PLASLIFE: A tool to assist in the interpretation of ionospheric observations at the Earth and Venus

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The PLASLIFE (PLASma LIFEtime) code, developed at Aberystwyth University, is a tool used to assist in the interpretation of ionospheric observations. The code calculates the plasma density in a volume of plasma at one second intervals. As a starting point an initial value for the density of this volume is required as input and the subsequent rate of change depends upon several driving parameters: Solar flux, solar zenith angle, thermospheric composition, optical depth of the atmosphere, ion temperature, neutral temperature and relative velocity of the ion and the neutral species. Each of these can be varied and chosen to be representative of estimated conditions.

PLASLIFE was originally developed for use in the high-latitude terrestrial ionosphere at the F-layer peak and it has been used to simulate the decay of large-scale plasma density enhancements known as polar cap patches. The combination of these simulations with observations has enabled studies of the origin and evolution of these enhancements. PLASLIFE has also been used to determine the relative importance of the parameters driving the changes in the plasma density by varying any one parameter, or combination of parameters, whilst keeping others constant.

The modular form of the code means that PLASLIFE can readily be adapted to represent other situations and it has recently been modified for the Venusian ionosphere where it was used to simulate the nightward flow of ions at the terminator. The code quantified the extent of penetration of dayside plasma into the nightside, and hence determined the importance of the transterminator transport process. The next application will be to quantify what proportion of the nightward flow observed at the terminator populates the nightside ionosphere and what proportion, if any, is lost to the solar wind.

The modeling approach and scientific results from PLASLIFE are discussed together with the modifications required to apply this code to other scenarios, including exo-solar planets.