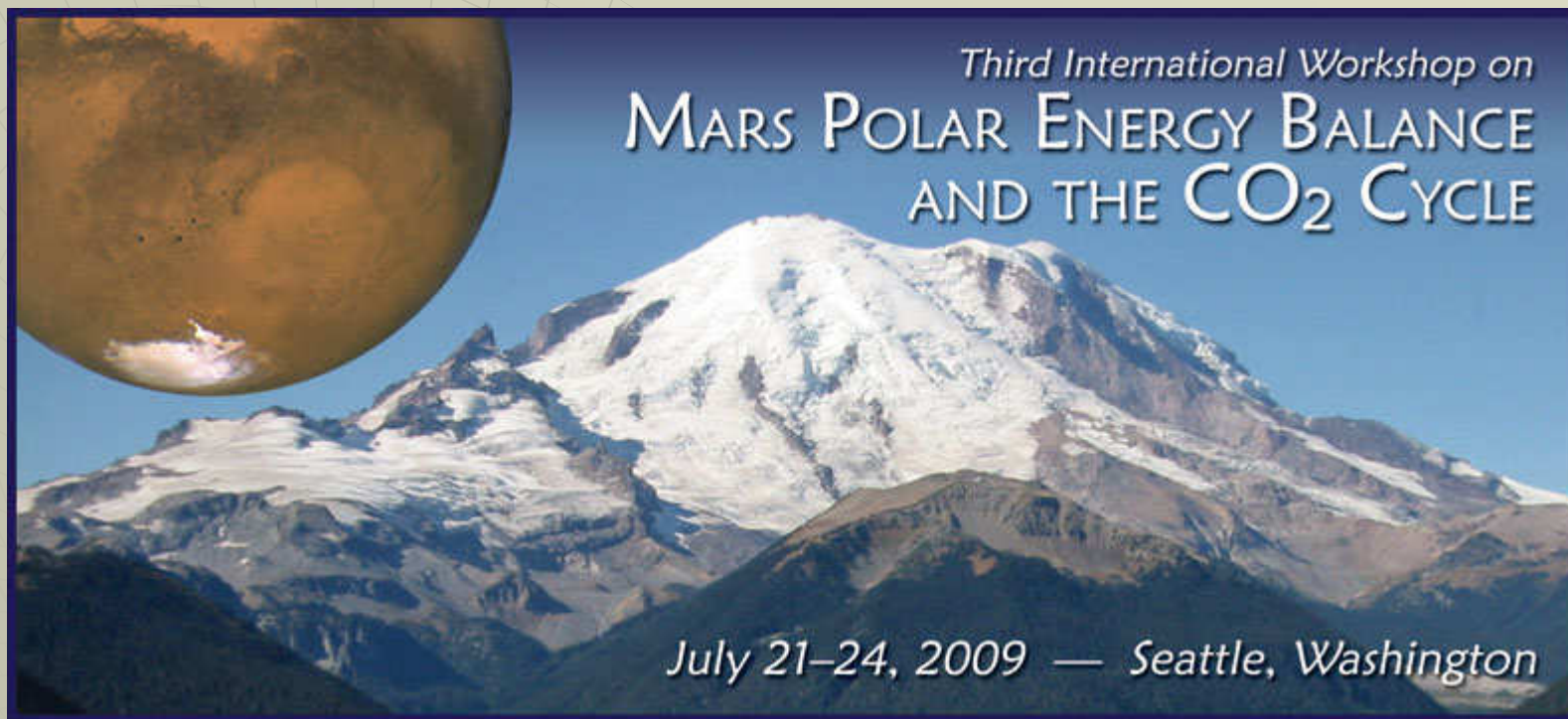


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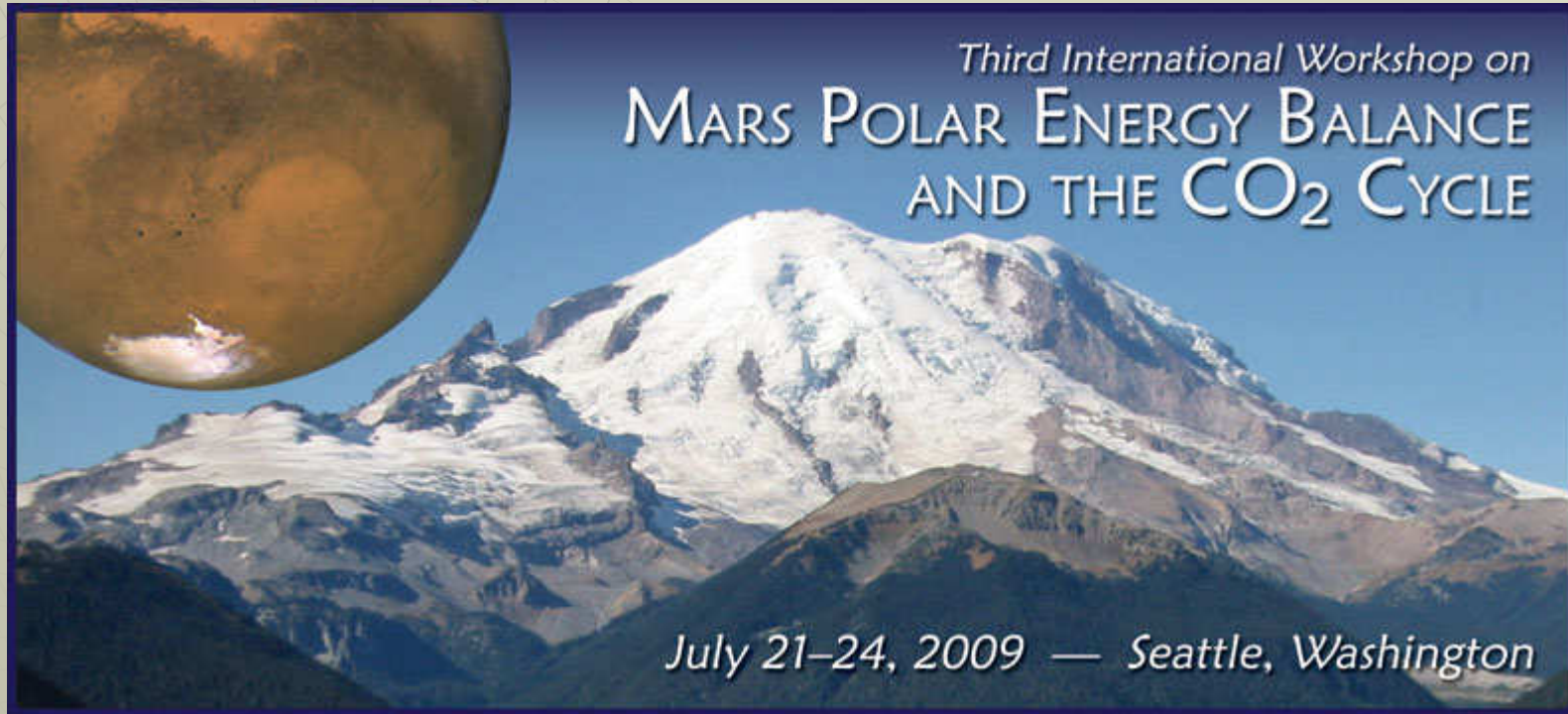
White Paper



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U.S. Geological Survey
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The Polar Regions:

Where the atmosphere becomes the surface.



& the surface becomes the
atmosphere.



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Mars Polar Energy Balance Workshop

- ◆ 36 Registered Attendees
- ◆ United States
- ◆ France
- ◆ Russia
- ◆ Germany
- ◆ Switzerland
- ◆ Spacecraft Instrument Teams
- ◆ Atmospheric Modelers
 - GCM
 - Mesoscale
- ◆ Thermal Inertia
- ◆ Laboratory Experimentalists
- ◆ Spectroscopists

Mars Polar Energy Balance Workshop

- ◆ HiRISE
- ◆ CRISM
- ◆ CTX
- ◆ Marci
- ◆ OMEGA
- ◆ THEMIS
- ◆ Neutron Spectrometer
- ◆ TES
- ◆ MOLA
- ◆ MOC

Why should you care?

- ◆ 25-30% of the Mars Atmosphere is cycled through the polar caps annually
- ◆ Understanding the current climate is a precursor to understanding Mars past climates.
- ◆ Most dynamically Active Place today
 - CO₂ Jets & the carving of "spiders."
 - CO₂ Ice Snow Storms



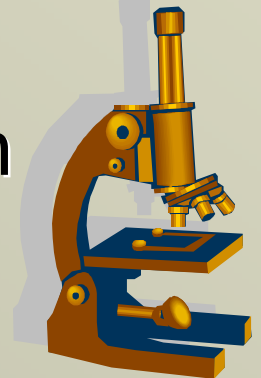


Priorities for the Next Decade (The Teenage Years of the 21st Century)

- ◆ Mars Polar Fundamental Research & Data Analysis Program
 - Mars Polar Research is inter-disciplinary.
 - Mars Fundamental Research
 - Mars Data Analysis
- ◆ **CO₂ Ice Laboratory Experiments**
- ◆ What are the densities of the seasonal and residual CO₂ ices as a function of space & time?
- ◆ Long-term monitoring of the mass of the atmosphere.
- ◆ Measurements of the mixture ratios of the Non-condensable Gas Enhancement in the polar region.

Mars Polar Fundamental Research & Data Analysis Program(s)

- ◆ Mars Polar Fundamental Research
 - **CO₂ Ice Laboratory Experiments**
 - ◆ Spectral Properties of mixtures under Mars conditions
 - ◆ Physical Properties of mixtures under Mars conditions
- ◆ Mars Data Analysis
 - More allocated funds to analyze the data we have.
 - More interdisciplinary cross-platform research



What are the densities of the seasonal and residual CO₂ ices as a function of space & time?

- ◆ Height evolution of the seasonal caps
 - MOLA on Steroids
 - Interferometric Synthetic Aperture Radar
- ◆ Higher spatial resolution of the Column Density of Seasonal CO₂.
 - Collimated Thermal Neutron Detector

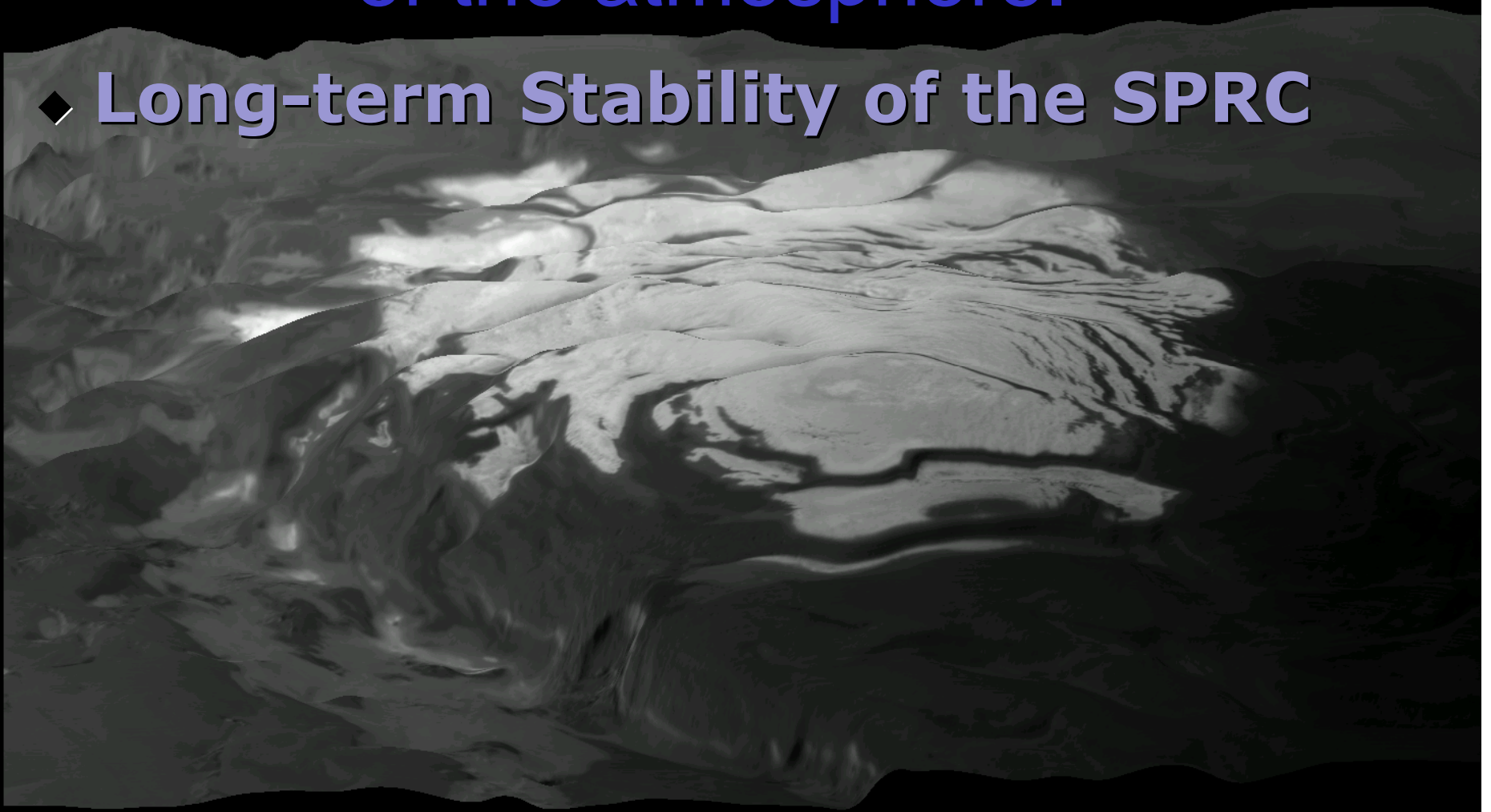
Long-term monitoring of the mass of the atmosphere.

Pressure is the heartbeat of the Climate



Long-term monitoring of the mass
of the atmosphere.

- ◆ **Long-term Stability of the SPRC**



Long-term monitoring of the mass of the atmosphere.

- ◆ **Long-term Stability of the SPRC**
- ◆ Pressure measurements accurate to a few Pascal per Mars decade.
- ◆ Surface Pressure
 - E.g. RTG Polar Lander.
 - Network landers.
- ◆ Orbital Measurements
- ◆ Telescopic Measurements

Measurements of the mixture ratios of the Non-condensable Gas Enhancement in the polar region.

- ◆ Can increases in the mixing ratio of non-condensable gasses account for observed super-saturation of the atmosphere in the polar night?
- ◆ What are the implications for CO₂ cloud and snow formation?



Mars Polar Energy



Balance & CO₂ Cycle Priorities

- ◆ Establish a Mars Polar Fundamental Research & Data Analysis Program
 - Mars Fundamental Research
 - Mars Data Analysis
- ◆ **CO₂ Ice experiments under Mars conditions**
- ◆ Determine the densities of the seasonal and residual CO₂ ices as a function of space & time.
- ◆ Establish long-term monitoring of the mass of the atmosphere.
- ◆ Measure the mixture ratios of the Non-condensable Gas Enhancement in the polar region as a function of space & time.

Backup Slides



Mars Polar Discovery Highlights

- ◆ TES discovered that jets of dusty gas produce dark markings on the south polar cap.
- ◆ TES discovered why the "Mountains of Mitchel" remain bright well into local spring.
- ◆ THEMIS solves Martian polar riddle of Jets.
- ◆ THEMIS confirms water ice at Mars polar cap