

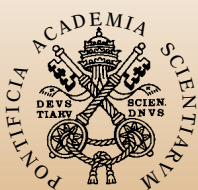
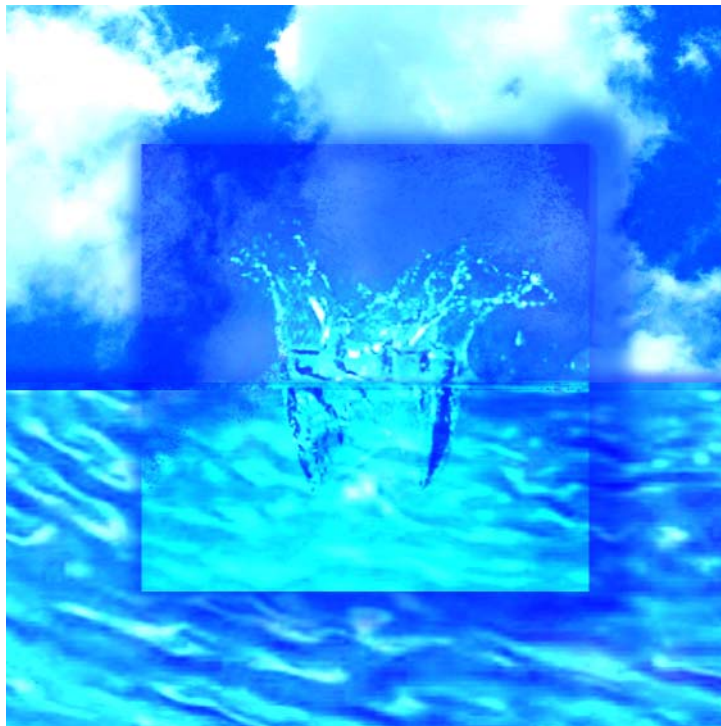
THE PONTIFICAL ACADEMY OF SCIENCES

Working Group on

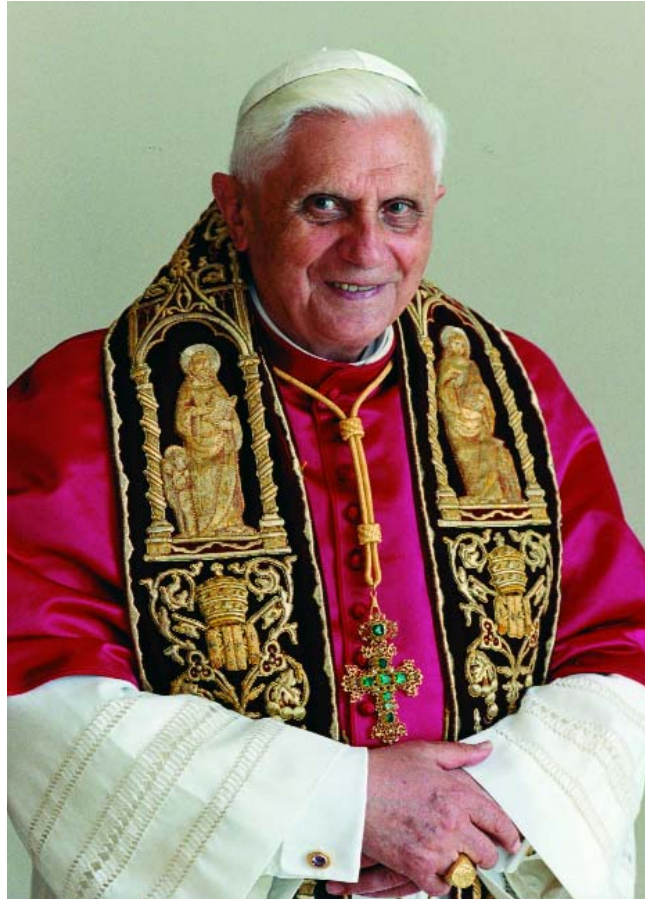
# **WATER AND THE ENVIRONMENT**

12-14 November 2005

Casina Pio IV



VATICAN CITY 2005



‘As you can imagine, we will not go into the technical question, or into the possibilities of its application, which would probably still be premature. But we know that it is a question of a kind of important metabolism, which it is in the interest of mankind to discern, since the shortage of reserves of fresh water threatens to hinder its development. Let us just emphasise, in the more general field of scientific research, two attitudes which, it seems to us, should characterise the scientist, and especially the scientist who is a Christian. On the one hand, he must honestly consider the question of the earthly future of mankind and, as a responsible person, help to prepare it, preserve it, and eliminate risks; we think that this solidarity with future generations is a form of charity to which a great many men are sensitive today, in the framework of ecology. But at the same time, the scientist must be animated by the confidence that nature has in store secret possibilities which it is up to intelligence to discover and make use of, in order to reach the development which is in the Creator’s plan. This hope in the Author of nature and of the human spirit, rightly understood, is capable of giving new and serene energy to the researcher who is a believer’.

**Paul VI, *Address of 19 April 1975 to the participants of the study week on ‘Biological and Artificial Membranes and Desalination of Water’*<sup>1</sup>**

<sup>1</sup>*Papal Addresses*, The Pontifical Academy of Sciences, Scripta Varia 100, Vatican City 2003, p. 208 f.

## WORKSHOP DESCRIPTION

# Water and the Environment

The Pontifical Academy of Sciences is sponsoring a workshop on 'Water and the Environment' which will take place November 12-14, 2005. This workshop will have as its goal to discuss the scientific frontiers of the main environmental issues related to the impact of hydrologic dynamics on sustainable development.

### The Priority of Water

For the Presocratics, water was the principle of all things, and curiously enough it is only today that we have once again become aware that the survival of humanity and of all other species on earth depends upon the fate of water. Where water is absent, life is absent. Thus water, the common symbol of life for all mankind, valued and respected in all religions and cultures, has also become a symbol of social equity. Today we can say that the problem has two main facets: the first belongs especially to the natural sciences (study the great basins, conserve them and develop them in a sustainable way with relation to the rest of the environment); the second facet pertains more to the social sciences (fair distribution of water). For these reasons, the Pontifical Academy of Sciences, which has already organised several study weeks on this topic in the past, now wants to organise a first workshop referring principally to the first aspect, with a view to a second workshop in conjunction with the Pontifical Academy of Social Sciences.

### Workshop Goals

The world is keenly aware of the fundamental role that water resources play for a safe and sustainable development. Moreover, society is also conscious of the serious danger that these resources are facing because of industrial development, megacities, contamination, and many types of conflicting uses. Concepts like Integrated Water Resources Management are commonly used as 'a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems' (Global Water Partnership TEC Background Paper No. 4).

The above coordinated development needs a solid scientific background that will allow the decision making process to proceed with long term goals and equitable

considerations. In this scientific foundation a key role is played by the science of Hydrology and its intimate links with Ecology and also with its sister geophysical sciences like Geomorphology, Geology, Climatology and Meteorology. As Hedin *et al.* have described it (2002, Report to the U.S. National Science Foundation), 'this disciplinary convergence will over the next several decades transform our understanding of basic processes that control the stability and sustainability of natural environmental systems. The ensuing findings will have extraordinary implications for our abilities to predict and manage how humans impact the health of ecosystems across local, regional, and global scales. Such knowledge is a critical component of a safe, sustainable and prosperous future'.

The workshop is addressed to the analysis and discussion of some of the key scientific issues that arise in the formulation described above. Because of the very wide scientific scope of the problem and its associated impacts, the workshop concentrates on some aspects that have a number of connections with the decisions that society faces in relation to water and the environment. The Vatican Academy plans to sponsor a following future meeting that will center on the more applied considerations of this most important scientific area.

### Workshop Structure

The workshop is organized around 5 main topics: Biodiversity, Global Hydrology, Climate Change, Land-Atmosphere Interactions, and River Basins. In all of them hydrologic dynamics provides the underlying unifying theme through which all the 5 themes are studied and discussed.

A central purpose of the meeting is to analyze the feedbacks and interactions between the 5 areas described above and explore the main scientific challenges that presently exist for a sound understanding of the hydrologic dynamics underlying some of the world most pressing environmental problems.

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## PROGRAMME

# Water and the Environment

**SATURDAY, 12 NOVEMBER**

9:00	General Introduction: <b>Prof. M. GOVIND KUMAR MENON</b> <i>The Pontifical Academy of Sciences, Welcome, and Goals</i>
9:15	Speaker: ◆ <b>Dr. REZA ARDAKANIAN</b> <i>The Fair Distribution of Water</i> Discussion
<b>BIODIVERSITY AND HYDROLOGIC DYNAMICS</b>	
10:15	Chairperson: <b>Prof. NICOLA CABIBBO</b> Speaker: ◆ <b>Prof. MARINO GATTO</b> <i>Threatened Biodiversity: Understanding, Forecasting, Taking Action</i> Discussion
11:15	Coffee Break
11:45	Speaker: ◆ <b>Prof. IGNACIO RODRÍGUEZ-ITURBE</b> <i>Hydrologic Fluctuations and Vegetation Dynamics</i> Discussion
<b>GLOBAL HYDROLOGY AND HYDROLOGIC DYNAMICS</b>	
12:45	Speaker: ◆ <b>Prof. VEERABHADRAN RAMANATHAN</b> <i>Global and Regional Hydrological Cycle: Changes during the Anthropocene</i> Discussion
14.00	Lunch at the Casina Pio IV
15.30	Chairperson: <b>Prof. IGNACIO RODRÍGUEZ-ITURBE</b> Speaker: ◆ <b>Dr. PETER M. COX</b> <i>Global Hydrology, Climate Change and Ecosystems</i> Discussion
16.30	Speaker: ◆ <b>Prof. SOROOSH SOROOSHIAN</b> <i>Water Distribution and Availability: An Overview of the Hydrologic Cycle, its Connection to Climate and Impact on Water Resources Management Strategies</i> Discussion
17.30	Coffee Break



<b>CLIMATE CHANGE AND HYDROLOGIC DYNAMICS</b>	
18:00	Speaker: ◆ <b>Prof. Dr. LENNART BENGSSON</b> <i>Changes in Global Rainfall and the Hydrological Cycle: Present and Future Perspectives</i> Discussion
19:00	Speaker: ◆ <b>Prof. GRAHAM FARQUHAR</b> <i>Worldwide Changes in Evaporative Demand</i> Discussion
20:00	Dinner at Domus Sanctae Marthae

**SUNDAY, 13 NOVEMBER**

9:00	Holy Mass
10:00	Cultural Visit to Vatican Necropolis
12:30	Social Lunch at the Casina Pio IV

**MONDAY, 14 NOVEMBER**

9:00	Chairperson: <b>Prof. RAYMOND HIDE</b> Speaker: ◆ <b>Prof. ULRIKE LOHMANN</b> <i>Impact of Aerosols on the Hydrologic Cycle</i> Discussion
<b>LAND-ATMOSPHERE INTERACTIONS</b>	
10:00	Speaker: ◆ <b>Prof. GABRIEL KATUL</b> <i>Bringing Photosynthesis to the Atmosphere: A Feedback on Terrestrial Water Cycling</i> Discussion
11:00	Coffee Break
11:30	Speaker: ◆ <b>Prof. DANIEL ROSENFELD</b> <i>Precipitation Suppression by Anthropogenic Air Pollution: Major Loss of Water Resources Where We Need Them Most</i> Discussion
12:30	Speaker: ◆ <b>Dr. CARLOS A. NOBRE</b> <i>Biosphere-Atmosphere Interactions in Amazonia</i> Discussion
13:30	Lunch at the Casina Pio IV

RIVER BASINS	
15:00	Chairperson: <b>Prof. VEERABHADRAN RAMANATHAN</b> Speaker: ◆ <b>Prof. WILLIAM DIETRICH</b> <i>Is There a Topographic Signature of Life on Earth?</i> Discussion
16:00	Speaker: ◆ <b>Prof. ANDREA RINALDO</b> <i>River Basins: Water and Complex Adaptive Systems</i> Discussion
17:00	Speaker: ◆ <b>Dr. MOUSTAFA CHAHINE</b> <i>NASA's Measurements of Water from Space</i> Discussion
18:00	Coffee Break
18:30	Speaker: ◆ <b>Prof. MALIN FALKENMARK</b> <i>Heading Towards Basin-level Hydrosolidarity – Goal for Land/Water/Ecosystem Coordination</i> Discussion
19:00	Final Discussion
20:00	Dinner at Domus Sanctae Marthae



## LIST OF PARTICIPANTS

# Water and the Environment

Outside Experts

NAME AND TITLE	NAT.	DISCIPLINE AND CHARGE	PAPER
<b>Dr. Reza Ardakanian</b>	<b>IR</b> Teheran	Regional Center on Urban Water Management	<i>The Fair Distribution of Water</i>
<b>Prof. Dr. Lennart Bengtsson</b>	<b>D</b> Hamburg	Max Planck Institute for Meteorology	<i>Changes in Global Rainfall and the Hydrological Cycle: Present and Future Perspectives</i>
<b>Dr. Moustafa T. Chahine</b>	<b>USA</b> Pasadena	Chief Scientist at NASA-JPL Jet Propulsion Laboratory	<i>NASA's Measurements of Water from Space</i>
<b>Dr. Peter M. Cox</b>	<b>UK</b> Dorchester	CEH – Dorset Winfrith Technology Centre	<i>Global Hydrology, Climate Change and Ecosystems</i>
<b>Prof. William E. Dietrich</b>	<b>USA</b> Berkeley	University of California, Berkeley Department of Earth and Planetary Science	<i>Is There a Topographic Signature of Life on Earth?</i>
<b>Prof. Malin Falkenmark</b>	<b>S</b> Stockholm	Stockholm International Water Institute (SIWI)	<i>Heading towards Basin-Level Hydrosolidarity – Goal for Land/Water/Ecosystem Coordination</i>
<b>Prof. Graham D. Farquhar</b>	<b>AUS</b> Canberra	Australian National University Research School of Biological Sciences	<i>Worldwide Changes in Evaporative Demand</i>
<b>H.Em. Card. Geraldo Majella Agnelo</b>	<b>BR</b> Brasilia	President of National Bishops' Conference of Brazil (C.N.B.B.)	
<b>Prof. Marino Gatto</b>	<b>I</b> Milan	Polytechnic of Milan Department of Electronics and Information	<i>Threatened Biodiversity: Understanding, Forecasting, Taking Action</i>
<b>H.E. Msgr. Catalino Claudio Giménez Medina</b>	<b>PY</b> Asunción	President of the Bishops' Conference of Paraguay (C.E.P.)	
<b>H.E. Msgr. Estanislao E. Karlic</b>	<b>RA</b> Paraná	Former President of the Bishops' Conference of Argentina and Archbishop Emeritus of Paraná	
<b>Prof. Gabriel G. Katul</b>	<b>USA</b> Durham	Duke University Nicholas School of the Environment and Earth Sciences	<i>Bringing Photosynthesis to the Atmosphere: A Feedback on Terrestrial Water Cycling</i>
<b>Prof. Ulrike Lohmann</b>	<b>CH</b> Zürich	Swiss Federal Institute for Technology (ETH) Institute for Atmospheric and Climate Science	<i>Impact of Aerosols on the Hydrologic Cycle</i>
<b>H.E. Msgr. Eduardo Vicente Miras</b>	<b>RA</b> Buenos Aires	President of the Bishops' Conference of Argentina (C.E.A.)	
<b>Dr. Carlos A. Nobre</b>	<b>BR</b> Cachoeira Paulista	Centre for Weather Forecasts and Climate Studies	<i>Biosphere-Atmosphere Interactions in Amazonia</i>
<b>Prof. Andrea Rinaldo</b>	<b>I</b> Padua	Padua University 'Dino Tonini' International Hydrology Centre	<i>River Basins: Water and Complex Adaptive Systems</i>
<b>Prof. Ignacio J. Rodríguez-Iturbe</b>	<b>USA</b> Princeton	Princeton University Department of Civil and Environmental Engineering	<i>Hydrologic Fluctuations and Vegetation Dynamics</i>
<b>Prof. Daniel Rosenfeld</b>	<b>IL</b> Jerusalem	The Hebrew University of Jerusalem Institute of Earth Sciences – Program of Atmospheric Sciences	<i>Precipitation Suppression by Anthropogenic Air Pollution: Major Loss of Water Resources</i>
<b>Prof. Soroosh Sorooshian</b>	<b>USA</b> Irvine	University of California, Irvine Department of Civil and Environmental Engineering	<i>Water Distribution and Availability: An Overview of the Hydrologic Cycle</i>

	NAME AND TITLE	NAT.	DISCIPLINE AND CHARGE
Observers	<b>Prof. James Dooge</b>	<b>IRL</b> Dublin	Former Foreign Minister of Ireland
	<b>Prof. Viliam Novák</b>	<b>SK</b> Bratislava	Slovak Academy of Sciences, Institute of Hydrology
	<b>Prof. Mary Power</b>	<b>USA</b> Berkeley	University of California, Berkeley
	<b>Msgr. James Reinert</b>	<b>V</b> Vatican City	Pontifical Council for Justice and Peace
	<b>Prof. Lucio Ubertini</b>	<b>I</b> Rome	La Sapienza University of Rome
	<b>Prof. Howard S. Wheeler</b>	<b>UK</b> London	Imperial College, Faculty of Engineering

	NAME AND TITLE	NAT.	DISCIPLINE AND CHARGE	PAPER
Academicians	<b>Prof. Nicola Cabibbo</b>	<b>I</b> Rome	Professor of Physics La Sapienza University of Rome President of the Pontifical Academy of Sciences	<i>Welcome Address</i>
	<b>H.E. Msgr. Marcelo Sánchez Sorondo</b>	<b>V</b> Vatican City	Professor of the History of Philosophy LUMSA University of Rome Chancellor of the Pontifical Academy of Sciences and the Pontifical Academy of Social Sciences	<i>Presentation of the Activity of the Pontifical Academies</i>
	<b>Prof. Paul J. Crutzen</b>	<b>D</b> Mainz	Max Planck Institute for Chemistry Department of Atmospheric Chemistry Member of the Council of the PAS	
	<b>Prof. Raymond Hide</b>	<b>UK</b> Surrey	Emeritus Professor of Physics, Oxford University Senior Research Investigator in Mathematics, Imperial College, London	
	<b>Prof. M. Govind Kumar Menon</b>	<b>IND</b> New Delhi	Dr. Vikram Sarabhai Distinguished Professor, Indian Space Research Organisation, Govt. of India Member of the Council of the PAS	<i>The Pontifical Academy of Sciences, Welcome, and Goals</i>
	<b>Prof. Veerabhadran Ramanathan</b>	<b>USA</b> San Diego	University of California, San Diego Scripps Institution of Oceanography Center for Atmospheric Sciences	<i>Global and Regional Hydrological Cycle: Changes during the Anthropocene</i>

