Ten centimeters orbits in real-time on-board of a satellite:

DORIS-DIODE current status

- DORIS & DIODE main features
- DIODE / SPOT4 conclusions
- DIODE / Jason-1 in-flight results
- News about DIODE/ENVISAT
- DIODE / SPOT5 in-flight results
- current status
The DORIS network
On-Board Orbit Determination function, providing:

- satellite position/velocity (plus a quality assessment),
- TAI time-tagging (plus a quality assessment),
- ancillary products (next beacon, expected Doppler, …),
- elaborated on-board and in real-time every ten seconds.

Products are useful for:

- platform and payload,
- ground processing of the data (images, altimetry, …),
- DORIS receiver (self-programming and reduction of Doppler tolerances).
DORIS-DIODE current status

Christian JAYLES

Conclusive probatory experiment

After more than four years:

- accuracy = a few meters RMS,
- availability ≅ 99.5% (MTBF ≅ one year),
- meet specifications (200 m MAX) > 99.9%),
- good behaviour during manoeuvres.

Users of the products:

- POAM several times a day (near poles),
- SPOT IMAGE: DIODE is the nominal source for image positionning,
- VEGETATION (permanent since July 1999).
**DORIS-DIODE current status**

Christian JAYLES

- Complete mission, including:
  - improved dynamical model,
  - improved autonomy:
    » self-initialisation (« lost in space »),
    » self-programming of the DORIS receiver,
  - TAI (or UTC) time-tagging of external events.

- Users of the products:
  - quick-look processing of altimetric data,
  - possible use by the platform,
  - and by the ground Control Center.
DORIS-DIODE current status

Christian JAYLES

New functionnalities:

- self-initialisation algorithm (4 passes, two filters),
- receiver programming (prediction of the next-to-come beacon, optimal choice, Doppler shift).

Improved models:

- adjusted: Earth pole coordinates, Hill accelerations, thrust accelerations,
- force model = 40x40 optimised E.G.F., moon&sun attractions, solar pressure (box&wings), air drag.

improved quality assessments.
DIODE / Jason-1 performances

- Performances:
  - routine accuracy: 1m RMS 3D, between 10 and 30 centimeters radial RMS,
  - self-initialisation:
    » ten hours after launch (without any TC, in barbecue mode),
    » in January, first position 35 mn after restart.
  - time determination (between 1 and 2 microseconds),
  - operationnal use of the self-programming mode.

- Availability: 100 % until now.
  » (except 35 mn due to a DORIS restart)
DORIS-DIODE current status

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DIODE/DIODE/Jason-1 on-orbit results

RMS = 0.453 m
MAX = 1.435 m

RMS = 0.210 m
MAX = 0.786 m

RMS = 0.111 m
MAX = 0.339 m
DORIS-DIODE current status

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DIODE/Jason-1 on-orbit results

RMS = 0.481 m
MAX = 1.312 m

RMS = 0.363 m
MAX = 0.939 m

RMS = 0.199 m
MAX = 0.451 m
Time determination results (DIODE/Jason-1)

Discrepancies between DORIS TAI Time-tagging of PPS and PPS reference TAI time

- Discrepancies Analysis
  - RMS error (microseconds): 1.416
  - Mean error (microseconds): -1.036
  - Error standard deviation (microseconds): 0.966

1 microsecond PPS jitter
DORIS-DIODE current status

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- Operating since April 12, 2002.
- Undergoing on-orbit acceptance test
  - comparisons with ground orbits,
  - time determination results.
- Operationnall use of the self-programming mode.
DORIS-DIODE current status

Christian JAYLES

Performances :

– routine accuracy : better than 1m RMS 3D, ≅ 15 centimeters radial RMS,

– DORIS full self-initialisation :
  » routine mode 8 hours after DORIS ON,
  » less than 2 orbits after the first pass over a master-beacon.

– time determination used for the images,

– operationnal use of the self-programming mode.

Availability : almost 100 % until now.

» Except 40 mn after the first orbit acquisition manoeuver.
DORIS-DIODE current status

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DIODE/SPOT5 on-orbit results

RMS = 0.233 m
MAX = 0.678 m

RMS = 0.308 m
MAX = 1.118 m

RMS = 0.154 m
MAX = 0.493 m
DORIS-DIODE current status

- On-orbit: SPOT4, Jason-1, ENVISAT, SPOT5.
- Waiting for flight: a retrofit on SPOT4.
- On Skybridge, DORIS/DIODE has been evaluated as technically acceptable.
- First CRYOSAT version under validation (ERC32 64 bits processor).
- Currently under study:
  - AltiKa, Jason-2, NPOESS, Pléiades, ...
DORIS-DIODE current status

DORIS/DIODE current status

– (64 bits SPARC processor)
DORIS-DIODE current status

Christian JAYLES

DIODE/TOPEX cy 232 radial errors – (64 bits SPARC processor)
DIODE/TOPEX ground results – (64 bits SPARC processor)
Contact

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