INTERSTELLAR FLOW AND TEMPERATURE DETERMINATION WITH IBEX: ROBUSTNESS AND SENSITIVITY TO SYSTEMATIC EFFECTS

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ABSTRACT

The Interstellar Boundary Explorer (IBEX) samples the interstellar neutral (ISN) gas flow of several species every year from December through late March when the Earth moves into the incoming flow. The first quantitative analyses of these data resulted in a narrow tube in four-dimensional interstellar parameter space, which couples speed, flow latitude, flow longitude, and temperature, and center values with approximately 3° larger longitude and 3 km s−1 lower speed, but with temperature similar to that obtained from observations by the Ulysses spacecraft. IBEX has now recorded six years of ISN flow observations, providing a large database over increasing solar activity and using varying viewing strategies. In this paper, we evaluate systematic effects that are important for the ISN flow vector and temperature determination. We find that all models in use return ISN parameters well within the observational uncertainties and that the derived ISN flow direction is resilient against uncertainties in the ionization rate. We establish observationally an effective IBEX-Lo pointing uncertainty of ±0.18° in spin angle and confirm an uncertainty of ±0.1° in longitude. We also show that the IBEX viewing strategy with different spin-axis orientations minimizes the impact of several systematic uncertainties, and thus improves the robustness of the measurement. The Helium Warm Breeze has likely contributed substantially to the somewhat different center values of the ISN flow vector. By separating the flow vector and temperature determination, we can mitigate these effects on the analysis, which returns an ISN flow vector very close to the Ulysses results, but with a substantially higher temperature. Due to coupling with the ISN flow speed along the ISN parameter tube, we provide the temperature *T*VISN∞ = 8710 +440 -680 K for *V*ISN∞ = 26 km s-1 for comparison, where most of the uncertainty is systematic and likely due to the presence of the Warm Breeze.