Charter – Bias & Ambiguity Resolution (BAR) committee

Over the last decades, several Global Navigation Satellite Systems (GNSS) have been deployed in support of positioning, navigation, and timing (PNT) users, as well as Earth-science applications. Originally, GPS receivers were tracking a limited number of signals/frequencies, whose observables are subject to different satellite biases such as well-known P1-P2 and P1-C1 differential code biases. However, with the introduction of multi-GNSS constellations and multi-frequency tracking receivers, the number of different biases has grown significantly, and their accurate estimation is crucial to future high-integrity and safety-critical applications.

The newly established Bias & Ambiguity Resolution (BAR) committee supersedes and consolidates the former PPP-AR Pilot Project merging with the Bias & Calibration committee. The main objective is to coordinate research, standardisation, validation, and dissemination of bias products relevant for current GNSS and future constellations (*e.g.*, low Earth orbit, LEO). The foreseen activities of the BAR committee have a strong relationship with the clock and ionosphere products. For this reason, it is expected to operate in close collaboration with the Analysis Centre Coordinator (ACC), Real-Time Service (RTS), Clock committee, and other relevant IGS entities.

Goals and Tasks

The objectives of the BAR committee are divided into three parts. Tasks are defined in continuation of the PPP-AR Pilot Project, integrating fundamental activities carried out by the former Bias & Calibration Committee.

Part 1: harmonization and methodology consolidations

Main activities concern:

- Survey existing bias definitions, network estimation strategies, and formats across individual ACs.
- Consolidate existing observable-specific bias (OSB) conventions to accommodate all bias types, and update SINEX_Bias format if necessary.
- Address issues with datum changes, e.g., at day boundaries, exploiting continuity of the integer carrier phase measurements.
- Assessment of hardware stability, including intra-day variations and potential temperature-dependent effects.
- Definition of a *white paper* describing the status of satellite and station bias products, which shall also provide clear recommendations in preparation of upcoming LEO-PNT systems and/or signals.

Part 2: product interoperability and bias combination

Main activities concern:

- Address issues with availability of satellite products for specific signals and/or frequencies, encouraging and supporting more ACs to estimate multi-GNSS/all-frequency biases.
- Evaluate consistency between code and phase biases, in particular since are often estimated in a cascade approach rather than in a single processing step.
- Cross-validation quality assessment of clocks and biases, and standardize the specification of the product combination statistics in support of ACC and WCC.

- Initiate testing campaigns, open to the community, to evaluate performances and to identify key issues in the combined products.
- Potential development of a clock-bias combination *free and open-source* software toolbox that will be provide to the IGS community.

Part 3: ambiguity resolution and integrity monitoring

Main activities concern:

- Provide best practices for a successful integer-cycle resolution of carrier-phase ambiguities, while defining common misconceptions in the statistical interpretation of ambiguity-fixed solutions.
- Address issues with FDMA-signals, like in GLONASS, due to inter-frequency biases, or in future LEO-PNT systems working on alternative frequency bands, along with potentially accounting for intra-day variations currently neglected (or assumed slowly varying in current systems).
- Establish an integrity monitoring system to detect unmodelled errors and degraded performance during the generation of satellite clock/bias corrections.