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Preface to the Special Issue on "Arrays and Array Methods in Global Seismology"

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The increased availability and fidelity of broadband seismic instruments have played a key role in bridging the gap between exploration and global seismic applications. Long gone are the days when global structure mapping and source characterization/monitoring relied on the manual digitization of WWSSN (World-Wide Standard Seismographic Network) analogue records or hours in front of microfiche machines. Even the GSN (Global Seismographic Network), a milestone of the digital era, now pales in comparison with the scope and density of regional seismic arrays that dominate the global data stream. Today, the nominal resolution estimated from the ratio between wavelength (approximately tens to hundreds of kilometers) and target dimension (often of continental scale) in properly designed global experiments could rival the typical resolution of a controlled source seismic survey. Vastly improved data coverage, highlighted by multi-disciplinary initiatives such as the USArray project, has overcome many conceptual (as well as practical) barriers between exploration and global seismic applications. A direct consequence is that the "global community" can now take full advantage of important array methods that are predicated upon superior data density and distribution. In fact, it could legitimately be argued that exploration seismology is fast becoming a realistic, scaled-down model for global seismic surveys.

This Special Issue reviews the assumptions, algorithms and prospects of several important methodologies in today's global and regional seismic surveys. A key objective is to highlight developments and novel applications that improve our ability to determine seismic structures across all spatial scales. We mainly emphasize those methodologies and applications that are relevant to structure imaging (note: source characterization may be detailed in a future Special Issue). Apart from the obvious scale differences between exploration (<20 km) and global (typically > several 100 km) problems, we demonstrate that key objectives such as signal isolation, correlation, reconstruction and noise reduction

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are nearly independent of the application. The topics covered in this Special Issue include, but are not limited to, data migration (Rost and Thomas), PP and SS precursors (Deuss), the Radon transform (Gu and Sacchi), mantle triplication (Wang, Wen and Weidner), P-to-S and S-to-P converted waves (Rondenay), shear-wave splitting (Long and Silver), seismic tomography (Boschi, Fry, Ekström and Giardini), and ambient-noise interferometry (Snieder, Miyazawa, Slob, Vasconcelos and Wapenaar). Each data type/methodology has increased considerably our understanding of the Earth's mineralogy and dynamics. The fundamentals and backgrounds of the relevant approaches are carefully documented for ease of comparison, implementation and critique by the general readership.

The eight contributions in this Special Issue are ordered by the approximate imaging depths of the methods therein. Admittedly, this subjective ordering scheme is debatable at best since most methods are viable for a wide range of applications (both regional and global) and depths. This Special Issue begins with an overview of the fast growing inventory of array methods, and concludes with a detailed review of Green's function retrieval using ambient seismic noise, a powerful concept that has also found important applications in physics, acoustics, engineering and medical imaging. The depths accessible by the data and methodologies of the remaining contributions span the top 2,900 km of the Earth's interior.

We hope that readers will find this to be a valuable collection of timely papers. Finally, we sincerely thank all the contributors and all the referees for their valuable work. We are also indebted to Petra van Steenbergen (Publishing Editor) and Joanne Cabato (Journal Editorial Assistant) for their great support and assistance throughout the editorial process.