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Review #5

PROPOSAL NO.: 0417929

INSTITUTION: U of Colorado Boulder

NSF PROGRAM: GEOPHYSICS

PRINCIPAL INVESTIGATOR: Ritzwoller, Michael H

TITLE: Collaborative Research: CMG: Uncertainty and Physical Constraints in Seismic Inferences

RATING: Multiple Rating: (Very Good/Good)

REVIEW:

What is the intellectual merit of the proposed activity?

This proposal meets the criteria of the CMG program; it involves collaboration between a mathematician and a geophysicist and it touches on all three themes. It is most strongly focused on representing uncertainty in a complex geosystem, but also involves an innovative approach to tomography, which falls under the first theme, and certainly involves analysis of a large data set. The plan for collaboration seems to be fairly well worked out, with visits to each other's institutions and working through graduate students and grad student exchange visits.

Success in terms of novel approaches developed through sharing expertise will depend greatly on how closely and effectively the two PIs work together - perhaps true of any proposal of this type, but the steps are not laid out so clearly that the outcome is obvious. Ritzwoller has long been working on this type of tomographic problem, recently incorporating physical constraints directly into the inversion.

In some ways, this is a novel approach, but in other ways, it follows a long tradition of simply using observations to determine the best parameters in a physical model of predetermined form. In principle, it is really not much different from solving for the best velocities based on geological province or age of sea floor or any other a priori physical basis, or with constraints such as non-negativity or maximizing smoothness. In that sense, the proposal follows an already established research agenda. As the PIs point out, the procedures used in incorporating any physical model will be highly specific to the particular problem, so it is not clear what general procedures can be developed that will be applicable to this general class of problem. However, having a statistician thinking about the problem in conjunction with a geophysicist will probably improve the error estimates and the recognition of model failures in this particular application and may well come up with an approach that I am not aware of that will be of use in other applications.

What are the broader impacts of the proposed activity?

The broader impacts are routine for this type of research proposal - some benefit in terms of education of individual students, plus carryover of research results to classroom and broader community.

Summary Statement

90% of my weight is put on the intellectual merit for this type of proposal.

[Back to Proposal Status](#)

