Preface

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My initial exposure to early data from the *Solar Dynamics Observatory* (SDO) took place late one morning in the Spring of 2010 and eventually ended in the early evening. As night fell, I found myself feeling excited, a little relieved, and hugely impressed by the scientific and technical contributions of those who developed the SDO systems. I was also confounded by what I had seen.

The data were so rich! The temporal and spatial content of the imagery was overwhelming. It took until the next morning for me to realize that the new data were, in fact, revolutionary. In half a day, my understanding of the dynamic Sun had been swept away by the SDO systems. The mission's quest for new observing capability was wildly successful! I could only speculate on the SDO's future impact on scientific research.

In its first year SDO has given us unprecedented views of filament eruptions, measured the total energy emitted by flares, and started watching for active regions before they erupt through the solar surface. Each is a vital piece in our understanding of solar activity and of how that activity creates space weather. Filament eruptions are the source of coronal mass ejections, while solar flares increase satellite drag and disrupt communications. Prediction of solar activity is a goal of SDO and knowing where they will erupt is a major step toward short-term prediction.

SDO is the first space-based mission of NASA's Living With a Star program. It carries three instruments dedicated to improving our understanding of the production, evolution, and destruction of the solar magnetic field. The SDO science investigation teams are committed to rapidly providing their data to scientists, space-weather organizations, and the public.

SDO provides full-disk images of the Sun in many wavelengths, starting in the soft X-ray and moving through the UV into the visible. Magnetic-field maps and Doppler-velocity maps

The Solar Dynamics Observatory

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are now obtained at cadences never before achieved. The EUV spectral irradiance is measured at an unprecedented rate allowing the estimation of the total energy radiated by even small, C-class flares. This irradiance is also used to calibrate the EUV images, so that the radiance from coronal loops can be measured and converted into temperature maps. By revealing global changes in the solar atmosphere over spatial scales ranging from the resolution limit to fractions of a solar diameter, SDO is writing a new chapter in our understanding of the Sun and of how space weather is created by solar activity.

This volume on the *Solar Dynamics Observatory* (SDO) mission continues a tradition of *Solar Physics* to dedicate topical issues to major space science missions. I encourage you to read the articles, use SDO data in your research, and simply enjoy looking at the Sun in the splendor that SDO is revealing.