These simplified models complement full-physics GCMs because they help understand key physical processes (such as flow instabilities) that are too difficult to elegantly isolate from the complexities of full-physics GCM atmospheres. The idealized approach may shed new insight into the physical connections between vortex instabilities and the Venusian global circulation.

In addition to idealized models, SSEC continues to take a leading role in observational analysis of cloud structures related to Venusian vortices.

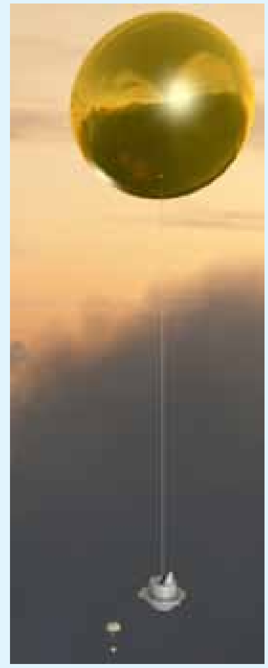
In imagery sequences from the Venus Monitoring Camera aboard Venus Express, large spiral bands can be seen expanding toward the equator from the turbulent vortex core centered near the pole. Scientists are currently examining the temporal and spatial characteristics of these wave structures to determine if these waves are planetary vortex Rossby waves propagating on the meridional vortex structure.

If these waves are in fact Rossby waves, and if they can be related to the zonally asymmetric structures in the core of the Venusian vortices, then it can be stated that vortex instabilities likely influence the global circulation of Venus. With the assistance of GCMs and idealized models, it is hoped that the wave-mean flow interactions between Rossby waves and the general circulation can be quantified.

Christopher Rozoff
Sanjay LImaye

Exploring Venus with High-Altitude Balloons

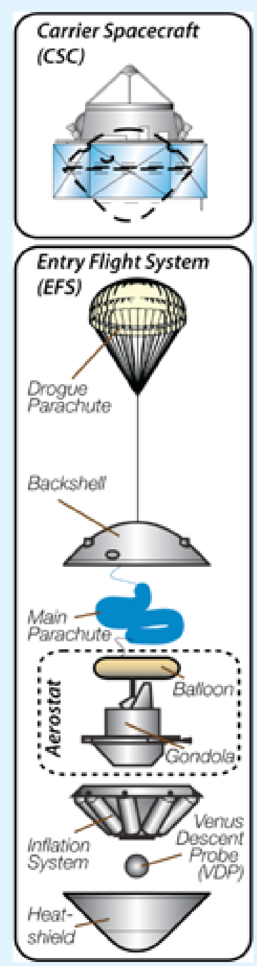
The balloon-borne Venus Aerostatic-Lift Observatories for in-situ Research (VALOR) aerostat is a proposed mission to circumnavigate the northern skies of our sister world, Venus, multiple times during a 24-day flight.



"Venus is perfect for a balloon mission," says Principal Investigator Kevin Baines. "It's CO_2 atmosphere is 50% more dense than the nitrogen that makes up 75% of our atmosphere, so it will support more weight in a helium balloon."

Carried by winds at its 55.5 km high float altitude, the VALOR balloon would sample the chemistry and dynamics of Venus's sulfur-cloud meteorology. Clouds on Venus are formed chemically, rather than by condensation, so they have different dynamics. Cloud motion is difficult to determine from orbit. Zonal, meridional, and vertical winds would be measured with unprecedented precision, as would trace gases associated with Venus's active photo- and thermo-chemistry.

"You can't measure noble gases from orbit," Baines says. "They are inert and have no spectral signatures. But they don't change with time, so if you get down into the atmosphere, you get a record from millions of years back. Their isotopes will tell you about the origin of the planet. You just have to be in the atmosphere to measure and sample them. The balloon stays at an altitude where temperature is about room temperature (at half a bar pressure; the wind will be around 100 knots). The jet streams take the balloon around the world in 4 days. It's a tough balloon."



In addition, VALOR will sense present-day volcanism, lightning, and thunder. VALOR will measure Venus' super-rotating winds from temperate to near-polar latitudes (from 25° north to 60° north, or higher). VALOR will also detect convective activity and fly over the tallest plateaus of Venus, searching for topographically-induced gravity waves.

Finally, a deep atmospheric probe supplied by the Russian Space Research Institute will profile pressures, temperatures, and winds down to the ground, examining the stability of the near-surface temperature.

"Why is it that Venus has 100 mph winds – everywhere?" Baines asks. "We don't know, but it could be important. There is a very good chance that we might get some real information about Earth winds via Venus studies."