

# ANOMALIES (01.01.2011 - 04.07.2011)

This report covers ERS-2 GOME operations from 1 January 2011 until the end of the mission on 4 July 2011 (orbit 84717). Exceeding its nominal life-time significantly, after 16 years in operation the de-orbiting of ERS-2 was initiated on 5 July 2011, preparing for its decommissioning. On 5 September 2011 ERS-2 de-orbiting was completed, moving ERS-2 from 785 km to about 573 km. At this height the risk of collision with other satellites or space debris is significantly reduced. See also related web stories at:

[http://www.esa.int/esaEO/SEMJ006TLPG\\_index\\_0.html](http://www.esa.int/esaEO/SEMJ006TLPG_index_0.html)

[http://www.esa.int/esaCP/SEM8Q40UDSG\\_index\\_0.html](http://www.esa.int/esaCP/SEM8Q40UDSG_index_0.html)

## Mission overview:

The ERS-2 satellite was launched in April 1995. Major anomalies were:

• **The failure of the satellite gyroscopes in 2001**, which was overcome with a new gyro-less operations scenario.

• **The failure of the on-board Low Bit Rate tape recorder in 2003.**

On June 22 2003 the ERS-2 tape recorder became permanently unavailable due to a technical failure. The ERS-2 tape recorders were used to record the ERS-2 Low Rate mission globally. After eight years of continuous acquisition, this service was discontinued. The ERS-2 Low Rate mission has continued within the visibility of ESA ground stations over Europe, North Atlantic, the Arctic, Antarctica and western North America.

Additionally, the DLR Antarctic Receiving Station at the O'Higgins base has been providing GOME data in near-real time since 22 October 2003, allowing the continuation of the monitoring of the ozone hole over the South Pole.

During the year 2006 two new stations have been added: Hobart (13 February 2006), and Singapore (18 October 2006). In 2007 the station of Chetumal (Mexico, 19 October 2007) has been added. In 2008 the station of Johannesburg (South Africa, 17 July 2008) has been added. The final configuration for GOME data acquisition was at the following ground stations:

Kiruna (Sweden), Maspalomas (Canary Islands, Spain), Gatineau and Prince Albert (Canada), McMurdo (Antarctica), Matera (Italy), Singapore, Beijing (China), Miami (USA), Chetumal (Mexico), Hobart (Tasmania), Johannesburg (South Africa), O'Higgins (Antarctica).

## GOME anomaly overview (only major anomalies):

GOME throughout the 16 years in-orbit performed nominally, considering the expected degradation over time of its detectors. In order to take into account the increased number of GOME calibration lamp failures after the first eight years of the mission, a new algorithm has been implemented on-ground using the Fraunhofer lines from solar calibration measurements.

Single Event Upsets: external solar radiation hitting the satellite instrument can cause memory corruptions of the on-board memory and is referred to as Single Event Upset. The harm of the operations of GOME depended on the affected memory addresses. For example during 17/12/1997 to 11/2/1998 a bitflip caused an anomaly where a shift in detector channel 3 of two pixels rightwards in the science data occurred. For anomaly mitigation purposes, in May 2000 an operations scenario was integrated, performing an automatic instrument switch off and on, rebooting the GOME on-board software (the instrument is switched off for a duration of ca. 90 seconds).

In 2008-2009 padded frames (frame 20) occurred (February-September 2008; from 18<sup>th</sup> December on) due to ATSR/IRR switch off. This feature disappeared after ATSR IRR switch on (3 February 2009, without heater and stirling coolers to minimize power consumption).

Special GOME operations such as the operational switch off/switch-on in time tag (on calendar days 04, 14, 24 each month) preventing for impacts of the so-called Single Event Upsets were continued after the unavailability of the tape recorders in 2003. Nevertheless due to the reduced orbital coverage of data, analysis of cooler switchings and instrument switch-offs could not be completely performed and detailed information is missing in the tables below.

Quarterly calibration was operated in the following way:

5 Calibration orbits are scheduled for 28 January, 28 April, 28 July, 28 October each calendar year started in October 2004.

The yearly report gives an overview on Lamp Failures as well as on nominally executed calibration lamp sequences.

Since June 2009 a new layout of the GOME daily report was published on the web at

[GOME/NEWDAILY/REPORTS/](http://www.esa.int/GOME/NEWDAILY/REPORTS/); past reports, starting from the year 2000, are also available on the same pages. It is recommended to refer to these pages for detailed instrument/data information.

## listed are:

### 1. single event upsets

2. patches of the on-board software
3. cooler switchings
4. list of datagaps due to anomalies or special GOME instrument operations
5. timeline interruption (operation in static nadir view)
6. narrow swath timeline GMNNOT41
7. commanding problems - incorrect timelines executions
8. moon measurements
9. lamp failures
10. Calibration Lamp Sequences without Lamp Failure
11. other events
12. ERS-2 end of mission de-orbiting

**single event upsets:**

Date	reason
14/02/11	i½GOME anomaly starting from 10:30:05 (outside gs visibility), cured with a power cycle at 11:38:55; data were nominal afterwards.
24/03/11	i½GOME anomaly starting after a power cycle at 15:46:57 prt of the nominal Narrow Swath operations, some anomalous values was observed; data were back to nominal after a further power cycle at 17:27:21.
24/05/11	i½GOME anomaly starting before 19:03:55 (outside gs visibility) cured with power cycle at 20:09:08; data back to nominal after.
31/05/11	GOME stopped sending data (only one product received at ca 00:00:00); the requested power cycle was performed on 01June at 12:19:55;i½ data were back to nominal afterwards

**patches of the on-board software:** none

**cooler switchings:** none

**list of datagaps due to anomalies or special GOME instrument operations:** (For detailed information see monthly performance)

Date	Orbit	duration (GOME off/start of nominal operations)	reason
14/02/11	82713	10:30:05 - 11:38:55	data gap due to GOME SEU

24/03/11	83620 - 83661	15:46:57 - 17:27:21	data gap due to GOME anomaly in concomitance with power cycle prior to Narrow Swath
24/05/11	84135	19:03:55 - 20:09:08	data gap due to GOME SEU
31/05/11 - 01/06/11	84224 - 84245	ca 00:00:00 - 12:19:55	data gap due to GOME SEU

**Timeline Interruption (operations in static nadir view):**

Date	Orbit No.	duration	reason
28/01/11	82470 - 82471		GOME in Nadir Static View
28/04/11	83760 - 83761	$i_c/2$	GOME in Nadir Static View

**Narrow Swath Timeline GMNNOT41:**

Date	Orbit No.	Duration
04-05/01/11	82128 - 82141	~14:00 (04/01/11) - ~11:00 (05/01/11)
14-15/01/11	82272 - 82285	~15:00 (14/01/11) - ~12:00 (15/01/11)
24-25/01/11	82813 - 82826	~13:00 (21/01/11) - ~10:00 (25/01/11)
04-05/02/11	82572 - 82586	~14:00 (04/02/11) - ~13:00 (05/02/11)
14-15/02/11	82715 - 82729	~14:00 (14/02/11) - ~14:00 (15/02/11)
14-15/03/11	83117 - 83130	~14:00 (14/03/11) - ~14:00 (15/03/11)
24-25/03/11	83261 - 83273	~16:00 (24/03/11) - ~14:00 (25/03/11)
04-05/04/11	83419 - 83433	~18:00 (04/04/11) - ~18:00 (05/04/11)
14-15/04/11	83563 - 83576	~19:00 (14/04/11) - ~17:00 (15/04/11)
24-25/04/11	83707 - 83720	~20:30 (24/04/11) - ~18:00 (25/04/11)
04-05/05/11	83848 - 83862	~18:00 (04/05/11) - ~18:00 (05/05/11)
14-15/05/11	83992 - 84005	18:00 (14/05/11) - ~16:30 (15/05/11)
24-25/05/11	84136 - 84150	~20:30 (14/05/11) - ~19:00 (15/05/11)
04-05/06/11	84294 - 84306	~21:00 (04/06/11) - ~18:30 (05/06/11)
14-15/06/11	84436 - 84449	19:00 (14/06/11) - ~18:00 (15/06/11)
24-25/06/11	84579 - 84592	~20:00 (24/06/11) - ~17:00 (25/06/11)

**Moon Measurements:** none

**Lamp Failures:**

Date	Lamp Failure / Orbit	remark
28/04/11	Lamp Failure (no. 274) Orbit 83763	Lamp Failure occurred during quarterly calibration Start 19:59:52 (no visibility gs) Stop 20:02:52

28/04/11	Lamp Failure (no. 275) Orbit 83764	Lamp Failure occurred during quarterly calibration Start 20:15:00 Stop 20:15:1
28/04/11	Lamp Failure (no. 276) Orbit 83764	Lamp Failure occurred during quarterly calibration Start 21:39:28 (no visibility gs) Stop 21:43:20
28/04/11	Lamp Failure (no. 277) Orbit 83764	Lamp Failure occurred during quarterly calibration Start 21:55:26 Stop 21:55:42
28/04/11	Lamp Failure (no. 278) Orbit 83765	Lamp Failure occurred during quarterly calibration Start 23:16:01 (no visibility gs) Stop 23:23:50
28/04/11	Lamp Failure (no. 279) Orbit 83765	Lamp Failure occurred during quarterly calibration Start 23:35:54 Stop 23:36:10
29/04/11	Lamp Failure (no. 280) Orbit 83766	Lamp Failure occurred during quarterly calibration Start 00:59:17 (no visibility gs) Stop 01:04:18
29/04/11	Lamp Failure (no. 281) Orbit 83767	Lamp Failure occurred during quarterly calibration Start 02:37:58 (no visibility gs) Stop 02:44:47

### Calibration Lamp Sequences without Lamp Failure:

Date	Orbit	remark
28/01/11	82472	Start: 14:32:16½ Stop after 14:34:07½ (no visibility gs) Calibration lamp instabilities: value at ca 197 V (nominal would be 198 V)
28/01/11	82472	Start: 14:41:13½ (outside gs visibility) Stop 14:42:07½ Calibration lamp instabilities: value at ca 197 (nominal would be 198 V)
28/01/11	82472	Start: 15:41:42½ Stop after 15:49:56½ (no visibility gs) Calibration lamp instabilities: value at ca 180 (nominal would be 198 V)
28/01/11	82473	Start before 16:02:12½ (no visibility gs) Stop 16:02:34½ Calibration lamp instabilities: some values at ca 180 ½(nominal would be 198 V)
28/01/11	82473	Start before 16:18:37½ (no visibility gs) Stop 16:22:44½ Calibration lamp instabilities: some values at ca 180½ (nominal would be 198 V)

28/01/11	82474	Start 17:38:10 (no visibility gs) Stop 17:41:07 Calibration lamp instabilities: some values at ca 180 V (nominal would be 198 V)
28/01/11	82474	Start before 18:02:24 (no visibility gs) Stop 18:03:21 Calibration lamp instabilities: some values at ca 180 V (nominal would be 198 V)
28/01/11	82475	Start before 19:15:59 (no visibility gs) Stop 19:21:42 Calibration lamp instabilities: some values at ca 180 V (nominal would be 198 V)
28/01/11	82476	Start before 20:55:58 (no visibility gs) Stop 21:02:19 Calibration lamp instabilities: some values at ca 180 V (nominal would be 198 V)
28/01/11	82477	Start before 22:38:43 (no visibility gs) Stop 22:43:00 Calibration lamp instabilities: value at ca 197.5 V (nominal would be 198 V)
28/04/11	83763	Start 18:34:32 Stop after 18:41:34 (no visibility gs) Calibration lamp instabilities: value at ca 180 V (nominal would be 198 V)

**other Events:**

Date	Orbit	remark
22/02/11- 11/03/11	82821(tbc) - 83075 (tbc)	Solar calibration & Narrow Swath Timelines interrupted due to ERS2 orbit lowering manoeuvres to change the orbit to a 3-day repeat cycle
10/03/2011 -01/01/11	83056 - 83808	GOME North Polar View operations