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# On the magnetic configuration near Venus: EOF modeling and statistical analyses based on Venus Express measurements

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## Abstract

More than 2000 orbits of Venus Express magnetic field measurements are used for Orthogonal Function (EOF) analysis to study and model the magnetic environment over the Venus northern polar cap. The modeling results extract the dominant coherent variations, separate the known physical phenomena on different EOFs and identify the most important driving factors. EOF1 represents the magnetic draping configuration of IMF Bz component whereas EOF2 is controlled by IMF By component and presents the draping and piling-up of IMF By. Besides, our analysis illustrates an asymmetric response of magnetic By component to IMF between the ±E hemispheres, constricted over the terminator (about 90–93° Solar Zeniths Angle) below 300km altitude. The magnetic By component increases as the increase of the parallel IMF component in the +E hemisphere but antiparallel IMF component the –E. To detail the asymmetry, we define a new coordinate system referring to the Sun-Venus-VEX plane which is more robust in comparison with the SVE or VSO coordinate system, and develop a new data averaging method which balances the significance and resolution of data representation. Our result suggests the asymmetry is neither resulting from a large plane of current nor a line of current.

## 1. Introduction

Venus Express (VEX) data advance the details of the magnetic configuration near Venus, such as the asymmetry in the magnetic field draping pattern in the near magnetotail between the VSE ±E hemispheres [Zhang et al. 2010], different magnetic field topologies at low altitude [Dubinin et al. 2013], and the asymmetry of the magnetic field configuration in the low altitude ionosphere (<300 km) [Dubinin et al., 2014]. These studies used either method basing on selected cases or data averaging within equal sized bins split up from the sample space. The first method suffers from the risk of relying too heavily on interpretation to guide findings, whereas the second one yields results with inhomogeneous significance due to inhomogeneous space data coverage. In the present work, we aim to implement new statistical method to consolidate the knowledge on Venus, develop new data binning method to improve the efficiency of data representation, and tailor EOF modeling technique to build an empirical model for the low altitude magnetic configuration following He et al., [2011, 2012, 2013].

## 2. Figures

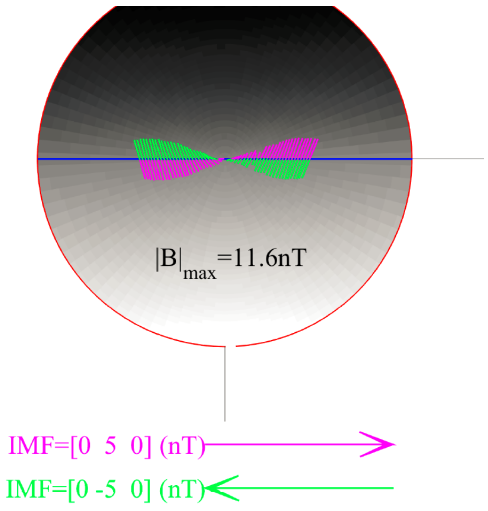


Figure 1: polar magnetic configuration represented by EOF2 in response to the reverse of IMF By component, viewed over the North Pole. The magenta elements represent IMF equals to (0, 5nT, 0) and the green ones represent for (0, -5nT, 0). In each panel, the blue line represents the terminator and the red one is the equator.

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