

International Technical Symposium on Navigation and Timing (ITSNT) 2018



GMV's ***gmvBRAVE***

A powerful tool for SBAS engineering and performance analysis

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The need of a tool for engineering and analysis of a SBAS

- **Complete monitoring** of a (in-development, operational) SBAS
- **Assessment** of performances and other important parameters
- **Simplification** of maintenance/development tasks
- **Quick** scenario analysis
- **Management** of extensive number of outcomes

***gmvBRAVE* is *THE* tool**

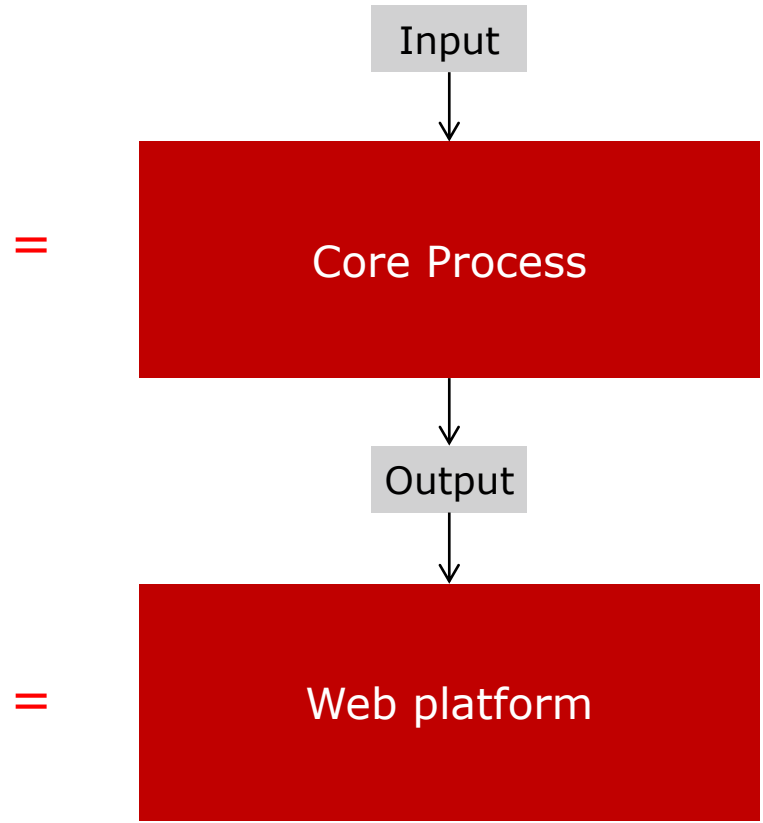
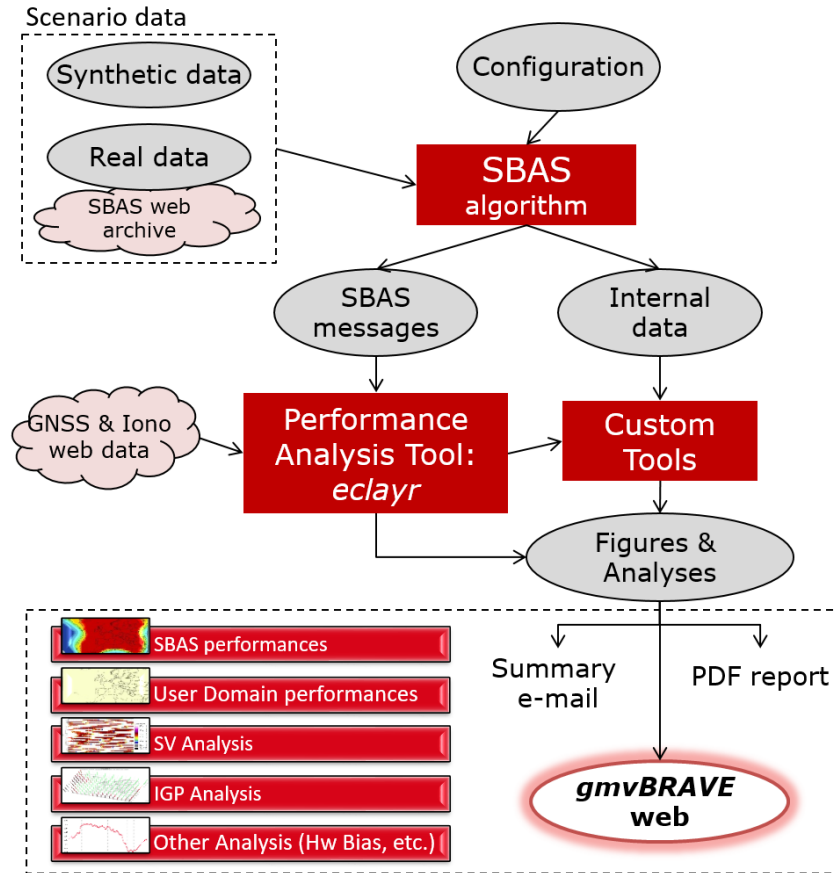
What is *gmvBRAVE*?

gmvBRAVE
(**B**rief **R**eport for **A**nalysis, **V**alidation and **E**ngineering)

Main functionalities:

- **Execution** of SBAS Algorithms
- **Monitoring** of the SBAS **performances** at system & user level
 - integrity, continuity, accuracy and availability
 - for requested services: Non-precision approach (NPA), Approach with vertical guidance (APV), etc.
- **Analysis** a set of **additional** SBAS data: ionosphere, receivers, etc.
- **Organization** of all the data generated from the analysis
- **Generation** of daily **reports**
- **Generation** of **historical archive** of performances

How does it work?



Core Process

- **Coupling** of different SBAS tools:
 1. **SBAS algorithms**: corrections and integrity information of a scenario
 2. **GMV's eclayr**: analysis tool of SBAS performances.
 3. **Other utilities**: further analysis tools.
- **Automation** of tasks
- **Management** of scenario configuration
- **Downloading** of real data from web archives
(eg: receivers raw data, satellite ephemeris, clocks, ionosphere data...)
- **Execution** of (long-period) scenarios
- **Generation** of performance analyses (figures, tables, data...)
- **Communication** with the **web platform**
- **Sending** summary reports via e-mail

Web Platform

- Show all the **outcomes** from the performance analysis in a **visual** and **structured** way

gmV BRAVE ①
THE PERFORMANCE SURVEY SERVICE FOR SBAS ALGORITHM EVALUATION

REAL_SCENARIO_1 REAL_SCENARIO_2 REAL_SCENARIO_3 SYNTH_SCENARIO_1
SYNTH_SCENARIO_2 ②

③

Scenario Info
115 analyses
46 days
5 versions
4 Internal Analysis
1 mask changes

④

« March 2024 »						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
26 9 SBAS_algorithm_V1	27 SBAS_algorithm_V1	28 SBAS_algorithm_V1	29 SBAS_algorithm_V1	1 SBAS_algorithm_V1 SBAS_algorithm_V2	2 SBAS_algorithm_V1 SBAS_algorithm_V2	3 SBAS_algorithm_V1 SBAS_algorithm_V2
4 SBAS_algorithm_V1 SBAS_algorithm_V2	5 SBAS_algorithm_V1 SBAS_algorithm_V2	6 SBAS_algorithm_V1 SBAS_algorithm_V2	7 SBAS_algorithm_V1 SBAS_algorithm_V2	8 SBAS_algorithm_V1 SBAS_algorithm_V2	9 SBAS_algorithm_V1 SBAS_algorithm_V2	10 SBAS_algorithm_V1 SBAS_algorithm_V2
11 SBAS_algorithm_V1 SBAS_algorithm_V2	12 SBAS_algorithm_V1 SBAS_algorithm_V2	13 SBAS_algorithm_V1 SBAS_algorithm_V2	14 SBAS_algorithm_V1 SBAS_algorithm_V2	15 SBAS_algorithm_V1 SBAS_algorithm_V2	16 SBAS_algorithm_V1 SBAS_algorithm_V2	17 SBAS_algorithm_V1 SBAS_algorithm_V2
18 SBAS_algorithm_V1 SBAS_algorithm_V2	19 SBAS_algorithm_V1 SBAS_algorithm_V2	20 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	21 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	22 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	23 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	24 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3
25 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	26 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	27 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	28 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	29 newMask SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	30 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	31 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3
1 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	2 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	3 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	4 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	5 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	6 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3	7 SBAS_algorithm_V1 SBAS_algorithm_V2 SBAS_algorithm_V3 SBAS_algorithm_V4

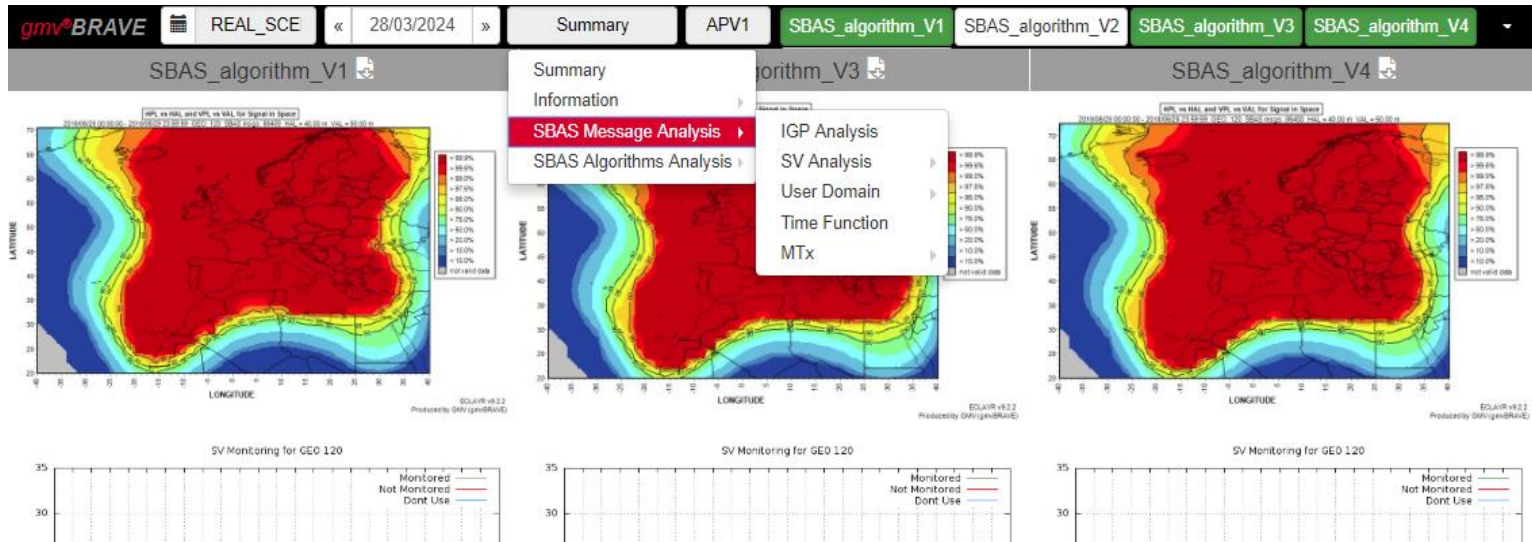
⑤

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Welcome page:

- User-friendly design
- List of scenarios
- Info by scenario
- Date-picker calendar
- Additional info of scenarios and executions

Web: Daily analysis

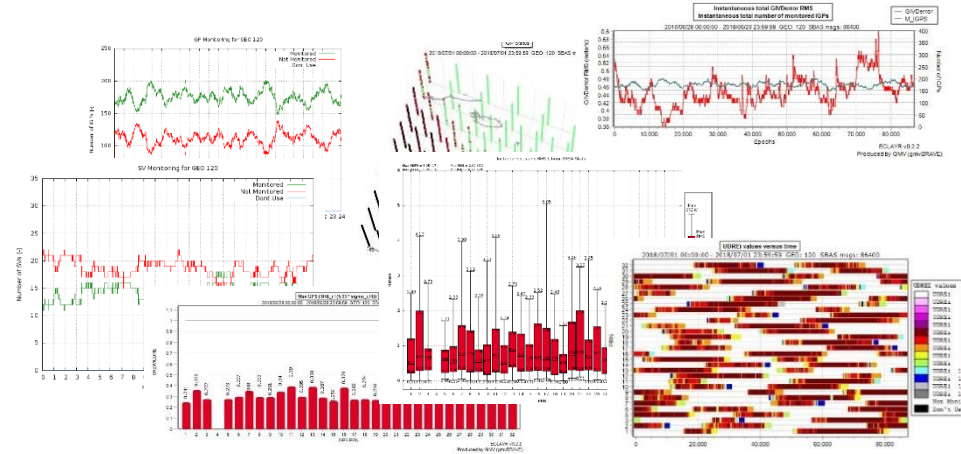


- **Comparison at a glance** of different SBAS algorithm executions
- **Monitoring** of the progression of a specific SBAS version
- **Organization** of the outcomes by categories
- **Finding** and **filtering** (by service, analysis category, satellite, receiver...)

Web: Analysis by category I

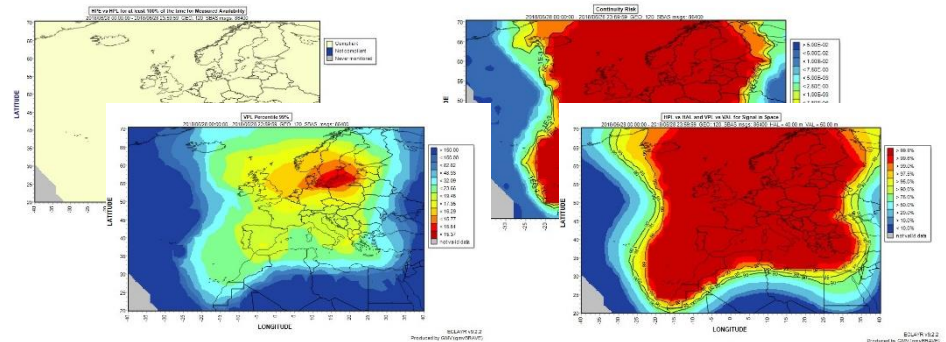
- **SBAS Signal In Space**

- Iono. Grid Point (IGP) analysis:
 - Monitoring
 - GIVE statistics & evolution
- Satellite analysis:
 - Monitoring
 - UDRE statistics & evolution



- **Performances on User domain:**

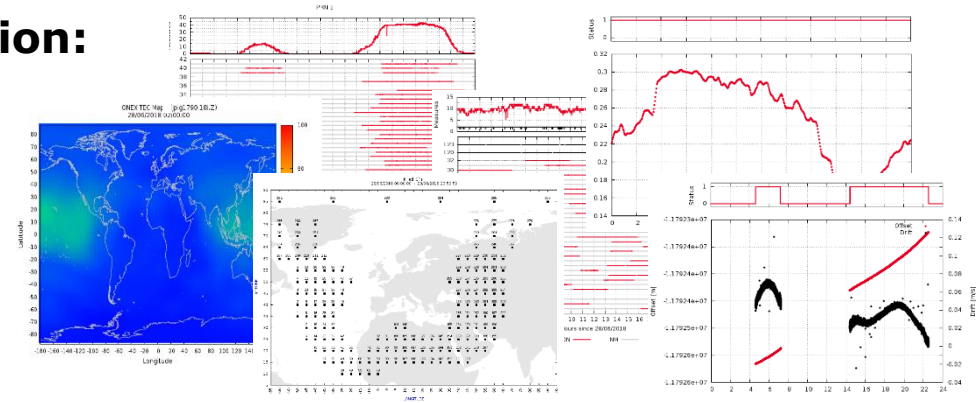
- Integrity
- Continuity
- Accuracy
- Availability



Web: Analysis by category II

- **Internal algorithm information:**

- Input measurements
- Hardware biases
- Ionosphere analysis
- Etc.



- **Historical of global statistics**



Use cases

gmvBRAVE monitoring and analysis platform allows:

- **Identification and preliminary analysis** of anomalous events
- **Anticipation** to the reporting of observations
- **Testing** of different experimental algorithm evolutions in baseline scenarios
- **Quick comparison and evaluation** of the performances of the different algorithm versions
- **Identification** of algorithm bugs and possible improvements
- **Cataloguing** (anomalous) events on real data

Use cases: an example

Detection and **preliminary analysis** of a *loss of ionosphere monitoring* + **testing** of algorithm improvements:

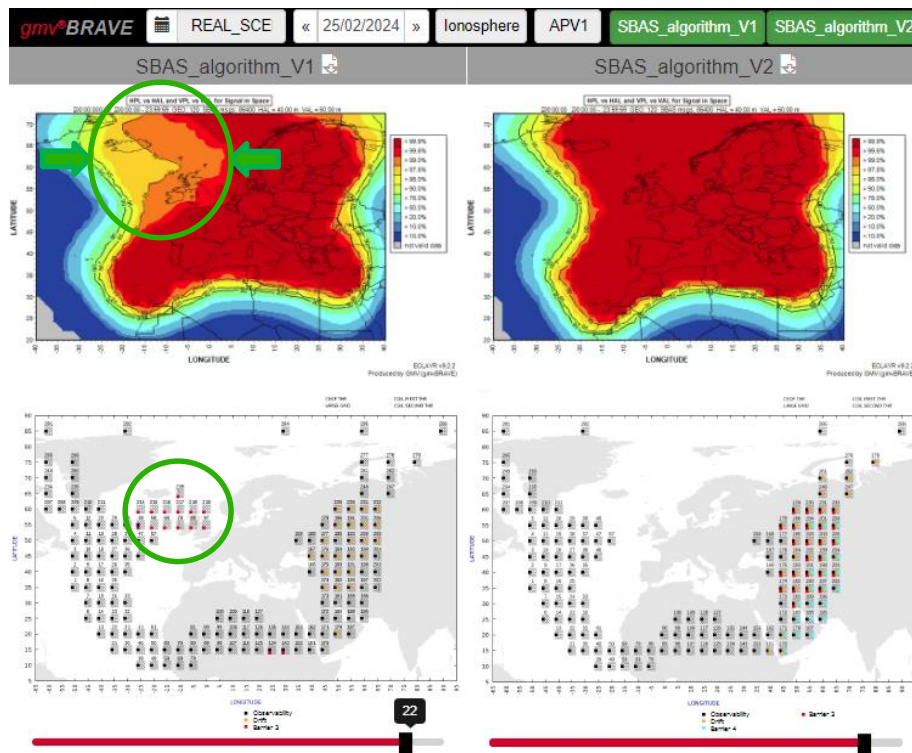
Baseline
SBAS version

Availability map:

Performance degradation for requested service on the north-west

IGP map:

Loss of IGP monitoring



Improved
SBAS version

No degradation
observed

Recovering of
IGP monitoring

Conclusions

- **gmV**BRAVE****: a tool for **engineering, monitoring** and **analysis** of performances of a SBAS. See for further details:
 - Cuesta-Martínez, Arnal, Arenas & Ochoa (2018)
 - GMV's webpage: <https://www.gmv.com/en/Products/brave>
- **Speed-up** of analysis and engineering tasks of a SBAS
- **Easy** to use:
 - Simple: modular internal structure
 - Accesible: friendly web platform + daily reports
 - Portable: easy to migrate to any (Linux/Windows) machine
 - Scalable: lots of long-period executions at the same time
- **Powerful** tool for **development, validation and maintenance phases** of a SBAS

gmV BRAVE

THE PERFORMANCE SURVEY SERVICE FOR
SBAS ALGORITHM EVALUATION



THANK YOU!