Comparative Aeronomy on Earth and Mars

This workshop will discuss the most important physical processes, major scientific puzzles, and observational techniques related to the aeronomy of Earth and Mars. Its aim is to stimulate an interest in martian aeronomy in scientists working in terrestrial aeronomy, with the hope that the application of their skills and wisdom can advance our understanding of Mars. At the same time, comparative studies offer feedback and insights that benefit terrestrial atmospheric science. An introduction to the basic physical similarities and differences between Earth and Mars will be provided for context, then four invited talks will discuss dynamics, modelling, instrumentation, and data access.

Timeline:
Five 15 minute talks followed by 45 minutes for open discussion.

Tentative Schedule:

Introduction
Michael Mendillo
Introduction to basic physical similarities and differences between the aeronomic systems of Earth and Mars. The major issues at Mars parallel in many ways the CEDAR's Phase III initiatives.

Solar Terrestrial Interactions:
How does the martian ionosphere and thermosphere respond to solar flares, solar CMEs, and the 11-yr solar cycle?

Polar Aeronomy:
How does Mars's weak and patchy magnetic field affect the responses of the thermosphere and ionosphere to the solar wind?

Long-term Variations:
What are the current and past escape rates and dominant processes for ionized and neutral species?

Coupling with Lower Altitudes:
How are upper atmospheric temperatures and winds influenced by lower atmospheric temperatures, winds, tides, and waves? Does the state of the upper atmosphere affect the lower atmosphere at all? What processes and properties govern the behaviour of tides and waves?

Invited Talk #1: "Tides and Gravity Waves on Earth and Mars"

Monica Angelats i Coll (tentative)

What physical properties are most important on each planet for controlling tides and gravity waves? Land/ocean contrasts, topography, ozone layer, dust loading, thunderstorms?

What terrestrial models are most suited to interpreting the sparse martian data?

What controls dissipation and how can it be studied? Wave-wave coupling, molecular viscosity?

Invited Talk #2: Thermospheric GCMs for Earth and Mars"

Steve Bougher (tentative)

What do models do well and what do they do poorly? Are their successes and failures similar on Earth and Mars?

What additional processes need to be included in models? Coupling to lower atmosphere, magnetic environment, better interactions between ions and neutrals, wave phenomena?

How can the community get access to output from the various GCMs?

Invited Talk #3: "Aeronomy Instrumentation for Earth and Mars"

Rod Heelis (tentative)

What earth-orbiting instruments would you like to see in Mars orbit and which are technically ready to do so?

What mission opportunities exist?

Can any ground-based techniques be applied to Mars for the first time?

Can any ground-based techniques be applied to Mars on a regular, coordinated basis to build up a useful long-term database?

Invited Talk #4: "Getting your hands on Mars data and sample studies of Space Weather"

Paul Withers

Discussion of the available data for Mars (Mariner 6, 7, 9 UV; Viking RPA; MGS TES; MGS and ODY ACC; MGS RS; Mars Express; ground-based) and how to get it so that people can start their own Mars aeronomy project.

What are NSF and NASA grants programs of relevance?

What are the most important analyses to perform with these datasets?

What cross-dataset analyses are the most useful?

How can CEDAR encourage comparative aeronomy?

Research example: Solar variability control of martian ionospheric variability

Workshop Participants - Audience Discussion - 45 minutes