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Accuracy of MRI-based Magnetic Susceptibility Measurements STEPHEN RUSSEK, HANNAH ERDEVIG, KATHRYN KEENAN, KARL STUPIC, NIST - Boulder — Magnetic Resonance Imaging (MRI) is increasingly used to map tissue susceptibility to identify microbleeds associated with brain injury and pathologic iron deposits associated with neurologic diseases such as Parkinson's and Alzheimer's disease. Field distortions with a resolution of a few parts per billion can be measured using MRI phase maps. The field distortion map can be inverted to obtain a quantitative susceptibility map. To determine the accuracy of MRI-based susceptibility measurements, a set of phantoms with paramagnetic salts and nano-iron gels were fabricated. The shapes and orientations of features were varied. Measured susceptibility of 1.0 mM GdCl₃ solution in water as a function of temperature agreed well with the theoretical predictions, assuming Gd^{+3} is spin 7/2. The MRI susceptibility measurements were compared with SQUID magnetometry. The paramagnetic susceptibility sits on top of the much larger diamagnetic susceptibility of water $(-9.04 \times 10-6)$, which leads to errors in the SQUID measurements. To extract out the paramagnetic contribution using standard magnetometry, measurements must be made down to low temperature (2K). MRI-based susceptometry is shown to be as or more accurate than standard magnetometry and susceptometry techniques.

> Stephen Russek NIST - Boulder

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