STATISTICS AND ANALYTIC COMPATIBILITY TO JOINT CATALOGS WITH A SET OF COMMON ICRF DEFINING SOURCES

F.J. Marco[1], J.A. López[1], M.J. Martínez[2]

[1] Universitat Jaume I. Dep. Matemáticas. Castellón. Spain.

[2] Universitat Politècnica de València. Dep. Matemàtica Aplicada. Valencia. Spain.

The construction of quasar catalogs from other catalogs with few points but having all of them a good number of ICRF defining sources represents an interesting way to obtain an increasingly extended and accurate catalog (see [1], [2] and [3]). Anyway, there are several questions that should be taken into account in order to successfully reach this aim. For example, the residuals of each catalog should be normally distributed and this property should be also translated to the final catalog. This final property must be compatible with other related with the "defining sources" which should be well corrected in such a way that, geometrically, conform a rigid structure. Also, the total residuals in the final catalog should not decrease while the variance increases too much, in order to avoid the introduction of excessive deformations.

There are several ways to correct catalogs. Roughly speaking we can classify the different methods in parametric and non parametric. The parametric methods subdivide in geometrical (including corrections for rotation or rotation+deformation) and analytical (which consider developments in different sets of functions, such as spherical harmonics or Legendre-Fourier functions). All the parametrical methods make aprioristic suppositions about the function of residuals, in order to assure that this function belong to a certain functional space. On the other hand, non parametrical methods do not need to make any supposition about the function of residual, because they start off from the statistical properties of the data. Our method uses both techniques related with each procedure in order to get the best possible properties. \\

We will set our attention in the problems that arise when we apply improperly the parametrical methods. We could remark that the application of the discrete least squares method can provide erroneous results due to different causes, such as:\\

1. Analytical causes: a lack of homogeneity in the data, because the functional orthogonality of the set of functions employed in the adjustment is not preserved\\

2. Statistical causes: The hypothesis of the Gauss-Markov theorem should be fulfilled in order to assure that the least squares method provide the least variance estimator in the class of unbiased estimators.

All the former problems could be avoided if we use a non parametrical method as a intermediary. If this is the case, a good method is to compute an estimation of the function over fiducial points homogeneously distributed over the celestial sphere. This procedure has additional advantages: in the first place, each coefficient of a harmonic development can be computed with independence of the other. Secondly, each coefficient may be obtained from the numerical approximation of different integrals allowing that the widthband for each coefficient used in the non parametrical (local) adjustment to be the most suitable.

References:

[1] Malkin, Z. A&A. 474, 665-670. 2007

[2] Sokolova, Ju & Malkin, Z. A&A. 474, 665-670. 2007

[3] Yatskiv, Y. & Malkin, Z. Journées systèmes de réference spatio- temporels. 2007