

A Celestial Reference Frame based on parameterized source positions

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Abstract. The latest realization in the radio domain of the International Celestial Reference System (ICRS) is the Third Realization of the International Celestial Reference Frame (ICRF3), as adopted by Resolution B2 of the 2018 General Assembly of the International Astronomical Union (IAU). The positions of the radio sources in the ICRF3 catalog are given as time invariant coordinate pairs. Refusing to acknowledge systematics within the source positions inevitably leads to a deterioration in the quality of the frame, and thus in all derived variables. A proven approach to overcome these shortcomings is to extend the parametrization of source positions using the multivariate adaptive regression splines (MARS), as they allow a great deal of automation, by combining recursive partitioning and spline fitting in an optimal way.

In this study we investigate the impact of the aforesaid parameterization on the reference celestial frame itself. For this purpose, we will empirically analyze the differences in source positions and resulting deformations when compared to the ICRF3 as well as the Gaia-CRF, adopted as the fundamental realization of the ICRS in the optical domain by the 2021 IAU Resolution B3. The aim is to shed light on the origin of known deformations present in the ICRF as well as the differences between ICRF3 and Gaia-CRF.