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Comprehensive database of heliospheric shocks: Introduction and early results

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Fast collisionless shocks are one of the most prominent manifestations of solar activity in the interplanetary space. Their importance in solar-terrestrial physics range from acceleration of charged particles, drivers of geomagnetic disturbances to fundamental plasma physics. We present the first version of the comprehensive heliospheric shock database hosted at the University of Helsinki. The database contains currently about 1500 shocks observed by Wind, ACE, and STEREO spacecraft. In addition, the database has search tools based on the spacecraft, time range, and key shock parameters (e.g., shock type, shock strength, shock angle) and data download options. Based on the database results we have also performed the first statistical analysis spanning over a solar cycle (1995-2013) on the properties and drivers of travelling fast forward (FF) and fast reverse (FR) interplanetary shocks. We find that FF shocks dominate over FR shocks in all solar cycle phases except during solar minimum. The rate of FF shocks follows roughly the variations in solar activity, while the number of FR shocks peaks during the late descending phase. Nearly all FR shocks are driven by slow-fast stream interaction regions (SIRs), while coronal mass ejections (CMEs) are the principal drivers of FF shocks in all phases except solar minimum. The strength of the shock shows relatively little variations over solar cycle while the shock speed peaks near solar maximum. CME-driven shocks are on average stronger and they show broader distribution of physical shock parameters than SIR-driven shocks. This large variability of CME-driven shocks can be traced to the varying crossing distance through the CME structure.