMO monitoring activities that focused on global issues of changing atmospheric composition. It noted that by strengthening the measurement network and by continuing to develop essential support facilities and training, WMO was positioned to contribute extensively to the implementation of the relevant parts of the Rio Declaration and Agenda 21, especially Chapter 9 - Protection of the atmosphere. Scientific advice was being provided by the GAW Scientific Advisory Groups. Congress especially acknowledged the global support facilities of GAW operated by Canada, Germany, Italy, Japan, Russia, Switzerland and the United States that maintained the GAW Station Information System, primary gas standards, measurement calibration, quality assurance/science activity and world data centres. Congress was pleased by the strong support provided by other Members in the development and maintenance of GAW activities. Congress urged all the Members operating GAW Global and Regional stations to submit data to the World Data Centres in a timely manner. Recognizing the critical need to maintain and develop atmospheric composition measurements in developing countries, Congress urged members to contribute to dedicated central Trust Funds through which their contributions could be focused on outstanding infrastructure problems in the global GAW network. A notable case was the trust fund for Research and Systematic Observations relevant to the Vienna Convention established by the Parties to the Vienna Convention in 2003.

3.3.2.2 Congress noted that the scientific input to the debate on environmental issues must be derived from an adequate knowledge basis. That could only be achieved through high quality, strategically-oriented observations, and research related to the particular issues.

That necessitated the maintenance and improvement of proper global environmental observing systems like GAW. Congress affirmed that GAW filled an important gap by ensuring systematic collection of atmospheric composition and related data worldwide, which was done according to comparable and clearly defined measuring criteria by promoting standardization, quality assurance and coordinated data processing and by facilitating the distribution and provision of available information to a varied group of users. It was noted that a key role of GAW was to promote capacity building for atmospheric composition measurements and modelling in developing countries. That complex international task, Congress acknowledged, was being addressed by WMO in collaboration with international organizations and the scientific community. In particular, Congress recognized the importance of the Brewer spectrophotometer component of the GAW global ozone and UV network and the urgent need for capacity building through training and the maintenance, calibration and upgrade of those instruments in developing countries similar to the current practices for the Dobson network. In that regard, Canada, as developer of the Brewer spectrophotometer and host of the GAW World Standard for Brewer measurements, was pleased to announce an annual contribution of US$ 30,000 to a WMO Trust Fund dedicated to capacity building through training and the maintenance, calibration and upgrade of Brewer instruments in developing countries operating GAW stations. The WMO Secretariat was asked to coordinate the optimal use of those funds through its GAW programme and associated Scientific Advisory Groups and to encourage others to contribute to that fund. With respect to the request of Region I countries operating GAW Global stations, Congress recognized the importance of coordination of regional measurement activities facilitated by the Region and GAW. It urged that other regions consider the need for such coordination. Congress emphasized that the training and education needs for GAW participants from developing countries needed to be a continuing priority for GAW and extended its appreciation to the Government of Germany for its substantive support for the GAW Training and Education Centre and to the Czech Republic for conducting training in ozone measurements.

3.3.2.3 Congress recognized the lead role that GAW was playing in developing strategies for integrated non-satellite and satellite measurements systems for atmospheric composition in the context of the multiagency IGOS partnership. It also encouraged CAS to assist GAW in developing partnerships with space agencies for that important activity. Integrated data systems and the resulting chemical data sets were essential for the development and evaluation of atmospheric transport and climate models and for realizing the full potential of satellite observations in global trends detection.

3.3.2.4 Congress welcomed the close cooperation of GAW with the atmospheric sciences and environment protection communities both within and beyond NMHSs including many international, regional and national organizations and programmes such as EMEP, IAEA, IAMAS, IGAC, UNEP and WHO. The need for close cooperation and coordination of international activities was stressed in particular for such environmental issues as smoke and haze pollution resulting from biomass burning, urban pollution, persistent organic pollutants and other potentially toxic substances. It was the intent of GAW to increase the involvement of NMHSs in climate studies, for example, by encouraging GAW stations to be used as aerosols and chemical composition platforms for the Atmospheric Brown Cloud project, the goal of which was to reduce the uncertainty of natural and man-made aerosols and air pollutants in climate forcing.

3.3.2.5 Satisfaction was expressed by Congress with respect to continued GAW assistance and advice provided to address urgent environmental problems such as the transboundary transport of smoke and air pollution in south and south-east Asia and long-range atmospheric transport and deposition of pollution. GAW was encouraged to continue to provide its expertise to existing and emerging environmental issues where possible. Continued GAW collaboration with established major chemistry precipitation deposition networks in North America, Europe and East Asia and the development of networks in areas with critical gaps in measurement was needed. CAS was encouraged to foster merging regional precipitation chemistry data sets into a global GAW database handled by the appropriate GAW World Data Centre and to make the data available through a central Web site.

3.3.2.6 Congress agreed that the urban component of GAW, the GAW Urban Research Meteorology and Environment (GURME) project, was viewed by members as an important undertaking by WMO. Congress noted the excellent progress made in the GURME pilot projects in Beijing and Moscow. It also noted that workshops had been held in China and Russia to determine the requirements of Member countries for development of the project. Those workshops resulted in guidelines for GURME. A workshop on Air Quality Forecasting was held in Malaysia followed by an experts workshop in Mexico (supported by the USA). Congress was pleased that training and technology transfer aspects and information exchange in operational and applied air quality forecasting capabilities had been addressed in GURME. Congress recognized the importance of including heat island studies in GURME and noted with satisfaction that the city projects had already begun to address that question. Congress recommended that forecasting workshops and pilot projects be continued in other parts of the world.

3.3.2.7 Congress was pleased that Australia and the United States had developed a prototype database containing results of a number of research campaigns relating to transport and dispersion of atmospheric pollutants. Those results would be of great interest to the modelling community in conducting both sensitivity and verification studies. Congress noted that the database had been provided to each Regional Specialized Meteorological Centre for Emergency Response.

3.3.3 World Weather Research Programme *(agenda item 3.3.3)*

3.3.3.1 Congress noted with satisfaction the continued progress made in the programme, aimed at facilitating international action to improve forecasting of high impact weather in support of the operational meteorological community. It was noted that the programme focused on weather events where there was a good likelihood of garnering sufficient international resources and where such research would lead to a verifiable and significant outcome.

3.3.3.2 Congress was informed that both the WWRP Mesoscale Alpine Programme, whose objective was the understanding and prediction of intense weather in mountainous areas, and the Aircraft In-Flight Icing Project were successfully conducting research campaigns. Congress, aware that both those projects were addressing topics which affect the safety of human life, encouraged the international research teams in their efforts to develop societal applications of their work.

3.3.3.3 Congress noted with satisfaction the great success in the implementation of the WWRP Sydney 2000 Forecast Demonstration Project, and urged that further steps were taken for technology transfer to the operational community. Congress noted with satisfaction the efforts of the China Meteorological Administration to prepare a WWRP Forecast Demonstration Project in association with the 2008 Olympic Games in Beijing. The Sydney 2000 Forecast Demonstration Project team was encouraged to maintain continuous interaction with the planning efforts for the Beijing 2008 Forecast Demonstration Project.

3.3.3.4 Congress was pleased with the substantial progress made in developing the Mediterranean Experiment on Cyclones that Produce High Impact Weather in the Mediterranean, and urged active participation of Members in the region.

3.3.3.5 Congress considered that sand and dust storms could result in serious socio-economic dislocation in many arid and semi-arid regions of the world and, therefore, supported the organization of a multidisciplinary international symposium on sand and dust storms, to be held next year in Beijing, China with co-sponsorship of the China Meteorological Administration, WMO and other scientific organizations, and a WWRP workshop, focusing on development of coordinated research plans, to be held in conjunction with the symposium.

3.3.3.6 Congress noted with satisfaction the efforts made by the Meteorological Service of Morocco for research development and operational performance of its NWP system based on the ALADIN model. In that connection, Congress encouraged that further efforts for transfer of limited-area models to developing countries should be continued.

3.3.4 Tropical Meteorology Research Programme *(agenda item 3.3.4)*

3.3.4.1 Congress noted the evident progress made in the programme since its last session. It recalled that the series of International Workshops on Tropical Cyclones had been a feature of WMO's Tropical Meteorology Research Programme for many years and had resulted in several publications as well as a forecast guide. Congress, therefore, was pleased to note that the fifth workshop in the series held in Cairns, Australia in December 2002, resulted in important recommendations addressed to WMO, research communities and practicing forecasters, thus the essential global and forecaster-researcher character of the series had been maintained.

3.3.4.2 With respect to the role of the Monsoon Activity Centres in New Delhi, Nairobi and Kuala Lumpur, Congress agreed with the CAS Working Group on Tropical Meteorology Research that those Centres should also serve as dissemination and coordination centres for NWP products relevant to monsoon forecasting, as well as data centres for ENSO and interannual variability studies in the region. Congress urged CAS to provide the necessary guidance and technical assistance to those Centres with their increased responsibilities.

3.3.4.3 Congress agreed with the recommendation of the Second International Workshop on Monsoon Studies (New Delhi, March 2001) that an ongoing Web-based training document should be developed in order to update forecasters on developments of direct relevance to monsoon forecasting.

3.3.4.4 Congress noted the increasing progress being made in the field of ensemble forecasting, and therefore encouraged further research in that field and its practical application through the implementation of LAM (Application of limited-area modelling to tropical countries) projects.

3.3.4.5 Congress recognized that great challenges existed for improving the prediction of landfalling tropical cyclones and welcomed the close collaboration between the WWRP and TMRP in developing an International Tropical Cyclone Landfall Programme, which would contribute to improving further safety and to reducing the economic losses of tropical cyclone affected countries.

3.3.4.6 Congress welcomed the Canadian initiative supported by CAS to hold the Second International Workshop on Extratropical Transition of Tropical Cyclones in Halifax, Canada, November 2003.

3.3.5 Programme on Physics and Chemistry of Clouds and Weather Modification Research *(agenda item 3.3.5)*

3.3.5.1 Congress noted the outcomes of the different meetings, workshops and conferences organized in the program and expressed its overall satisfaction for the systematic effort made by the program in support of the continuous interest of many WMO Members in the areas for hail suppression and precipitation enhancement, as well as for improved parameterization of cloud processes in weather forecasting models and for a better understanding of the behaviour of clouds in climate.

3.3.5.2 Congress was particularly pleased by the outcome of the Eighth WMO Scientific Conference on Weather Modification organized in Casablanca, in April 2003. The Conference demonstrated once again the very large interest in the subject, with more than 40 countries participating and reporting considerable achievements in weather modification. Congress was pleased to note the clear benefit of advanced technology and computers for those activities, thus allowing dramatic improvements in parameters in cloud observational capabilities and more complex modeling of clouds and mesoscale processes, leading to a sound scientific approach in planning of weather modification activities. The initiative led by Morocco for the launching of a Regional Precipitation Enhancement Project (PEP) in the North West part of Africa was endorsed and participating countries were encouraged to plan and execute according to the scientific requirements reflected in the WMO guidance.

3.3.5.3 Congress noted with appreciation that many WMO Members were conducting operational and research weather modification activities concerning precipitation enhancement and hail suppression. However, the need to conduct rigorous analyses of the results for international peer review was considered essential. Therefore, CAS was requested to review the criteria for assessing the success of weather modification experiments and in collaboration with IAMAS to redefine them based on recent advances in cloud microphysical measurements, application of statistics and scientific discussions which took place at the 8th WMO Scientific Weather Modification Conference in Casablanca.

3.3.5.4 Congress noted with concern the new additional evidence, also presented at the 8th WMO Scientific Conference on Weather Modification, that was pointing to an apparent substantial reduction of the rainfall efficiency of clouds by plumes of smoke caused by biomass burning (agricultural practices, forest fires, cooking and heating) and industrial processes. Congress also noted the evidence that such non-raining clouds could regain their raining ability once they moved over oceans or large bodies of water (such as the Aral Sea) because sea-salt was then mixed into the clouds and overrode the detrimental effect of the smoke particles. Therefore, Congress recommended CAS to establish an ad-hoc Group on Biomass Burning and Smoke Plumes in general, charge it to prepare a summary report for information of the Members, addressing relevant issues such as (1) the climatology of smoke and weather active aerosol (Cloud Condensation Nuclei or CCN) plumes, (2) the *in situ* and remote measurement of CCN and cloud droplet concentrations, (3) strategies to reduce biomass burning and hence the density of smoke plumes, and (4) the seeding procedures and evaluation methods to re-establish raining ability of clouds affected by smoke plumes, and CAS to report to Fifteenth Congress.

3.3.5.5 Congress noted with appreciation that in order to recognize, stimulate and award further scientific work, the Department of Water Resources Studies, Office of His Highness the President of the United Arab Emirates, had decided to provide the necessary funds for establishing an UAE Prize-for Excellence in Advancing the Science and Practice of Weather Modification in collaboration with WMO. This competitive Prize would be open for institutions, groups and/or individual scientists. It would be awarded in three categories, the First Prize US$ 250,000, the Second Prize US$ 200,000 and the Third Prize US$ 150,000. At first, the Prize would be awarded at the end of 2004 and the Secretary-General was requested to arrange for the necessary collaboration.

3.3.5.6 *C*ongress also noted with interest the outcome of the WMO International Workshop on Hygroscopic Seeding: Experimental Results, Physical Processes and Research Needs, jointly organized by WMO, NCAR and the Mexican State of Durango in Mexico (December 1999). Congress agreed that the better scientific understanding of the results obtained through hygroscopic seeding was a key to future improved precipitation enhancement experiments. Congress furthermore requested CAS to pursue its strategy to elucidate further the scientific questions associated with those techniques.

3.3.5.7 Congress was also pleased by the Secretary-General's initiative to examine the possibilities of European Union support to precipitation enhancement in the Mediterranean Basin, south-east Europe and the Middle East and recognized the potentially important contribution that any increase in precipitation could make to the region's water resources. It urged its Members and WMO to continue to play an active role in that long-term project. Congress urged NMHSs of the region to thoroughly examine available climatological and microphysical information for establishing feasibility for precipitation enhancement in advance of attempting weather modification experiments.

3.3.5.8 Congress noted with satisfaction that both the WMO Statement on the status of weather modification and the Guidelines for advice and assistance related to the planning of weather modification activities were revised by CAS and that the new versions were endorsed by the fifty-third session of the Executive Council.

10. NASA NEWS RELEASE

News Release

National Aeronautics and
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NASA SPACECRAFT PROVIDES DIRECT EVIDENCE - SMOKE INHIBITS RAINFALL

Smoke from forest fires has, for the first time, been proven to inhibit rainfall, according to an extensive analysis of data taken from NASA's Tropical Rainfall Measuring Mission (TRMM) spacecraft.

The TRMM data, published in the Oct. 15th issue of Geophysical Research Letters, shows that the warm rain processes in tropical clouds, polluted with heavy smoke from forest fires, are practically shut off. In clouds that have been "contaminated" with smoke, scientists found that the clouds tops must grow considerably above the freezing level (16,000 feet or 4.8 kilometers) in order for the clouds to start producing rain by the alternative mechanism of ice. In the typical rainfall process in cleaner air, rain can form in significantly smaller clouds without ice.

Raindrops in the atmosphere can grow by two means. The first is by coalescence or "collision." In this process, the Warm rain process, a few cloud drops get large enough to start falling. As they fall, they pick up the other clouds drops until they become big enough to fall to Earth as rain drops. The second way needs ice particles and supercooled water (water colder than 32 deg. F). Ice particles surrounded by supercooled water may grow extremely rapidly as water freezes onto the ice core. These large ice particles fall and eventually melt and become raindrops as they fall towards the warmer surface.

Scientists have known for some time that smoke from burning vegetation suppresses rainfall, but it was not known to what extent until now. Because of TRMM, scientists are able to observe both precipitation and cloud droplets over large areas, including clouds in and out of smoke plumes.

"We've seen evidence of decreased precipitation in clouds contaminated by smoke, but it wasn't until now that we had direct evidence showing that smoke actually suppresses precipitation completely from certain clouds," said Dr. Daniel Rosenfeld, TRMM science team member and the author of the paper, TRMM Observed First Direct Evidence of Smoke from Forest Fires Inhibiting Rainfall" the research paper in which this information was published.

Scientists have a keen interest in the changes in global precipitation not only because of its impact on human activities, such as crop production, but also because of its role in deriving the global rainfall weather pattern.

Tropical rainfall is responsible for about two-thirds of the energy required to power the global atmospheric circulation. The recent El Nino serves as a perfect example of the atmospheric circulation changes that can result from a displacement of the normal precipitation patterns in the central Pacific. Similarly, the modification of precipitation by aerosols (particles of liquid or solid dispersed as a suspension in gas, such as air) might also affect the global climate. More precise information about this rainfall and its variability is crucial to understanding and predicting global climate and climate change.

In the paper, Rosenfeld highlights one specific area - Kalimantan, Indonesia. During a TRMM overpass on March 1, 1998, the southeastern portion of the Island was engulfed heavily by smoke while the northwestern portion was relatively smoke free. The TRMM radar detected precipitation in smoke-free clouds while almost none in the smoke-plagued clouds, thus showing the impact of smoke from fires on the rain forest rainfall processes.

"It's important to note that this is not a unique case," said Rosenfeld of the Hebrew University of Jerusalem, the Institute of Earth Sciences, Israel. "We observed and documented several other cases that showed similar behavior. In some instances even less severe smoke concentration was found to have comparable impacts on clouds."

This research further validates earlier studies by Rosenfeld on urban air pollution showing that pollution in Manila in the Philippines has an effect similar to forest fires, according to Rosenfeld.

"Findings such as these are making the first inroads into the difficult problem of understanding humankind's impacts on the global precipitation process," said Dr. Christian Kummerow, TRMM project scientist at NASA's Goddard Space Flight Center, Greenbelt, MD.

The Tropical Rainfall Measuring Mission (TRMM) carries microwave and visible/infrared sensors, and a spaceborne rain radar - the first rain radar ever launched into space. The three primary instruments used for this research were the TRMM Precipitation Radar, the TRMM Microwave Imager, and the Visible and Infrared Sensor.

TRMM is NASA's first mission dedicated to observing and understanding tropical rainfall and how it affects the global climate. The TRMM spacecraft fills an enormous void in the ability to calculate world-wide precipitation because so little of the planet is covered by ground-based radars. Presently, only two percent of the area covered by TRMM is covered by ground-based radars, Kummerow said.

TRMM is a joint U.S.-Japanese mission that was launched on Nov. 27, 1997, from the National Space Development Agency at Japan's Tanegashima Space Center. The TRMM satellite has produced continuous data since Dec. 8, 1997. Tropical rainfall -- that which falls within 35 degrees north and 35 degrees south of the equator -- comprises more than two-thirds of the rainfall on Earth.

TRMM is part of NASA's Earth Science Enterprise, a long-term research program designed to study the Earth's land, oceans, air, ice and life as a total system. Images from the TRMM mission are available on the Internet at URL: http://trmm.gsfc.nasa.gov/

11. DR. KARL S. KRUSZELNICKI'S REPORT

Dr. Karl S. Kruszelnicki concerning Smoke and Air Pollution and how its affecting our health and environment

Wood Smoke Part 1

We humans have been making fires to cook meat and keep ourselves warm for over 400,000 years. But one of the troubles with a fire is that it gives off smoke. This smoke has bothered people for a long time. In 1661, Charles II of England commissioned John Evelyn to write a pamphlet called "Fumifugium: or the inconveniencie of the aer and smoak of London dissipated".

It was only after thousands of people died in the killer smogs in England in the early 1950s, that the Clean Air Act was passed in 1956. But it seems as though we haven't gone far enough. We now know that dirty air doesn't just take your view away, it also takes your breath away.

Some people might argue that we humans have burning wood fires for hundreds of thousands of years, and they haven't done us any harm, so what's all the fuss? Well the whole point is that they have been causing lots of harm all that time - lung diseases have always been one of the major killers.

According to the New South Wales Health Department, tiny particles in the air kill about 400 people each year prematurely, in that state. In the USA, it's thought that dirty air, mainly from burning stuff, kills tens of thousands of people each year.

Many of us have had the experience of being unable to open a window, because of the smoke from our neighbour's fire. But the effect of wood smoke goes beyond having your hair and clothes smell of your neighbours' smoke. And it goes beyond asking, "Where did the view go?". Wood smoke can cause irritations of the nose, throat and sinuses. It can trigger coughs, asthma, bronchitis, emphysema, pneumonia, middle ear infections, cardiovascular disease, and even lung cancer. An EPA study in 1991 concluded that volume for volume, the smoke from a wood fire is 12 times more carcinogenic than the smoke from cigarettes!

The smoke from a wood fire has tiny particles floating in the air. There's a special jargon used to describe these tiny particles. They're called "PM" or "Particulate Matter". PM10 are particles that are smaller than 10 microns in size (a micron is a millionth of a metre, and 10 microns is roughly the size of a bacterium, or one seventh of the size of a human hair). Today, PM10s are defined as particles between 2.5 and 10 microns in size. PM10s come both from natural sources (such as dust from soil and roads, and tiny droplets of seawater) and from artificial sources (such as trucks and buses, and the wood processing industry). The PM10 particles tend to fall to the ground fairly rapidly.

There are even smaller particles called PM2.5 - they're smaller than 2.5 microns. They mostly come from burning. They're made up of various sulphates, nitrates, tiny particles of carbon, or other condensed organic stuff. PM2.5 particles tend to hover for days, if not weeks. The real problem with the PM2.5 particles, is that they're so small that they can penetrate very deeply into your lungs. They can interfere with your respiratory system, and as a result, with your cardiovascular system as well. A recent article in Nature says that these tiny PM2.5 particles make smog and ozone.

We know that polluted air contains large amounts of various oxides of nitrogen. We also know that during the night, some of these oxides of nitrogen are turned into nitrous acid (HNO2), and that in sunlight, the nitrous acid turns into smog and ozone. Where did the nitrous acid came from? The Nature article says that suspended soot particles can turn nitrogen dioxide (NO2) into nitrous acid, 10 million times faster than other catalysts. Yep, soot from fires turns oxides of nitrogen into smog and ozone.

These dangerous particles are not being released from some giant industrial chimney complex hundreds of kilometers from where you live - they come from badly-tuned motor vehicles, barbecue grills and wood fires in the streets and backyards where you live.

In much of our society, wood fires are the main source of these tiny dangerous particles. But don't think that a brand-new latest-technology wood stove is a clean burner. In fact, such a wood stove will put out as much particle pollution in one day, as a car running for 15,000 kilometres, or one year. What can we do about it? Well, that's what I'll discuss next time"