

## LUNAR AND PLANETARY INSTITUTE

3303 NASA ROAD 1 HOUSTON, TEXAS 77058

A MECA Workshop on  
"Atmospheric H<sub>2</sub>O Observations of Earth and Mars"

September 25-27, 1986 Houston, TX

## FIRST ANNOUNCEMENT

Dear Colleague,

A workshop on "Atmospheric H<sub>2</sub>O Observations of Earth and Mars: Physical Processes, Measurements, and Interpretation" will be held at the Lunar and Planetary Institute September 25-27. The workshop will be the last official activity of the NASA-LPI study project entitled "Mars: Evolution of its Climate and Atmosphere" (MECA). Members of the Program Committee currently include Duwayne Anderson (Texas A&M), Bob Haberle (NASA Ames), and Bruce Jakosky (LASP).

The purpose of the workshop is to discuss a variety of questions related to the detection and cycling of atmospheric H<sub>2</sub>O on Earth and Mars. For example: What factors and processes govern the storage and exchange of H<sub>2</sub>O between planetary surfaces and atmospheres on diurnal and seasonal time scales? What types of instruments have been used (or proposed for use) in the measurement and mapping of atmospheric H<sub>2</sub>O on Earth and Mars? Do sources and sinks of H<sub>2</sub>O have uniquely identifiable water vapor column abundance signatures? What degree of time and spatial resolution in column abundance data (and other information) is necessary for determining dynamic behavior? Finally, what lessons have we learned that may benefit our understanding of the data we hope to receive from Mars Observer?

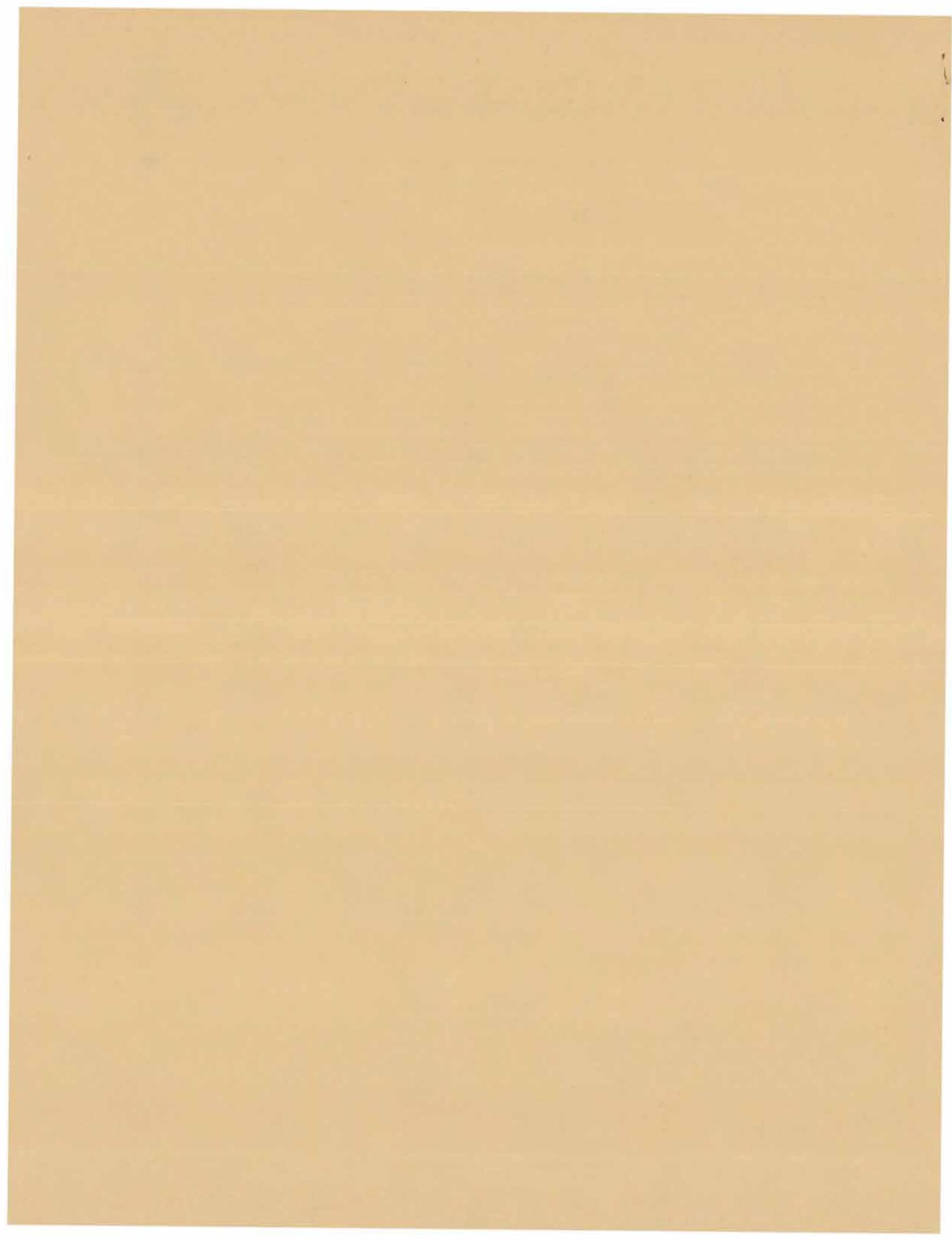
Because of the interdisciplinary nature of these questions, we are actively seeking the participation of scientists from a variety of fields, including: soil physics, atmospheric dynamics, atmospheric H<sub>2</sub>O instrumentation and martian volatiles. We wish to particularly encourage the participation of members of the terrestrial community, whose expertise and fresh perspectives may significantly improve our understanding of the Mars' water cycle. We would sincerely appreciate your assistance in recruiting potential participants.

The abstract deadline is July 11th. Further information regarding abstract preparation, and the workshop, will be included in the second mailing in June. If you would like to be kept on the mailing list to receive further information about this meeting, please complete and return the enclosed questionnaire to the LPI Projects Office prior to May 30th.

Sincerely,

Stephen M. Clifford  
for the Program Committee

Enclosure



# LUNAR AND PLANETARY INSTITUTE

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The MECA Workshop on  
"Atmospheric H<sub>2</sub>O Observations of Earth and Mars: Physical Processes,  
Measurements, and Interpretation"

## SECOND ANNOUNCEMENT - CALL FOR PAPERS

(Deadline: July 11, 1986)

Thank you for your response to the announcement of the workshop on "Atmospheric H<sub>2</sub>O Observations of Earth and Mars: Physical Processes, Measurements, and Interpretation". The meeting will be held at the Lunar and Planetary Institute, Houston, Texas, September 25-27. The response so far has been quite good.

**Workshop Format.** As stated in the first announcement, participants in the workshop will include terrestrial and planetary scientists from a variety of fields, including: soil physics, atmospheric dynamics, atmospheric H<sub>2</sub>O instrumentation, and martian volatiles. To take full advantage of this interdisciplinary gathering, the workshop format has been designed to encourage a high level of interaction between the workshop participants. A tentative schedule is enclosed.

The workshop will consist of six technical sessions: four oral, one poster, one working group, and a final discussion and summary session. Oral presentations will be made during the morning and afternoon sessions of Thursday and Friday. Each session will last about four hours and include seven 20-minute presentations, thus leaving considerable time for discussion.

Because of time constraints, the number of oral presentations will be limited; therefore, poster presentations are likely to play a major role in the meeting. Posters may be designed to supplement an oral presentation or to address some aspect of research that is not well suited to an oral delivery. A poster presentation may also be appropriate for papers that the Program Committee decides fall outside the topical scope of the oral sessions.

**Posters.** All posters will be exhibited during a special "Poster and Keg Session" to be held Thursday evening from 7:30 - 9:30 pm. Note that supporting papers are required for all poster presentations. Maximum poster size is limited to a square area that is four feet on a side. Those needing more space should contact LeBecca Turner at the LPI Projects Office (713-486-2158). You will have an opportunity to put up your poster display during the "Welcoming Social and Registration" to be held Wednesday evening from 7:00 - 9:00 pm or at anytime during the Thursday morning and afternoon sessions.

Workshop participants will be asked to join one of several Working Groups that will meet 7:30 - 9:30 pm Friday night. The purpose of these Working Groups will be to critically examine a number of important issues related to one of the following areas: surface processes, atmospheric dynamics, and H<sub>2</sub>O instrumentation. Items for discussion will include assessments of our current state of knowledge, suggestions for testing various hypotheses, and recommendations for new research. One or two spokespeople will be elected by each Working Group to summarize the Group's thoughts for presentation during the final "Summary Session" to be held Saturday, 9:00 am to 12:00 noon.

Topics. In the first announcement, questions were identified to outline areas of interest at the workshop. We repeat those questions here, and raise some new ones, in the hope that they will stimulate additional ideas. The following list is by no means exhaustive; therefore, participants are urged to report on any research they believe falls within the workshop's scope.

What factors and processes govern the storage and exchange of H<sub>2</sub>O between planetary surfaces and atmospheres on diurnal and seasonal time scales? What effects do soil structure, adsorption, thermal gradients, etc., have on the movement of soil moisture and its exchange with the atmosphere? Are there any aspects of H<sub>2</sub>O behavior in terrestrial desert soils that might be applicable to Mars?

What types of instruments have been used (or proposed for use) in the measurement and mapping of atmospheric H<sub>2</sub>O on Earth and Mars? What specific design and operational similarities exist between the various Earth and Mars orbital instruments (e.g., such as those flown on NIMBUS 4, 5, 6, and 7, SEASAT, VIKING, etc.)?

Do sources and sinks of H<sub>2</sub>O have uniquely identifiable water vapor column abundance signatures? What is the diurnal behavior of atmospheric water vapor like over terrestrial deserts, and how does it compare with what we observe on Mars? What degree of time and spatial resolution in column abundance data (and other information) is necessary for determining dynamic behavior?

Finally, what lessons have we learned that may benefit our understanding of the data we hope to receive from Mars Observer?

Papers. Forms and instructions for the preparation of workshop papers are enclosed. While the instructions refer to the submissions as "abstracts", they are more accurately described as "short papers" in view of their maximum length of 5 (five) standard LPI pages. This 5 page limit includes all text, figures, tables, and references. As indicated by the extended page limit, contributions are expected to be substantive.

The final deadline for receipt of the papers at the LPI is Friday, July 11, 1986. Papers received after this deadline will be returned to their authors. This is a firm deadline.

All papers will be reviewed by the Program Committee. Those papers that are accepted for either oral or poster presentation will be compiled in a preliminary volume that will be distributed to all participants at the beginning of the meeting. After the workshop, there will be an opportunity to submit revised or new abstracts for publication in an LPI Technical Report. This Technical Report will be the final product of the workshop and will include summary reports from each Working Group.

**Logistics.** A final announcement including a preliminary program, pre-registration form and local travel information will be mailed to you in mid-August. Until then, the following information may be useful in planning your trip.

Hobby Airport is approximately 20 miles from LPI; Houston Intercontinental Airport is approximately 50 miles. Rental cars, taxis and transportation via the Galveston Limousine Service are available from either airport. A taxi from Hobby will run around \$18; from Intercontinental, about \$50; Galveston Limousine, about \$16. If you take the Galveston Limousine Service you will be dropped off at the NASA Road 1 Gulf Station next to the Comfort Inn.

Local hotels in the local area are listed below. Hotels are listed in the order of distance from NASA/JSC and LPI (closest first). All rates shown are subject to a 10% tax and may change without notice.

	<u>Lowest Single Rate</u>	<u>Other Rates</u>
QUALITY INN 2020 NASA Road 1 Houston, TX 713-332-3551	\$30.00	\$35.00 (Twin)
THE NASSAU BAY HILTON 3000 NASA Road 1 Houston, TX 77058 713-333-9300	\$70.00-\$106.00	
HOLIDAY INN OF HOUSTON-NASA 1300 NASA Road 1 Houston, TX 77058 713-333-2500	\$49.75 (single or twin) w/complimentary breakfast & one drink at club each day if you identify yourself as LPI Meeting Attendee	
SHERATON KINGS INN 1301 NASA Road 1 Houston, TX 77058 713-488-0220	\$58.00 - \$71.00	
THE COMFORT INN 1001 NASA Road 1 Webster, TX 77598 713-332-4581	\$30.00	\$35.00 (twin)
SUPER 8 MOTEL 889 West Bay Area Blvd. Webster, TX 77598 713-338-1526	\$34.88	\$30.88 (corporate)

## TENTATIVE WORKSHOP SCHEDULE

Wednesday, September 24, 1986

7:00 pm - 10:00 pm Welcoming Social and Registration

Thursday, September 25, 1986

8:00 am - 12:00 pm Oral Session I

12:00 pm - 1:30 pm Lunch

1:30 pm - 5:30 pm Oral Session II

7:30 pm - 9:30 pm Poster and Keg Session

Friday, September 26, 1986

8:00 am - 12:00 pm Oral Session III

12:00 pm - 1:30 pm Lunch

1:30 pm - 5:30 pm Oral Session IV

7:30 pm - 9:30 pm Working Group Sessions

Saturday, September 27, 1986

9:00 am - 12:00 pm Discussion and Summary Session

12:00 pm WORKSHOP ADJOURNS

## THE PROGRAM COMMITTEE

Stephen M. Clifford, Convener  
Lunar and Planetary Institute  
713-486-2146

Duwayne M. Anderson  
Texas A&M University  
409-845-8585

Crofton B. Farmer  
Jet Propulsion Laboratory  
818-792-2039

Robert M. Haberle  
NASA Ames Research Center  
415-694-6343

Bruce M. Jakosky  
Laboratory for Atmospheric  
and Space Physics  
303-492-8004

## Information for Contributors

### Abstracts for the MECA Workshop on Atmospheric H<sub>2</sub>O Observations of Earth and Mars

**SCHEDULE** -- Deadline for receipt of abstracts at the Lunar and Planetary Institute is July 11, 1986. Note that this is an absolute deadline--any abstract received after this date will be returned to the author. A technical report will be published in Spring, 1987; if you wish to revise your abstract for inclusion in this volume, your revised paper is due at the LPI by November 1, 1986. If you do not submit a revised version, your original abstract will automatically be included in the technical report.

**FORMAT** -- You may use the enclosed forms for typing your abstract, or any good quality 8-1/2 X 11" bond paper. If you use your own bond paper, allow a 1-inch margin on each side as well as at the top and bottom of each sheet. Abstracts must be no longer than 5 pages, including figures, tables, and references. Figures and tables must be drawn, typed, or glued directly on the forms.

**REFERENCES** -- References should be cited by number (1) and listed sequentially at the end of the paper. You do not need to cite titles of papers referenced. Please use the following format for papers in Proceedings volumes of Lunar and Planetary Science Conferences:

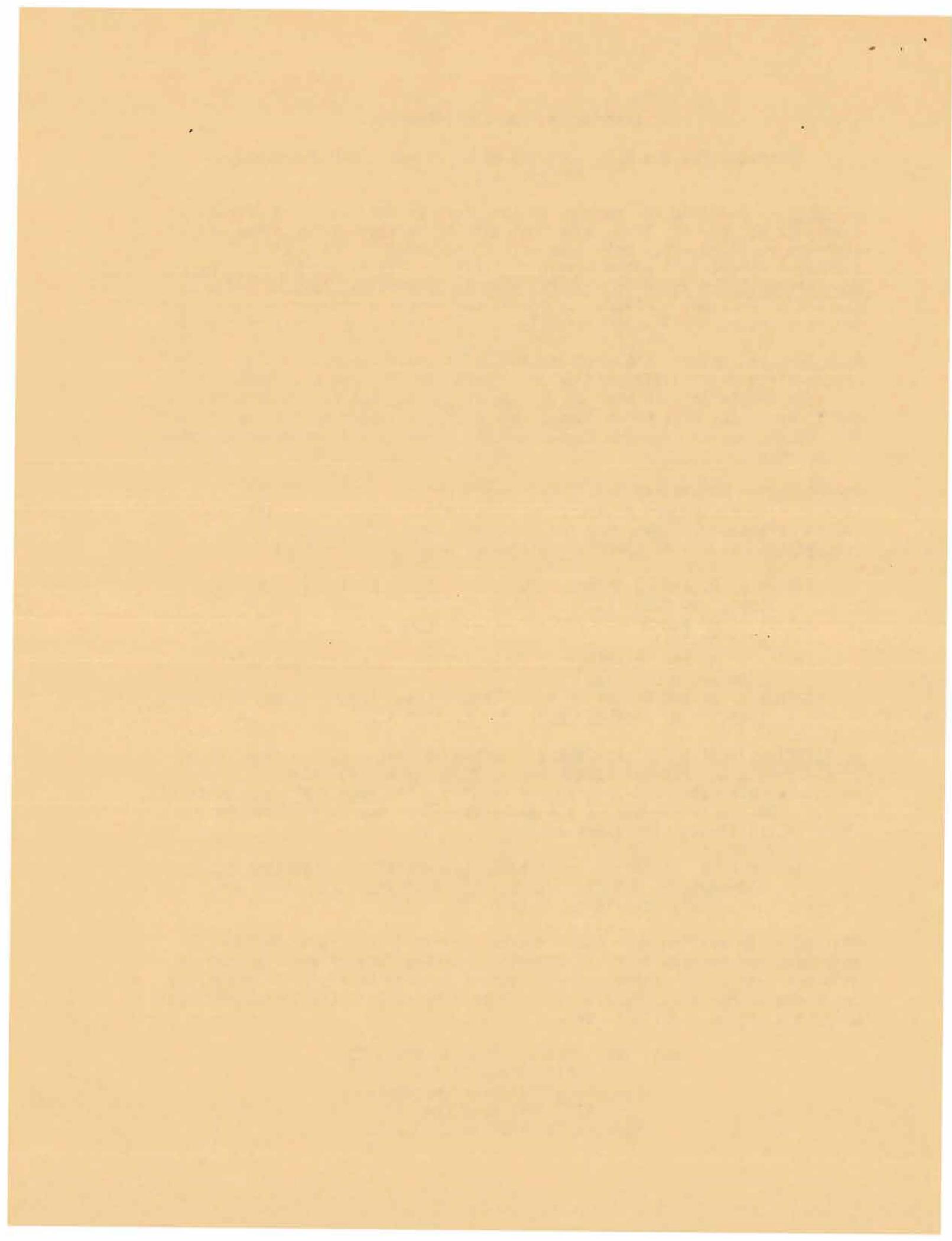
- Author A. B. and Co-Author C. D. (Year) Proc. Apollo 11 Lunar Sci. Conf., p. 0000-1111.  
Author C. B. and Co-Author D. C. (Year) Proc. Lunar Sci. Conf. 4th, p. 0000-1111.  
Author G. H. and Co-Author J. B. (Year) Proc. Lunar Planet. Sci. Conf. 11th, p. 0000-1111.  
Author J. B. and Co-Author B. A. (Year) Proc. Lunar Planet. Sci. Conf. 13th, in J. Geophys. Res., 87, p. A000-A111.

**REFERENCING THESE PAPERS ELSEWHERE** -- These abstracts will be xeroxed and compiled into an informal volume for workshop attendees only; if you wish to reference an abstract, you should reference the post-workshop technical report. (Due to the length of the abstracts, they may be referred to as short papers if you wish.) For example:

Author P. O. (1986) Title of paper (abstract). In MECA Workshop on Atmospheric H<sub>2</sub>O Observations of Earth and Mars. Lunar and Planetary Institute, Houston, in press.

**MAILING** -- In mailing your contribution, please do not fold. Include a completed information form and copyright release form. Please be sure to give the name of the correspondence author to whom we may write about any questions we may have. Papers will not be published in the technical report without a signed copyright form.

MAIL YOUR ORIGINAL PLUS 3 COPIES TO:  
Publications Office  
Lunar and Planetary Institute  
3303 NASA Road One  
Houston TX 77058-4399 U.S.A.



## TENTATIVE WORKSHOP PROGRAM

### Wednesday, September 24, 1986

7:00 pm - 9:00 pm Welcoming Social and Registration

### Thursday, September 25, 1986

8:00 am Registration

8:30 am Welcome - Kevin Burke, Director of LPI

8:35 am Opening Remarks - Stephen Clifford, Workshop Convener

8:45 am **SESSION I: Background**

The behavior of water vapor in the Mars atmosphere  
B. M. Jakosky

The Earth atmospheric water cycle as viewed from a planetary  
perspective  
R. W. Zurek

10:45 am BREAK

11:00 am **SESSION II: Mars Atmospheric H<sub>2</sub>O**

The interpretation of data from the Viking Mars Atmospheric  
Water Detectors (MAWD): Some points for discussion  
S. M. Clifford

The inter-annual variability of atmospheric water vapor on Mars  
R. Zurek

11:50 pm DISCUSSION

12:00 pm LUNCH

1:30 pm **SESSION II: Mars Atmospheric H<sub>2</sub>O (continued)**

The vertical distribution of water vapor in the martian tropics  
R. M. Haberle

Factors governing water condensation in the martian atmosphere  
D. S. Colburn, J. B. Pollack, and R. M. Haberle

Seasonal and diurnal variability of Mars water-ice clouds  
P. Christensen and R. W. Zurek

Seasonal dependence of very high water ice clouds on Mars  
F. Jaquin

3:10 pm DISCUSSION

3:30 pm BREAK

Transport of Mars atmospheric water into high northern latitudes  
during a polar warming  
J. R. Barnes and J. L. Hollingsworth

Circumpolar hoods and clouds and their relation to the martian  
 $H_2O$  cycle  
P. B. James and L. J. Martin

Measurements of the vertical profile of water vapor abundance  
in the martian atmosphere from Mars Observer  
D. McCleese and J. T. Schofield

5:00 pm DISCUSSION

5:15 pm DINNER

8:00 pm - 9:45 pm Thursday Evening Discussion Session.

Topic: Determining the dynamic behavior of atmospheric  $H_2O$  from  
orbital observations alone - is it possible?  
(Beer, soda, and snacks will be provided)

Friday, September 26, 1986

8:30 am SESSION III: Earth Atmospheric  $H_2O$

The effect of global-scale divergent circulation on the  
atmospheric water vapor transport and maintenance  
T. C. Chen

Cumulus convection and the terrestrial water vapor distribution  
L. J. Donner

Measurements of lower stratospheric/upper tropospheric water  
vapor by the Sage II instrument  
J. Larsen

The Nimbus 7 LIMS water vapor measurements  
E. E. Remsberg and J. M. Russell III

10:10 am DISCUSSION

10:30 am BREAK

Solar Mesosphere Explorer observations of stratospheric and mesospheric water vapor

B. M. Jakosky, G. E. Thomas, D. W. Rusch, C. A. Barth,  
G. M. Lawrence, J. J. Olivero, R. T. Clancy,  
R. W. Sanders, and B. G. Knapp

Flux of water vapor in the terrestrial stratosphere and in the martian atmosphere

C. B. Leovy, M. H. Hitchman, and D. J. McCleese

Measurements of H<sub>2</sub>O vapor in the terrestrial mesosphere and implications for extraterrestrial sources

J. J. Olivero

12:00 pm DISCUSSION

12:15 pm LUNCH

1:45 pm SESSION IV: The Regolith as a Source & Sink of Atmospheric H<sub>2</sub>O

Evidence for regolith water vapor sources on Mars

S. M. Clifford and R. L. Huguenin

Atmospheric H<sub>2</sub>O and the search for martian brines

A. P. Zent, F. P. Fanale, and S. E. Postawko

Atmospheric heat engines, and H<sub>2</sub>O in the martian regolith

J. R. Philip

Diurnal fluctuations in simultaneous transport of water and heat through the surface as affected by soil properties

D. Hillel

3:25 pm DISCUSSION

3:45 pm BREAK

Crystalization and exchange of atmospheric water with the Mars regolith

D. Anderson

Regelation and ice segregation

R. D. Miller

Possible significance of H<sub>2</sub>O-Ic ice in the martian atmospheric water cycle

J. L. Gooding

5:00 pm DISCUSSION

5:15 pm DINNER

8:00 pm - 9:45 pm Friday Evening Discussion Session.

Topic: Detecting regolith sources and sinks of atmospheric  
H<sub>2</sub>O from orbit.

(Beer, soda, and snacks will be provided)

Saturday, September 27, 1986

9:00 am SESSION V: Discussion and Summary

Atmospheric H<sub>2</sub>O studies of Earth and Mars: Where do we stand?

The importance of ground-based and endoatmospheric studies

Unresolved problems

Opportunities for cooperative and interdisciplinary research

Future investigations

Mars Observer

12:00 pm WORKSHOP ADJOURNS

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The MECA Workshop on  
"Atmospheric H<sub>2</sub>O Observations of Earth and Mars: Physical Processes,  
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Lunar and Planetary Institute, Houston, Texas  
September 25-27, 1986

## FINAL ANNOUNCEMENT

August 22, 1986

Twenty-five papers have been scheduled for presentation at the workshop on "Atmospheric H<sub>2</sub>O Observations of Earth and Mars". The topics covered include soil water transport and storage, boundary layer meteorology, atmospheric dynamics, cloud physics, atmospheric water vapor measurements, and the operation of a variety of orbital instruments. Actual titles are listed in the accompanying program.

A preliminary abstract volume, and copies of late submissions, will be available at registration. The final abstract volume will be issued as an LPI Technical Report. This TR will be the workshop's "official" publication and will be sent to all workshop participants by early 1987.

**Program Changes:** There have been several changes to the program since the last announcement. Specifically, the activities that were originally scheduled for Thursday and Friday evenings have been replaced by dedicated discussion sessions on "The Dynamic Behavior of Atmospheric H<sub>2</sub>O" and "Detecting Regolith Sources and Sinks of Atmospheric H<sub>2</sub>O". These discussions are intended to be open, relaxed, and highly interactive. Everyone associated with the workshop is encouraged to participate. Beer, soda, and snacks, will be provided.

The special evening discussion sessions represent just one of the many measures that have been taken to encourage discussion at the workshop. Others include: allotting 25 minutes for each talk (15 minutes for the actual presentation, 10 minutes for discussion), and scheduling "open" discussion periods prior to all coffee, lunch, and dinner breaks. Finally, on Saturday, the workshop will conclude with an extended discussion and summary session. To aid the Program Committee in developing an agenda for this final session, we ask that you list (on the back of your pre-registration form) the five topics or questions you would most like to have addressed at the workshop.

This meeting is a unique opportunity for scientists from a variety of related (but in many cases, isolated) fields to meet and discuss issues of common interest. While it is hoped that the formal program will provide a useful introduction to many of these issues, the real benefits of the workshop are likely to be realized in the interdisciplinary contacts, discussions, and eventual collaborations, that arise informally between the workshop participants.

**Registration.** Those who complete and return the enclosed pre-registration form by the September 19th deadline, may register for a \$25 fee. The pre-registration form may be returned with or without the fee. Registrations received after the deadline will be \$30.

A welcoming social and registration will be held at the LPI on Wednesday evening from 7 to 9. For those who arrive too late to register on Wednesday evening, registration will be open again at 8 a.m. Thursday morning and will continue throughout the workshop.

**Speakers.** You will be allotted 15 minutes for your talk with an additional 10 minutes following your presentation for discussion. Dual screen projection of 35 mm slides and single screen projection of overheads will be available to support speaker presentations. Please complete the enclosed cue sheet and give it to the projectionist 10 minutes prior to the session in which you are scheduled to speak. If you require special audio-visual equipment for your presentation please call LeBecca Turner, 713-486-2158, at least two weeks in advance of the workshop.

**Messages.** Anyone wishing to reach you during the workshop sessions may call 713-486-2139. The sessions will not be interrupted to deliver messages unless there is an emergency. Messages will be posted on a message center board by the registration desk in the living room at LPI.

**Logistics.** An information sheet on local travel that includes a list of hotels and a map of the area near LPI is enclosed for your use in planning your trip. If you have any questions concerning your travel arrangements please feel free to call LeBecca Turner, LPI Projects Office, 713-486-2158.

We look forward to seeing you in September.

#### PROGRAM COMMITTEE

Stephen M. Clifford, Convener  
Lunar and Planetary Institute  
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NASA Ames Research Center  
415-694-6343

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