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Detection Performance of L1-based NEO Surveys

Philipp Maier[1], Raffaella Franco[2], Johannes Gelhaus[3], and Sven Müller[4]
[1]*ESA/ESTEC, Keplerlaan 1, NL-2200 AZ, Noordwijk, The Netherlands, +31 71 565 3147,*
[2]*ESA/ESTEC, Keplerlaan 1, NL-2200 AZ, Noordwijk, The Netherlands, +31 71 565 4772,*
[3]*Technische Universität Braunschweig, Hermann-Blenk-Str. 23, 38108 Braunschweig, Germany,*
[4]*Technische Universität Braunschweig, Hermann-Blenk-Str. 23, 38108 Braunschweig, Germany, +49 531 391-9974*

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ABSTRACT

Ground-based near-Earth object surveys bear intrinsic limitations in terms of observation time and observational biases. Space-based asteroid surveys, while perceived as much more costly, offer a valuable complement in regards to observation time and observable sky regions. The highly successful NEOWISE project is a prime example.
A considerable increase in data from space-based observations could be achieved if it was possible to gain value-adding data with compact sensors or with devices already installed on spacecraft. For a hypothetic space environment mission on an orbit around L1 we thus investigate and compare the expected detection performance of different sensors with a mass of less than 3 kg each. The considered sensors range from a field of view of 5x5 square degrees to 140x140 square degrees and limiting magnitudes from 16 to 9 respectively.
As reference population, the outcome of the newly developed near-Earth object population model by Granvik, Morbidelli, Bottke, and collaborators is used, with more than 25.000 objects at absolute magnitudes of 22 and brighter. Calculations are performed using the ESA NEOPOP population analysis and observation simulation tool.

In addition to comparing the expected numbers of detections among the different sensors, we also investigate the probabilities that the sensors discover previously unknown objects or objects belonging to particularly interesting subgroups such as interior to Earth orbit asteroids.
Furthermore, using the optical sensor model in NEOPOP and its ability to generate synthetic measurements, we evaluate the contribution the considered sensors could make to pinpointing the threat of 2013 PDC15.

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