# The evolution of Venus : what can we learn from the European Venus Explorer mission ?

E. Chassefière[1] , C. Wilson[2] and the EVE team

[1]Interactions et Dynamique des Environnements de Surface, CNRS-UPS, Université Paris-Sud, Bât. 504, 91405, Orsay Cedex, France
[2]Dept. of Atmospheric, Oceanic and Planetary Physics, Oxford University, Oxford, OX1 3PU, U.K.

Understanding the climate and past evolution of Venus is a major challenge of comparative planetology. Venus and Earth have been formed in relatively similar conditions, but evolved in drastically different ways, for reasons not still well understood. Venus could have been globally dried up relatively early in its history, due to the combination of a lower initial water endowment and a stronger hydrodynamic escape of water vapor from its atmosphere as compared to Earth [1], but the planet could have been endowed with cometary water long after accretion, possibly hosting bodies of liquid water for a certain time before runaway greenhouse occurred. A detailed investigation of Venus atmospheric composition and radiative balance, which can be done only by in-situ measurements from aerial platforms (like balloons), will provide major keys for deciphering the evolution of Venus.

A few years ago, it was proposed by a group of scientists, under European leadership, to use a balloon to characterize – by in-situ measurements – the evolution, composition and dynamics of the Venus atmosphere. This balloon was part of a mission called EVE (European Venus Explorer), which was proposed in response to the ESA AO for the first slice of the Cosmic Vision (CV) program by a wide international consortium including Europe, Russia, Japan and USA [2]. EVE will be proposed again in 2010 or 2011 in response to the ESA AO for the second slice of the CV program, for a launch in 2023.

The nominal mission scenario for the second EVE proposal consists of a superpressure balloon deployed at 55 km and low latitude (10-20°), with a nominal lifetime of 10 days, carrying a scientific payload of 15 kg devoted to the detailed measurements of (i) noble gases and stable isotopes, to improve our knowledge of Venus climate evolution, (ii) gas and particles chemical composition, to better understand the complex mechanisms cycling sulfur and other components in the low and middle atmosphere and (iii) radiative and meteorological parameters, in order to understand atmospheric super-rotation and wave activity. ESA would provide the launcher, the carrier, the entry probe and the instrumented gondola, the balloon and its inflation system being provided by CNES. The addition of an orbiter, provided by an international partner (Russia, India, other?) would be of great value for both providing context science and allowing a higher data transmission rate to Earth. Optionally, a second balloon could be deployed at polar latitudes to characterize the still unexplored vortex region. The release of miniprobes, carrying simple optical, meteorological and chemical sensors, together with a multi-wavelength imager, is under study as an option.

A few important results expected from EVE to better characterize the evolution of the planet will be presented and discussed.

**References**

[1] Gillmann, C., E. Chassefière and Ph. Lognonné, Earth Planet. Sci. Lett., 286, 503 (2009)
[2] E. Chassefière et al., Exp. Astron. 23, 741 (2009)