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Preface

The field of atmospheric research using mesosphere-stratosphere-troposphere (MST) radars is now a little over 30 years old. It began when it was discovered that 50 MHz radar signals, which were being used to study the ionosphere, were also unexpectedly being returned from the middle atmosphere. Although the first implementation of an MST radar, using the Jicamarca incoherent scatter radar in Peru, was simple by today's standards, it was able to demonstrate the ability of such radars to measure winds. This has led to the construction of a number of radars designed specifically for middle atmosphere research.

MST radars are also commonly known as wind-profilers. Operating in the ST mode, they have the unique ability to continuously measure the 3-D wind vector over the approximate altitude range 2−20 km at high resolution – typically a few hundred metres in altitude and a few minutes in time. This makes them ideally suited for studying everything from small-scale atmospheric phenomena, such as turbulence, through to synoptic-scale weather events. Moreover the observations made by some radars are now being routinely assimilated for numerical weather prediction by a number of national weather services. Although, in this context, the MST radar technique can be considered to be rather mature, research and development in the field remain active. Novel ways of operating the radars and of processing the data continue to increase the extent to which these instruments can be used for both atmospheric and ionospheric research.

This special issue contains a selection of papers based on presentations given at the Tenth International Workshop on Technical and Scientific Aspects of MST Radar (MST10), held at Universidad de Piura, Peru, 13–20 May 2003. A larger selection of 4-page extended abstracts is available through the workshop's website:

http://jro.igp.gob.pe/mst10/

Copies on CD-ROM can be requested from mst10@jro.igb.gob.pe.

As a new approach, the workshop was divided into two parts. The first consisted of regular oral and poster presentations within the following categories:

– Radar scattering processes in the neutral atmosphere.

– D-, E-, and F-region coherent scattering.

– Winds, waves and turbulence in the middle atmosphere.

– Meteorological phenomena and applications.

– Operational aspects and recent system developments.

The second, new, part of the workshop dealt with novel perspectives and unsolved issues in the form of brainstorming sessions. A number of invited presentations were given in order to stimulate discussions. Unsolved issues included:

– What is the turbulence seen by MST radars?

– How do the vertical velocities seen by MST radars relate to the vertical velocities considered by atmospheric modellers?

– What is the scattering mechanism responsible for Polar Mesosphere Summer Echoes (PMSE)?

– Why is there a difference between the occurrence of PMSEs in the Northern and Southern Hemispheres?

– What is the generation mechanism for E- and F-region scatterers?

New areas of interest included:

– The use of adaptive ground clutter rejection.

– The diagnostic capabilities of backscatter anisotropy.

– The use of multi-frequency observation techniques.

– A structure function approach to analysis for spaced antenna radars.

– The exploitation of commercial radio transmissions for passive radar observations of the atmosphere.

– Applications of a world-wide network of mesospheric radars, with special emphasis on the Space Shuttle Columbia disaster.

The discussions led to resolutions for:

- The coordination of hemispheric and interhemispheric observations of PMSEs in order to better understand the differences in occurrence at different locations.
- The continuation of MST radar schools, at the national and international level, in order to ensure a continuation of expertise in this field.
- The re-establishment and enhancement of existing radars, and the addition of new facilities, in order to create an "International Network of Tropical Radars" to address topics specific to the near-equatorial atmosphere.
- Further multi-instrument campaigns to study the mid-latitude E-region in order to improve the theoretical understanding of the plasma irregularities.

MST10 was sponsored by the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP), the International Union of Radio Science (URSI), the National Science Foundation (NSF) of the USA, Atmospheric Radar Systems (ATRAD) of Australia, Genesis Software of Australia, Modular Antenna Radar Designs Of Canada (MARDOC), and Consejo Nacional de Ciencia y Tecnologia (CONCYTEC) of Peru.

The International Steering Group of MST10 consisted of: J. Röttger (Chair, Germany), J. Chau (Peru), S. Fukao (Japan), E. Kudeki (USA), and R. Woodman (Peru).
Adherent to the International Steering Group were the Chairpersons of the MST Radar Permanent Working Groups: P. Chilson (USA), D. Holdsworth (Australia), G. Nastrom (USA), P. B. Rao (India), and M. Yamamoto (Japan).
Honorary Members of the International Steering Group are: M. F. Larsen (USA), C. H. Liu (Taiwan), A. P. Mitra (India).
The National Organizing Committee consisted of: R. Woodman (Chair), J. Chau, A. Mabres, and M. Sarango.
The Local Organizing Committee consisted of: R. Rodriguez (Chair), W. Ipanaque, and S. Balarezo.
The Program Committee included the members of the International Steering Committee and the following Topical Conveners: K. Gage (USA), W. Hocking (Canada), D. Hysell (USA), H. Luce (France), A. Muschinski (USA), R. Palmer (USA), I. Reid (Australia), D. Riggin (USA), and D. Thorsen (USA).

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David Hooper and Daggumati Narayana Rao

Guest Editors