Comparison of Monte-Carlo ion cyclotron heating model with full-wave linear absorption model

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Abstract. To fully account for the wave-particle interaction physics in ion-cyclotron resonant frequency (ICRF) heating experiment, finite orbit effects and non-Maxwellian distribution have to be self-consistently coupled with full-wave solutions. For this purpose, the 5-D Monte-Carlo code ORBIT-RF is being coupled with the 2-D full wave code AORSA to iteratively evolve the ion distribution in 4D spatial-velocity-space that is used to update the dielectric tensor in AORSA for evaluating the full-wave fields. In this paper, it is demonstrated that using the full-wave fields from a Maxwellian dielectric tensor in AORSA and confining the resonant ions to their initial orbits in ORBIT-RF, ORBIT-RF largely reproduces the AORSA linear wave absorption profiles for fundamental and higher harmonic ICRF heating. An exception is an observed inward shift of the ORBIT-RF absorption peak for high harmonics near the magnetic-axis compared with that of AORSA, which can be attributed to a finite orbit width effect. The success of this verification supports the validity of the Monte-Carlo wave-particle interaction model and the readiness of the iterative coupling between ORBIT-RF and AORSA for an improved modeling of ICRF heating experiments.