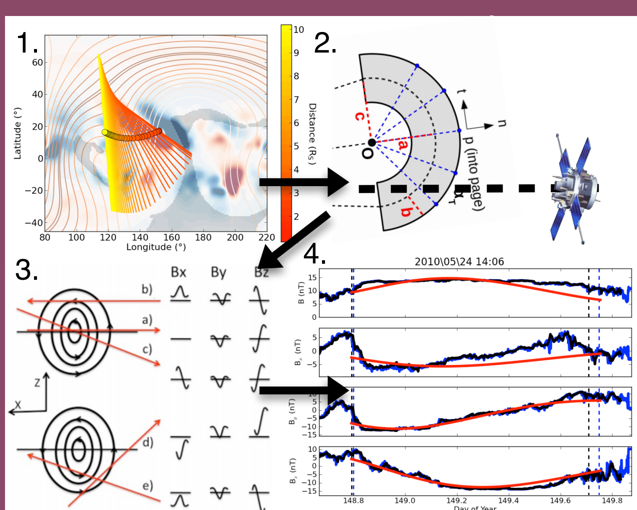
Summary of Involvement for the Metcalf Travel Award
SDO 2016: Unraveling the Sun's Complexity ~ October 17-21, 2016 ~ Burlington, VT

Christina Kay is a NASA Postdoctoral Program fellow at NASA Goddard Space Flight Center working with Nat Gopalswamy. She received her PhD from Boston University in 2015 where she worked with Merav Opher on modeling the deflection and rotations of both solar system and M dwarf CMEs. She has continued studying the nonradial behavior of CMEs at NASA GSFC and has begun looking at the effects of deflection and rotation on the in situ signatures of CMEs. She is passionate about bringing advanced computational techniques into heliophysics research, especially the use of GPUs for massively parallel programming.

Contribution: Determining ICME Magnetic Field Orientation with the ForeCAT In Situ Data Observer *or* Using Simplified Models to Describe CMEs from Sun to Earth

CMEs drive the strongest space weather events at Earth and throughout the solar system. At Earth, the amount of southward magnetic field in a CME is a major component in determining the severity of an impact. We present results from ForeCAT (Forecasting a CME's Altered Trajectory, Kay et al. 2015), which predicts the deflection and rotation of CMEs based on magnetic forces determined by the background magnetic field. Using HMI magnetograms to reconstruct the background magnetic field and AIA images to constrain the early evolution of CMEs, we show that we can reproduce the deflection and rotation of CMEs observed in the corona. Using this CME location and orientation from ForeCAT results and a simple force-free flux rope model we show that we can reproduce the in situ magnetic profiles of Earth-impacting CMEs. We compare these results with the in situ profiles obtained assuming that no deflection or rotation occurs, and find that including these nonradial effects is essential for accurate space weather forecasting.



The figure illustrates the method for determining in situ magnetic profiles of CMEs. (1) A CME is simulated with ForeCAT, yielding a final CME position, orientation, and shape. (2) The ForeCAT outputs are used to propagate a CME structure past a spacecraft, giving the position of the spacecraft with respect to the CME's axis as a function of time. (3) The spacecraft's position determines the relative magnitudes of the toroidal and poloidal components of the magnetic field (image from Borg et al. 2012). (4) The orientation of the CME and the magnitude of the toroidal and poloidal components are converted into the spacecraft coordinates and compared with observations.

Christina is very grateful for the opportunity to present her work at SDO 2016. Attending the meeting provided many opportunities to discuss potential applications for her models and important studies, particularly related to the magnetic field that drive the simulations.