The BOUSSOLE project technical reports; report #7-11, issue 1.

BOUSSOLE buoy deployment & maintenance log. April 05, 2009 – October 27, 2009

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BOUSSOLE project

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Foreword

This report is part of the technical report series that is being established by the BOUSSOLE project.

BOUSSOLE is funded/supported by the following Agencies, Institutions or Programs

European Space Agency

Centre National d'Etudes Spatiales, France

National Aeronautics and Space Administration of the USA

Centre National de la Recherche Scientifique, France

Institut National des Sciences de l'Univers, France

Université Pierre & Marie Curie, France

Observatoire Océanologique de Villefranche sur mer, France

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1. SCOPE OF DOCUMENT

The BOUSSOLE buoy deployment and maintenance log is a record of all events that occur from the deployment to the recovery of one of the two upper sections of the buoy.

The aim is to keep track of all maintenance operations, such as instruments cleaning or rotations, instruments malfunctions, incidents with the buoy structure, if any, biofouling development and so on.

This information is crucial to a subsequent correct interpretation of the data.

Keeping track of these events also allows their analysis in view of the permanent improvement of protocols.

The present report concerns “buoy deployment VIII”, from April 05 of 2009 to October 27 of 2009.

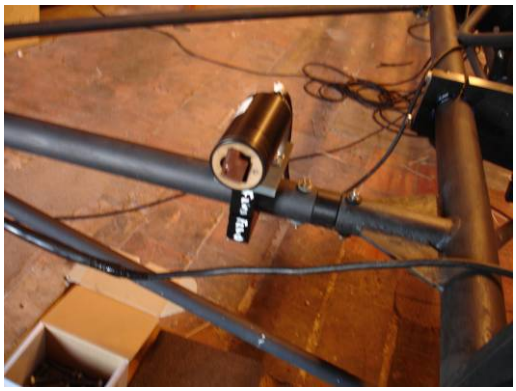
2. DESCRIPTION OF OPERATIONS

2.1 UPPER SECTION PREPARATION (2009-01)

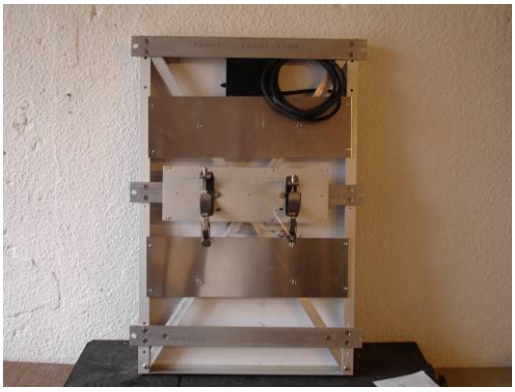
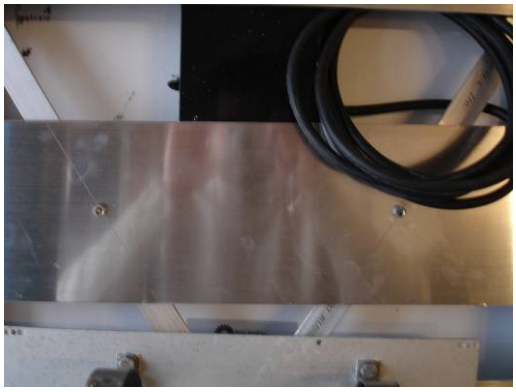
The buoy System (called system #2) was delivered from Satlantic on January 14th, and installation on the structure begun immediately since the deployment was initially scheduled by the first decade of February for divers' availability. Then the deployment had to be delayed for bad weather and finally had place on 5th April 2009.

The Buoy was equipped with sensors used for the deployment of the buoy V recovered in September 2007 plus: new Hyperspectral radiometers, a new Hydroscat-4. For the fist time the buoy will be also equipped with a PAR sensor. The system was prepared in the CCI local in Villefranche-Sur-Mer. Copper sheets and pieces were again fixed wherever possible to avoid biofouling arising (see pictures). After the crashes occurred for two solar panels of the buoy VII, two aluminium plates (3 mm thickness) have been fixed on the back side to reinforce them. The system was tested for several days running with solar panel energy and no anomaly was observed. Black IOPs measurements were also made for dark corrections.

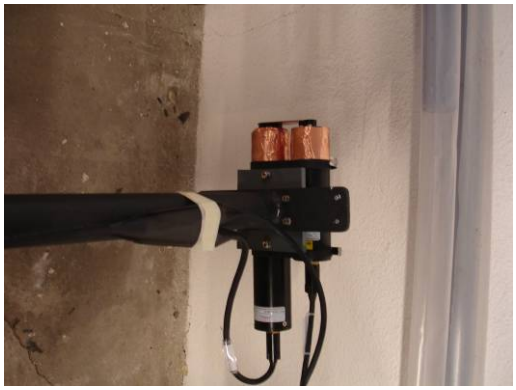






2.2 MOORING DEPLOYMENT

2.2.1 Sunday 05th April 2009

The upper structure to be deployed was brought to the Rochambeau field at 07:00am with the help of 5 people from the LOV. The 4 arms were assembled and connected to the buoy, the helicopter was called to get the buoy and bring it to the BOUSSOLE site at 09:00am. As usual the go/return trip lasted about one hour. After few hours the ARGOS messages arrived correctly but indicated the possible presence of the cap or a malfunctioning on the 9 m Ed sensor.

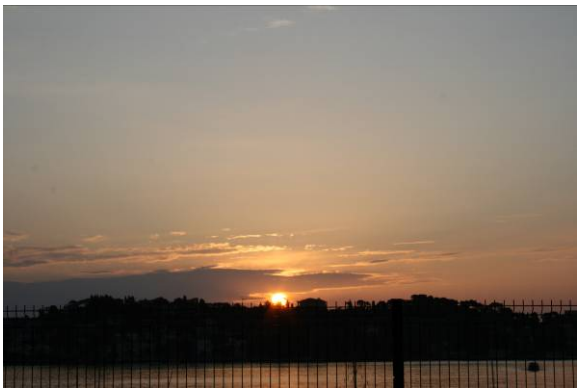














At this date, buoy is equipped with

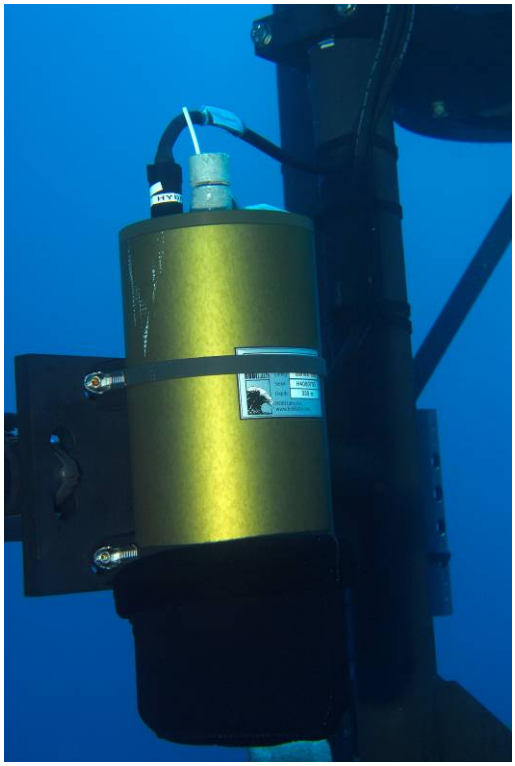
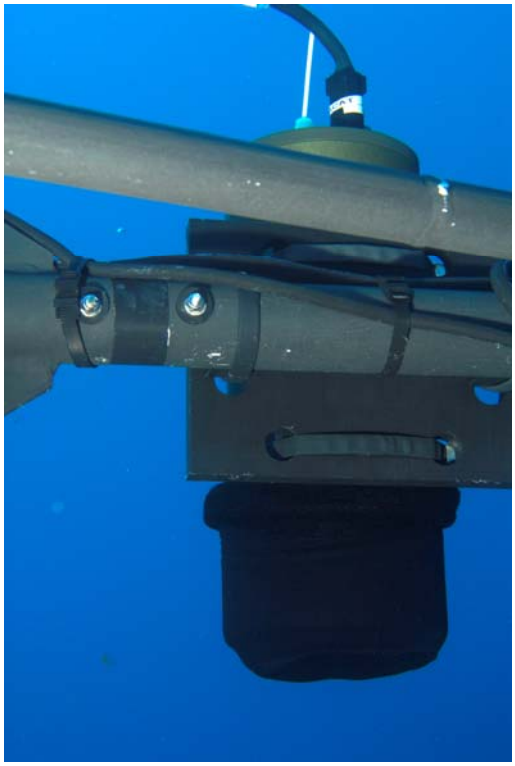
- **DACNet #002**
- **CLC #002**
- **Junction Box #002**
- **Rads set: OCI #048_Eu4m, #050_Ed4m, #164_Ed9m, #163_Eu9m #030_Es, OCR #036_Lu4m and #037_Lu9m), MVDS #062, OCP #036(4m) and OCP 037(9m)**
- **Hyper spectral units HOCR #276_Lu4m, #277_Lu9m, #327_Es, STOR-X #068 and Bio-shutters #118_Lu4m and 119_Lu9m.**
- **HS4 #H4080705**
- **Strain-100 #002**
- **Transmissometers C-Star #626PR (4m) and #847PR(9m)**
- **ECOFLNTUs #608 (4m) and #609 (9m)**
- **ARGOS beacon #18797 (prog id#26021)**
- **CTD #37SI 30260-2404**
- **Strain gauge GAROS #OML-CSCB40K**

The lower part of the buoy is still equipped with the emergency ARGOS beacon #5433 (prog. id. #12237).

2.2.2 Monday-Thursday 13-16th April 2009

These days are part of the BOUSSOLE#86 mission. The first day two CISCO connections with the buoy were attempted unsuccessfully. Then a direct connection on the top of the buoy was attempted and data were retrieved correctly. The CISCO connectors and ARGOS connectors were cleaned. The JUNCTION BOX was inadvertently mounted with the switch on the wrong side. Retrieved data showed that the problem on the Ed sensor at 9 m was just due to a cap forgotten on it and the

third day divers will remove it. For the first time a neoprene cap was put on the HS4 for acquiring three dark measurements.

2.2.3 Thursday 28th April 2009

The ARGOS messages from the buoy stopped since April 28th.

2.2.4 Monday 4th May 2009

This day divers from the private company Mare Nostrum went at the BOUSSOLE site for cleaning the buoy system.

2.2.5 Sunday-Tuesday 17-18th May 2009

These days are part of the BOUSSOLE#87 mission. Since April 28th, no ARGOS data were transmitted from the Buoy. On the first cruise day, an attempt of CISCO connection with the buoy was made but failed because of a wrong IP address on the laptop. A second attempt of CISCO connection with the buoy was, instead, successful. However, the connection was lost during data retrieval, probably the antenna was hidden. This connection proved that the buoy worked during the whole ARGOS stop period. The second cruise day divers went at sea for cleaning the instruments and a neoprene cap was put on the HS4 for acquiring three dark measurements. A significant amount of H2 bubbles was blowing from the battery pressure relief valve. The buoy also presented evident signs of an impact with a small boat. One of the thin tubes reinforcing the structure was distorted towards the interior of the structure near the surface. Some painting and colson used to fix the cables were missing. CISCO and ARGOS connectors were cleaned. ARGOS system well worked after that. A CISCO connection with the buoy was also established to complete data retrieval.

2.2.6 Friday 29nd May 2009

This day a private boat (Lollipop) from Darkpelican company in Villefranche was rent to go at the BOUSSOLE site. Scope of the mission was to turn off the battery alimentation by switching off the Junction Box. This operation was completed few minutes before 11h. ARGOS contacts were also cleaned. The buoy regularly continued to work and the battery voltage went soon back at nominal values and slightly started to discharge.

2.2.7 Monday 8th June 2009

From this day the charge of the battery was no more capable to power the system (about 11 Volts from ARGOS messages).

2.2.8 Monday-Tuesday 15-16th June 2009

These days are part of the BOUSSOLE#88 mission. On the 15th divers went at sea to take off the buoy battery and to clean the instruments. Then they installed the battery recovered from the buoy system#1. The buoy was then restarted and a CISCO connection was established for data retrieval. Battery voltage was now within ordinary values. Three dark measurements were collected for HS4 and transmissometers. On the 16th a connection with the buoy in the late morning revealed that the battery voltage was again too high. So an attempt to disconnect two solar panels from the J/Box was made. However it was not possible to establish a connection with the buoy to verify again the battery voltage so the J/Box was again switched off.

2.2.9 Tuesday 30th June 2009

This day a private boat (Lollipop) from Darkpelican company in Villefranche was rent from V. Vellucci and E. Diamond to go at the BOUSSOLE site with 3 divers (D. Luquet, F. Bourrin and Eric Grave from MARE NOSTRUM company). Scope of the mission was to exchange the CLC with the one of the system#1 recently shipped from Satlantic,

and to restart the BUOY. Departure from Villefranche was at 8h00 (UTC). We arrived at the BOUSSOLE site at 10h15 and the CLC #004 was installed. The CLC that was removed #002 did not present any particular external sign. Divers also cleaned sensors and made a general inspection of the Buoy that was found in good conditions. The system was restarted at 10h50 and at 11h00 the system restarted to collect data regularly. ARGOS and CISCO contacts were also cleaned. Then three dark measurements for the HS4 and the 2 transmissometers were collected at 11h15, 11h30 and 11h45. A CISCO connection was attempted at 12h15 unsuccessfully. Then we just waited to let time enough for the battery to charge and, at about 14h30, a direct connection on the Buoy was obtained when divers closed the AK circuit. Data were downloaded but connection was lost before deleting eventlogs files because of a corrupted file on the microdrive. At 15h15 another CISCO connection was attempted but again unsuccessfully.

At this date, buoy is equipped with

- **CLC #004**

2.2.10 Thursday-Friday 16th-17th Juillet 2009

These days are part of the BOUSSOLE#89 mission. When on site an attempt of CISCO connection with the buoy was made but failed. Divers went at sea for cleaning the instruments and for fixing the hydrophone to the buoy at 20 m. Neoprene caps were also put on the HS4 and on the transmissometers for acquiring three dark measurements. CISCO and ARGOS connectors on the head of the buoy were cleaned. A CISCO connection was established and data downloaded. On the second cruis eday a CISCO connection was established for data retrieval.

2.2.11 Wednesday 5th August 2009

This day divers from the private company Mare Nostrum went at the BOUSSOLE site for cleaning the buoy system and performing dark measurements.

2.2.12 Saturday 8th August 2009

At this date, data from ARGOS messages started to be constant.

2.2.13 Friday 14th August 2009

This day Grigor Obolensky went on board the *Tethys II* during the UNIMED cruise to try to download data. A direct connection was attempted unsuccessfully.

2.2.14 Xday xyth August 2009

On this date ARGOS messages dispatch stopped.

2.2.15 Tuesday 25th August 2009

This day divers from the private company Mare Nostrum went at the BOUSSOLE site for cleaning the buoy system and performing dark measurements. Emilie Diamond was on board. The system was rebooted and a connection was obtained and then lost without data download. The system has been seen to work from divers. Weather worsened soon and no other connections were possible. One of the anodes on the sphere showed a lot of corrosion.

2.2.16 Wednesday 2th September 2009

This day a private boat (Lollipop) from Darkpelican company in Villefranche was rent from V. Vellucci and E. Diamond to go at the BOUSSOLE site with 3 divers (D. Luquet, J. De Vaugelas and Eric Viano from MARE NOSTRUM company). Scope of the mission was to reboot the BUOY and download data. Divers went at sea for closing the AK connection. At the second attempt a direct connection with the buoy was obtained and data downloaded. After that, the system restarted, three CISCO connections were obtained and data showed a regular functioning of the system. Underwater sensors were cleaned and two dark measurements were made. ARGOS and CISCO connections, and above water sensors were cleaned too. The CISCO and MVD-MVDS cables presented usury signs that were covered with electrical tape.

2.2.17 Sunday 20th September 2009

From this day the ARGOS messages showed constant values.

2.2.18 Monday 28th September 2009

This day a private boat (Lollipop) from Darkpelican company in Villefranche was rent from V. Vellucci to go at the BOUSSOLE site with 3 divers (D. Luquet, Eric Viano and second diver from MARE NOSTRUM company).

Scope of the mission was to:

- reboot the buoy system that was actually stuck;
- cleaning sensors for allowing biofouling corrections before the next buoy lunch scheduled for the day after;
- download data;
- recover one solar panel to be installed on the next buoy;
- recover the light since the old one was not working anymore (though it still worked when went back on April 5th;
- exchanging the ARGOS transponder, in order to have the one dispatching messages at the right frequency available for the next buoy;
- performing dark measurements on the HS4 and C-stars;
- placing a new anode on the lower buoy structure.

All operations were successfully done, except the anode exchange: the new ones being too small.

At this date, buoy is equipped with

- **ARGOS #003**

2.2.19 Wednesday 30th September 2009

This day the rotation of the upper structure was scheduled, with 1 day of delay. Leo Gimenez and other divers from his company were at the Boussole site from the Tuesday afternoon. 6 persons from LOV were at 6h00 in the CCI local for transporting the buoy to Rochembau field and prepare it for launch. At about 07h50, when buoy was almost ready, divers contacted us for announcing that, though the low wind and calm sea, too much current didn't allow the dismounting of the buoy currently at see (only 1.5 m of the buoy were above surface and the tilt was up to 15°). The launch was then first delayed of few hours, and then definitively cancelled. Divers were nonetheless able to dismount the Strain Gauge on the lower part of the buoy, whose connector was damaged during deployment. The Strain Gauge cable rested without a dummy connector.

2.2.20 Friday 16th September 2009

From this day the ARGOS messages dispatch stopped.

2.2.21 Thursday-Sunday 08th-11th October 2009

These days are part of the BOUSSOLE#91 mission. The light blaze was put again on the top of the buoy. ARGOS and CISCO connectors were cleaned too. A first attempt of CISCO connection with the buoy failed but the second one succeeded.

On Saturday, divers went at sea for cleaning buoy sensors. Neoprene caps were also put on the HS4 and on the transmissometers for acquiring three dark measurements.

On the last day another CISCO connection was established for data retrieval before leaving.

2.2.22 Friday 16th October 2009

From this day the ARGOS messages dispatch stopped.

2.2.23 Tuesday 27th October 2009

This day the buoy upper structure was dismounted for the rotation with the system #1. The helicopter delivered the buoy at about 10h30. The structure was in good conditions. Only the light was broken and the strain sensor connector's pins were inside the female cable connector. The buoy was then first cleaned with Karcher on the Rochembau site and then transported into the CCI local were it was dismounted in the following days. On October 28 dark measurements were performed for testing and corrections and last data downloaded.

Instruments were shipped for calibration on November 6 and 9th, whereas the aluminium structure was sent to the CNB on November 12th.

3. QUANTITATIVE SUMMARY

The deployment lasted 206 days, among which 46 days were without data acquisition; 13 of which due to troubleshoot the overload of the battery and 33 for problems with DACNet microdrive.

4. INSTRUMENT SCHEDULE

1 minute acquisition every 15 minutes. The opening of the shutters are slightly delayed one from the other for avoiding high current demand and possible system shutdown for low voltage.

5. ANY PROBLEMS ENCOUNTERED ?

1- The battery of the buoy system was overloaded and produced H_2 that out gassed from the ventilation valve. The problem came from the CLC whose internal switch was not in the right position (as shipped from the fabricant).

2- The DACNet Microdrive was stuck two times, probably because of a partial corruption on the disk. Both times the system restarted after a forced reboot (AK connector).

3- The data series from **2009-09-28** to **2009-10-27** had to be pre-processed to remove bad data values on OCPs and MVD, probably due to high dark currents (but see point 4)

4- The deployment of the buoy in the second half of September resulted into a deployement on late October due to bad weather.

6. LESSONS LEARNED

1- The CLC has an internal switch that must be on the NORMAL position for a correct charge otherwise the voltage control is skipped and the battery is charged at the solar panel output. Hereinafter it will be fixed with glue to avoid this problem.

2- When signs of corruption of the disk are visible it is be better to exchange the microdrive even if it is still working.

3- Verify data asap and eventually try to change the OCP-radiometer cables.

4- Do the best to have gears returned by the first half of august and schedule the deployement in the first half of September.

7. ACKNOWLEDGEMENTS

The BOUSSOLE project has been set up thanks to the work of numerous people, and thanks to the support and funding of several Agencies and Institutions. The latter are listed in the foreword of this report. Specifically, the following contracts are acknowledged : the French Space Agency CNES provided funds through the TAOB and TOSCA scientific committees, ESA through ESTEC contract N°14393/00/NL/DC, including CCNs #1, #2 and #3, ESRIN through contract N° 17286/03/I-OL, and NASA through a “Letter of Agreement”. Funding has been also obtained from the French CSOA committee and the “Observatoire Océanologique de Villefranche”.

The crews and Captains of the following ships are also warmly thanked for their help at sea: the Castor-02 vessel from the Fosevel Marine company (buoy/mooring operations), the INSU R/V Téthys-II and Georges Petit (regular monthly cruises), the GG-IX from the Samar company and the Nika-III (on-demand short operations on site). Pilots and crew members of the Valair and Commerçair helicopter companies are also thanked for their willingness in accomplishing for us unusual survey missions above the BOUSSOLE site. Emmanuel Bosc, Maria Vlachou, Guillaume Lecomte, who have occasionally provided some help in collecting data, are also thanked for their help.

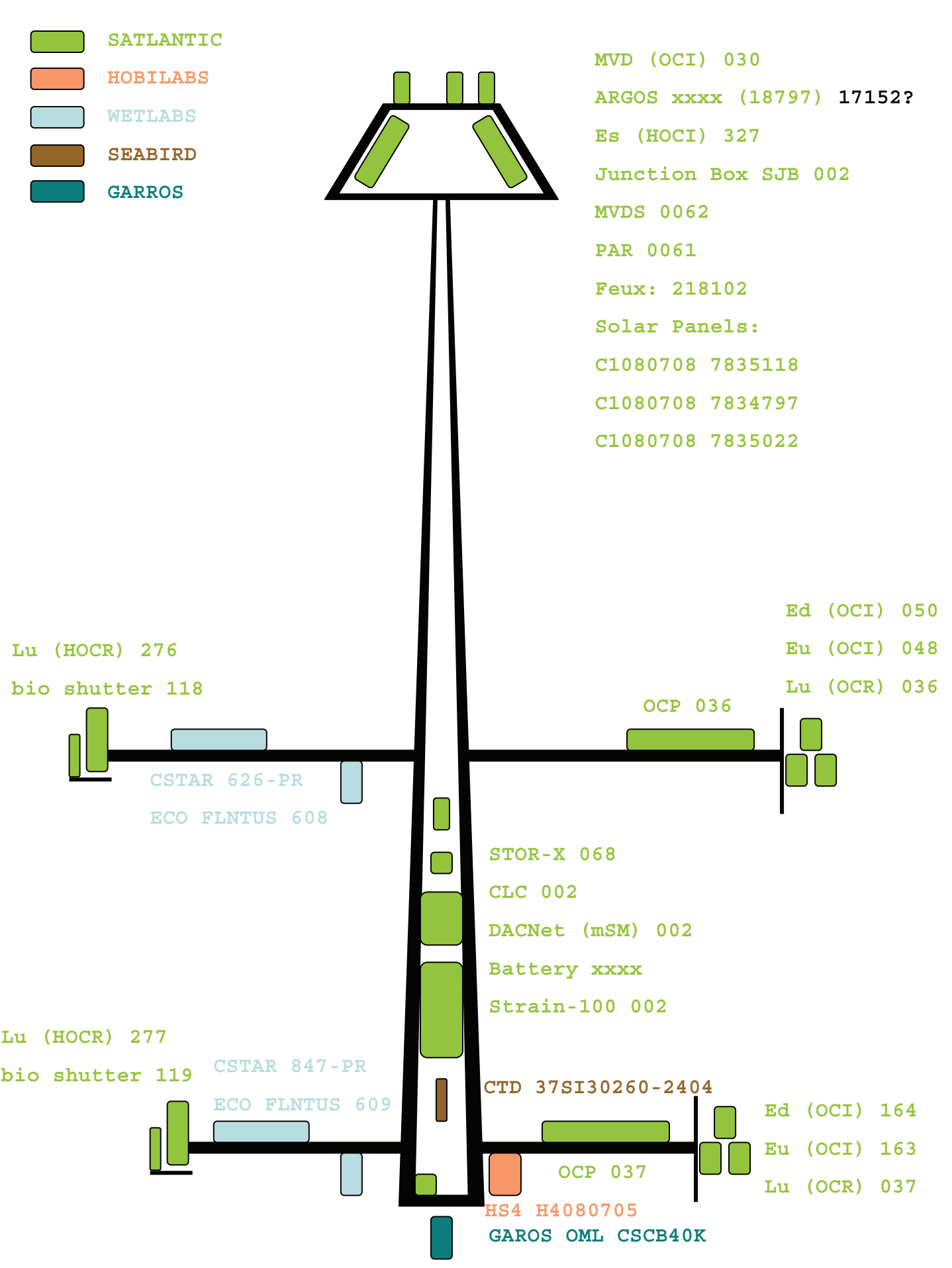
The French institute IFREMER and the Norvegian Marintek company are also thanked for their help and fairness in the engineering studies that were ordered to them after the major failure of the buoy in spring of 2002.

The data that are collected for several years near the BOUSSOLE site by the French weather forecast Agency, “Meteo France”, and which are provided in real time on the internet, have been of great help in the day-to-day management of the monthly cruises.

Two companies have largely contributed to the BOUSSOLE project, namely the ACRI-in/Genimar company, Sophia Antipolis, France (buoy conception) and Satlantic Inc., Halifax, NS Canada (buoy centralized acquisition system and radiometers); their help is specifically acknowledged here.

8. APPENDIX

The following page contains the schema of the buoy and the list of the calibration files.


SATLANTIC
HOBILABS
WETLABS
SEABIRD
GARROS
MVD (OCI) 030
ARGOS xxxx (18797) 17152?
Es (HOCI) 327
Junction Box SJB 002
MVDS 0062
PAR 0061
Feux: 218102
Solar Panels:
C1080708 7835118
C1080708 7834797
C1080708 7835022
Ed (OCI) 050
Eu (OCI) 048
Lu (OCR) 036
Lu (HOCR) 276
bio shutter 118
OCP 036
CSTAR 626-PR
ECO FLNTUS 608
STOR-X 068
CLC 002
DACNet (mSM) 002
Battery xxxx
Strain-100 002
Lu (HOCR) 277
bio shutter 119
CSTAR 847-PR
ECO FLNTUS 609
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Lu (OCR) 037
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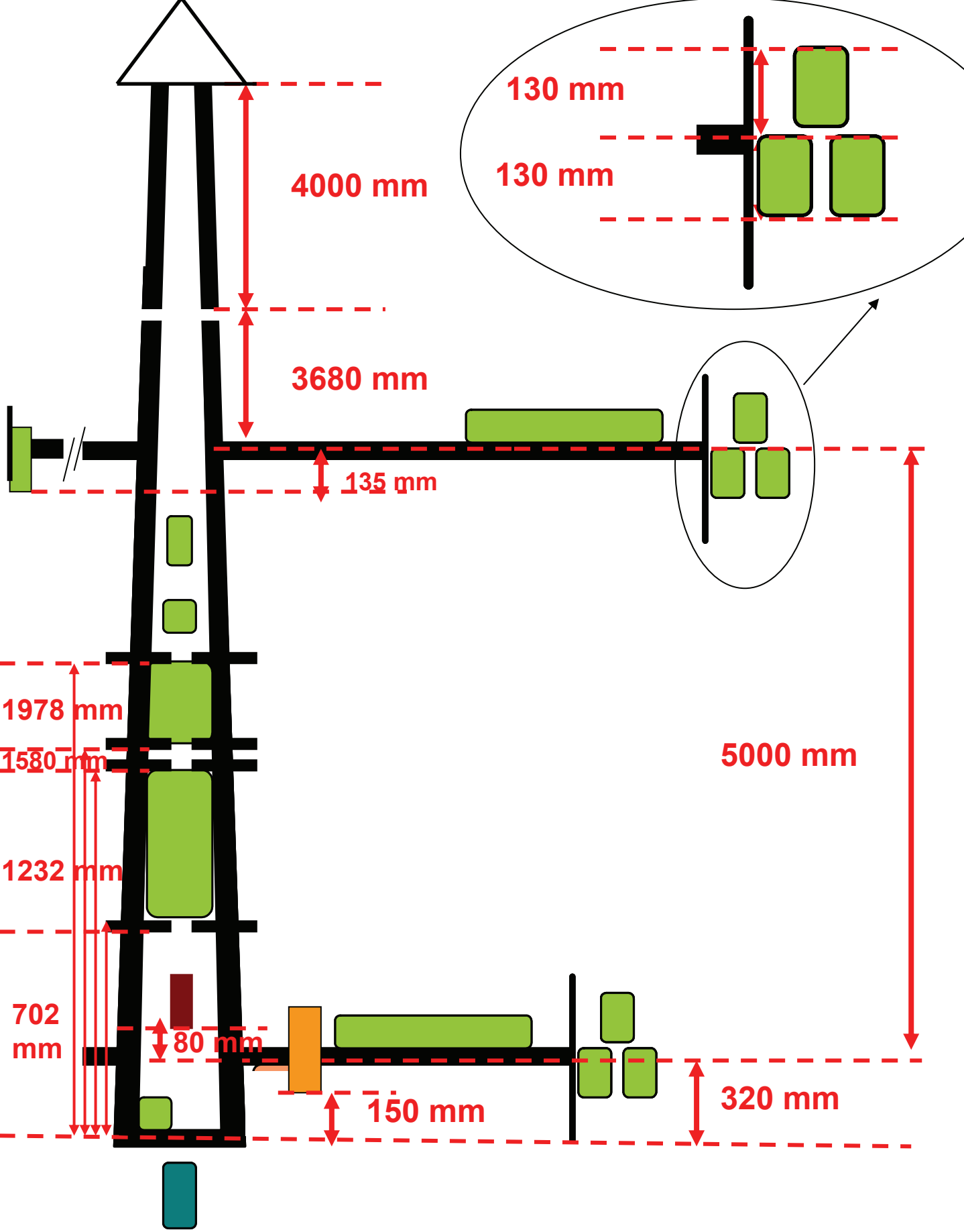
HS4 H4080705
GAROS OML CSCB40K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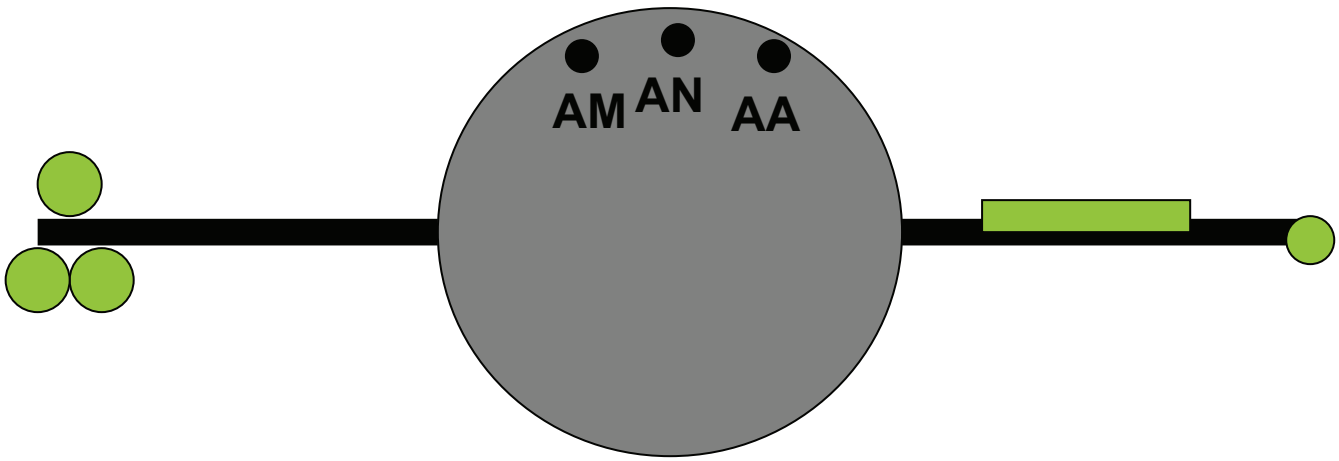
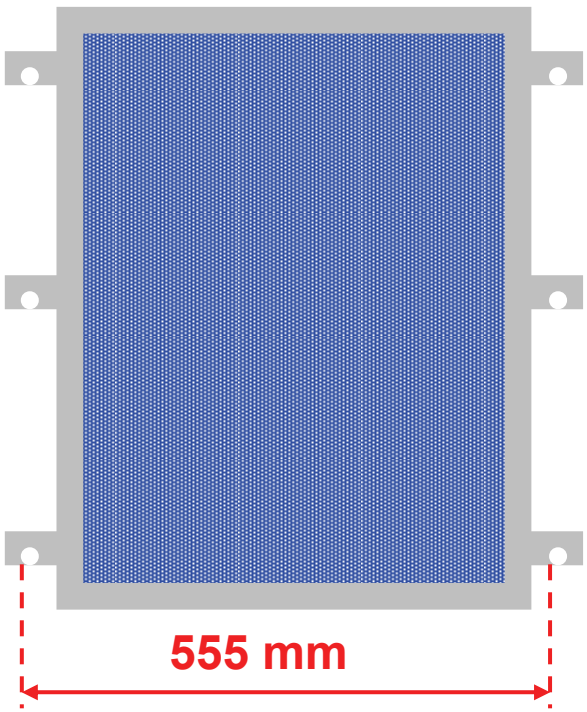
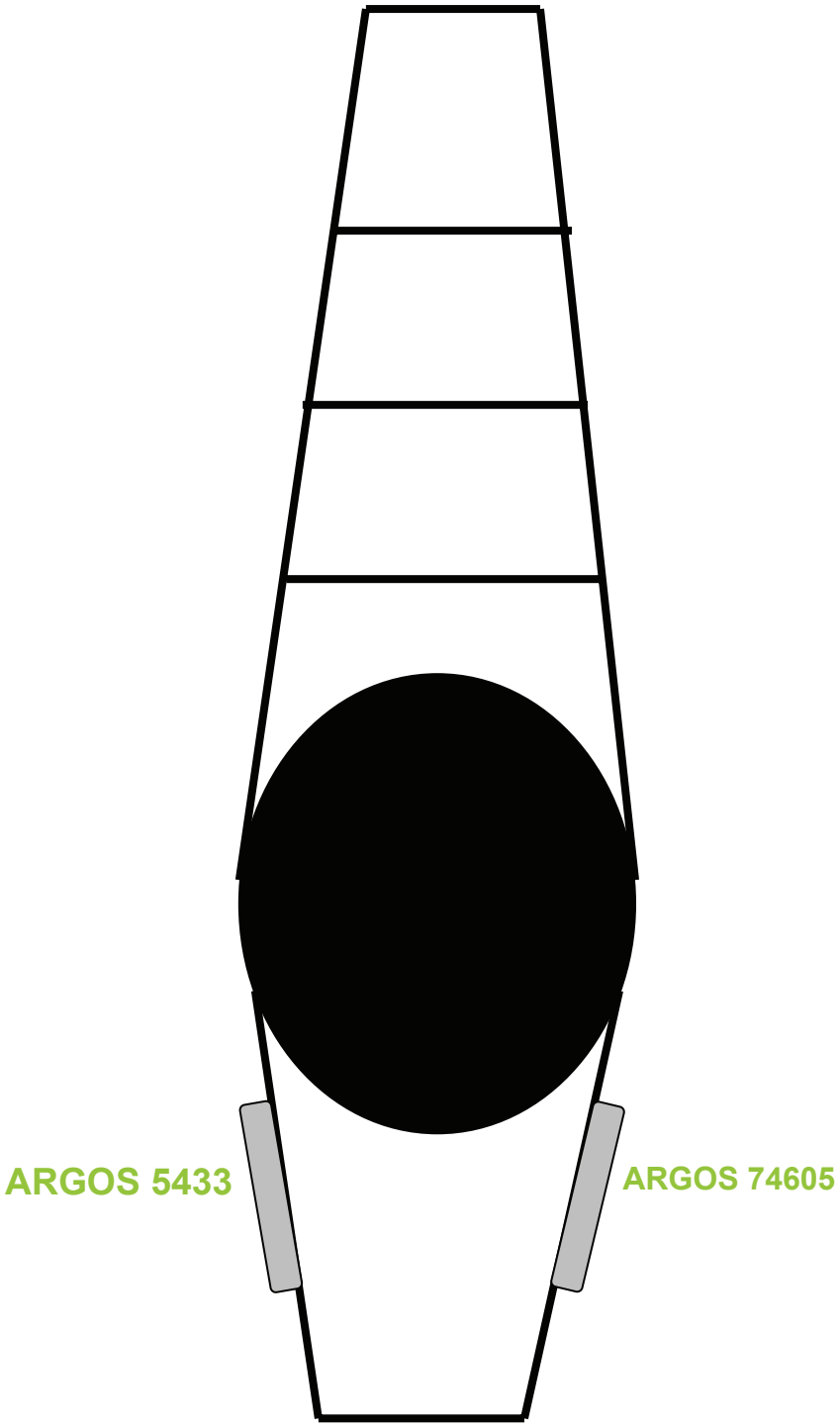
130 mm
4000 mm
3680 mm
135 mm
1978 mm
1580 mm
1232 mm
5000 mm
702 mm
80 mm
150 mm
320 mm


AM
AN
AA


555 mm


ARGOS 5433
ARGOS 74605

2008

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER

15-Jul 4-Aug 27-Aug 16-Sep 29-Sep 15-Oct 9-Dec

(only rads cleaning)

4 m

ocp040_s14_20070627.cal

tx-meter : CST-1057PR
fl-meter : ECO_FLNTUS 726

PL241a.cal & PLD241a.c

ocp040c_s04_20080623.cal

tx-meter : CST-1057PR
fl-meter : 726_2008-06-23

HPL241b.cal & PLD241b.cal

9 m

ocp041_s19_20070627.cal

tx-meter : CST-1058PR
fl-meter : ECO_FLNTUS 727

HPL242a.cal & PLD242a.cal

ocp041c_s09_20080623.cal

tx-meter : CST-1058PR
fl-meter : 727_2008-06-23

HPL242b.cal & PLD242b.cal

MVD

mvd053_095_20070625.cal

HED279a.cal & Hse279a.cal

mvd053g.cal

HED279b.cal & Hse279b.cal

H4070403 2007-6-21.cal

Strain001_003.cal

SATSTX0032a.cal

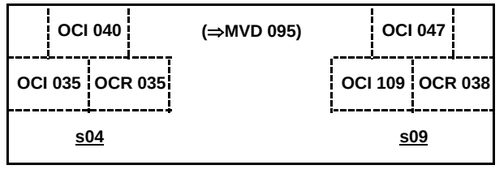
H4070403 2008-5-2.cal

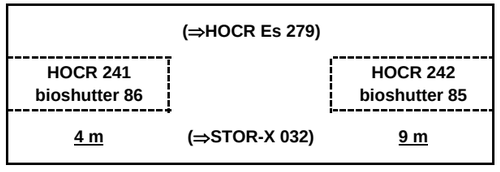
Strain100_001b.cal

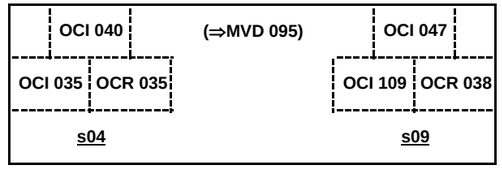
SATSTX0032a.cal

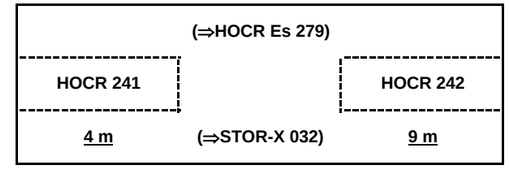
buoy VI crashed (recovered 2008-01-21)

buoy VII deployment (2008-06-28, vf1)









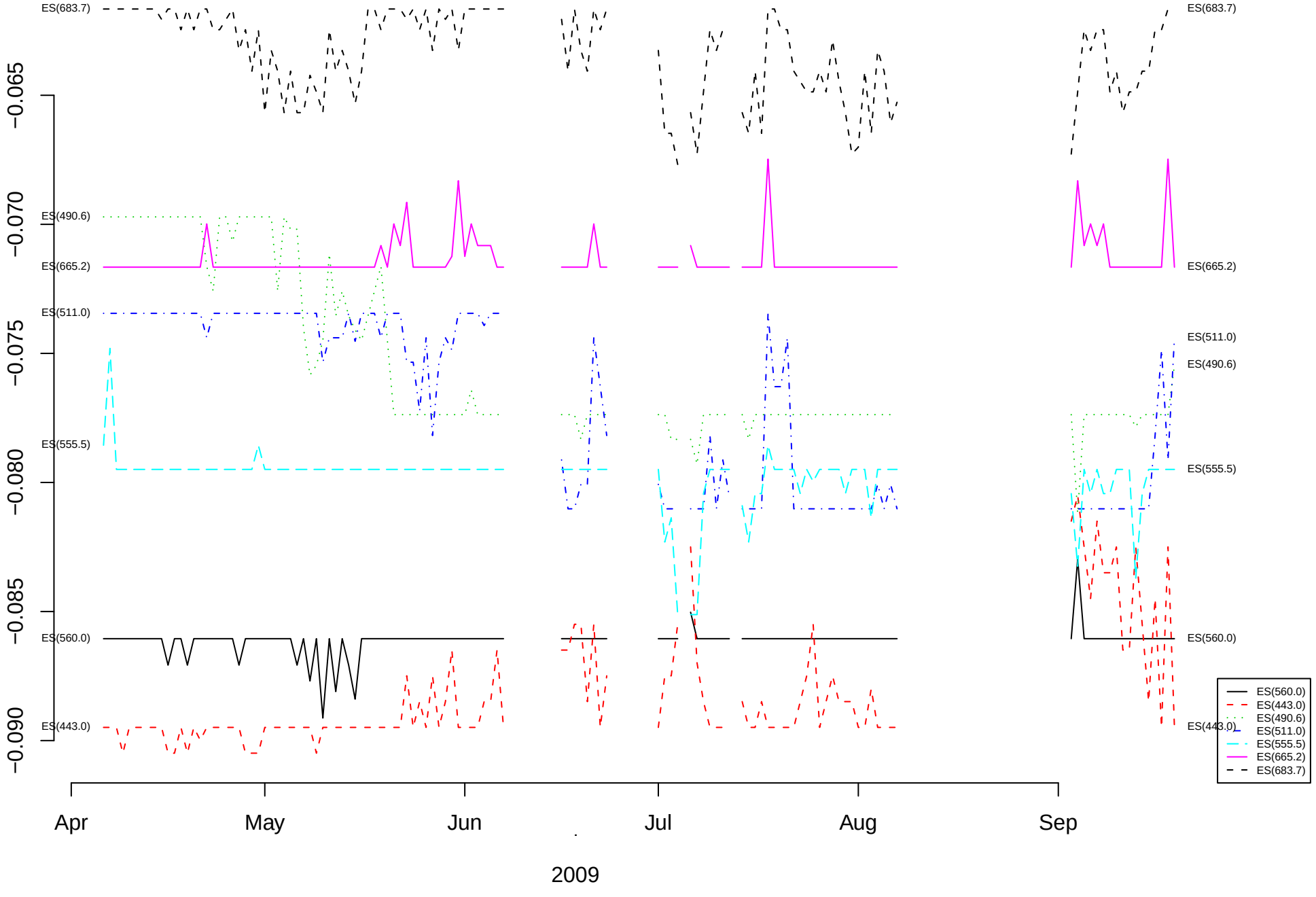
2009

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
	5-Jan	19-Feb	2-Mar 14-Mar	15-Apr	04-May 18-May	16-June 30-June	16-July	05-Aug	25-Aug	2-Sep 28-Sep 10-Oct	12-Nov	10-Dec
	(only rads cleaning)											
4 m	ocp040c_s04_20080623.cal				ocp036h_bis.cal						ocp040e.cal	
	tx-meter : CST-1057PR fl-meter : 726_2008-06-23	HPL241b.cal & PLD241b.cal			tx-meter : CST-626PR fl-meter : 608_2009-04-05	HPL276a_new.cal & PLD276a_new.cal					CST-1057PR 726_2009-10-27	HPL241d & PLD241d.cal
9 m	ocp041c_s09_20080623.cal				ocp037h_bis.cal						ocp041e.cal	
	tx-meter : CST-1058PR fl-meter : 727_2008-06-23	HPL242b.cal & PLD242b.cal			tx-meter : CST-847PR fl-meter : 609_2009-04-05	HPL277a_new.cal & PLD277a_new.cal					CST-1058PR 727_2009-10-27	HPL242d & PLD242d.cal
MVD	mvd053g.cal				mvd062g.cal						mvd053i.cal	
	HED279b.cal & Hse279b.cal				HED327a.cal & Hse327a.cal						HED279d.cal & Hse279d.cal	
	H4070403 2008-5-2.cal				H4080705 2008-10-31.cal						H4070403 2009-8-8.cal	
	Strain100_001b.cal				Strain100_002b.cal							
	SATSTX0032a.cal				SATSTX0068a.cal						SATSTX0032b.cal	

buoy VIII deployment (2009-04-05, vf2)

buoy IX deployment (2009-10-27, vf1)

OCI 040 (⇒MVD 095) OCI 047	(⇒HOCR Es 279)	OCI 050 (⇒MVD 030) OCI 164	PAR 061 (⇒HOCR Es 327)	same conf. of start 2009 +
OCI 035 OCR 035 / OCI 109 OCR 038	HOCR 241 / HOCR 242	OCI 048 OCR 036 / OCI 163 OCR 037	HOCR 276 / HOCR 277	PAR 097
s04 / s09	4 m (⇒STOR-X 032) 9 m	b04 / b09	4 m (⇒STOR-X 068) 9 m	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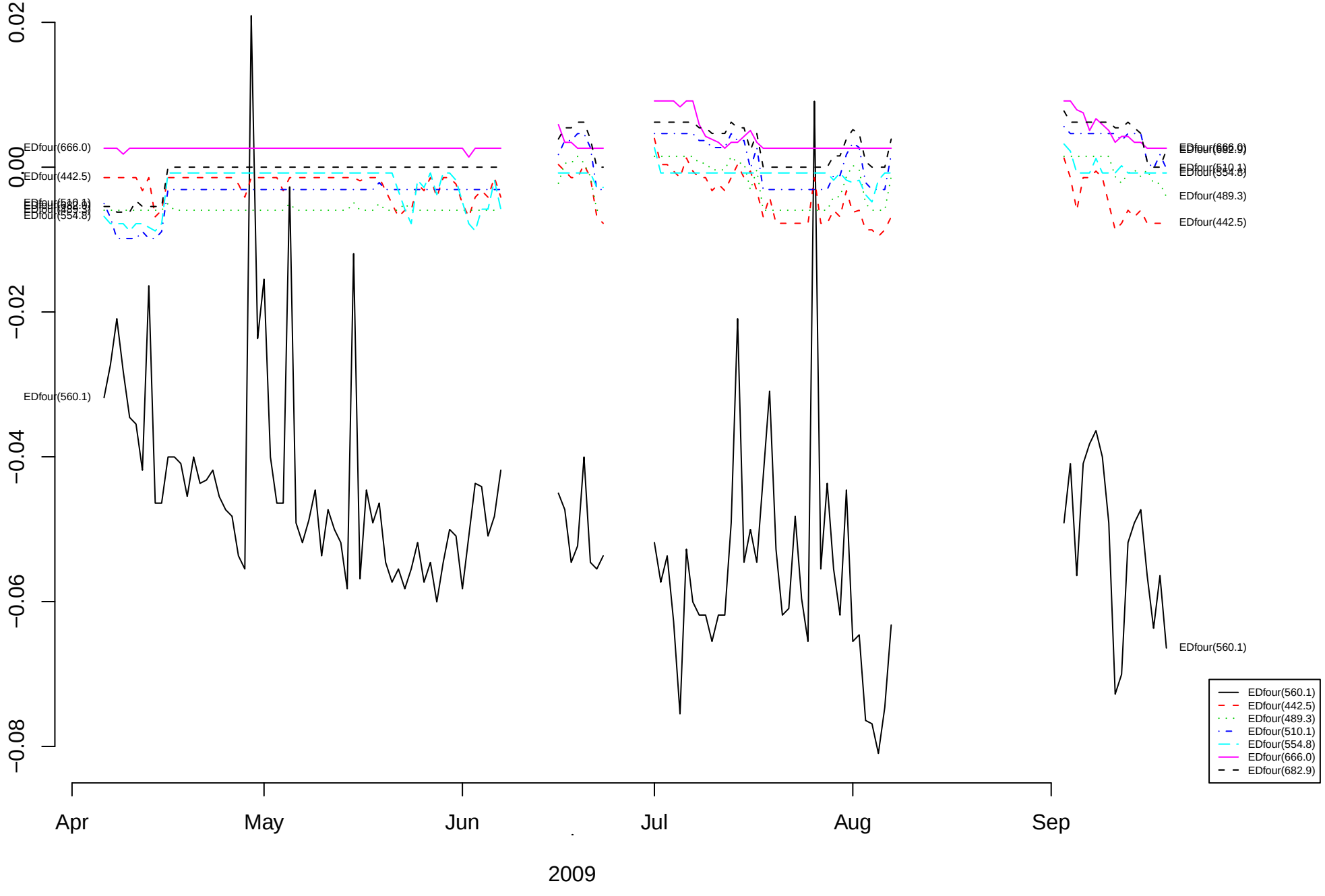
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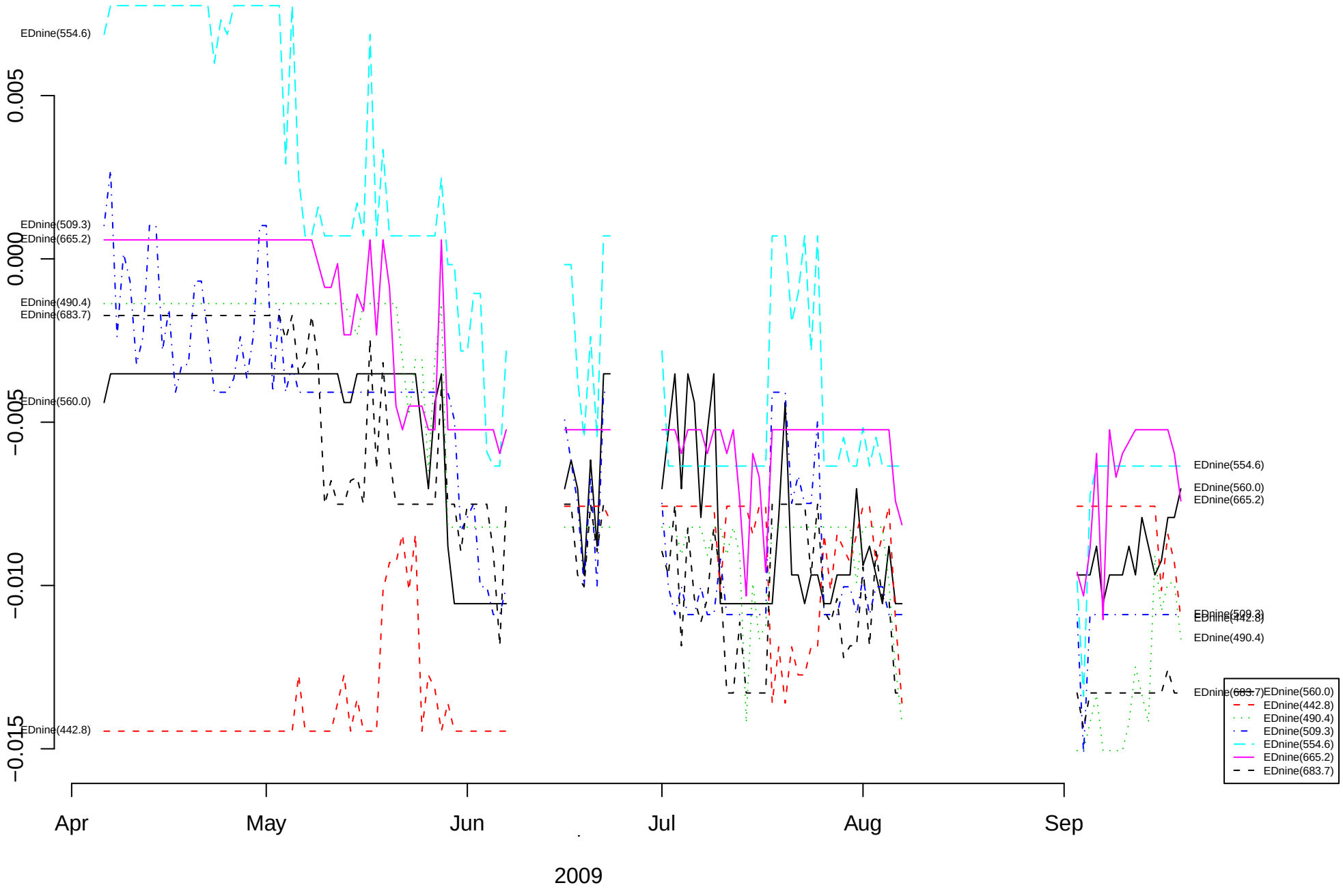
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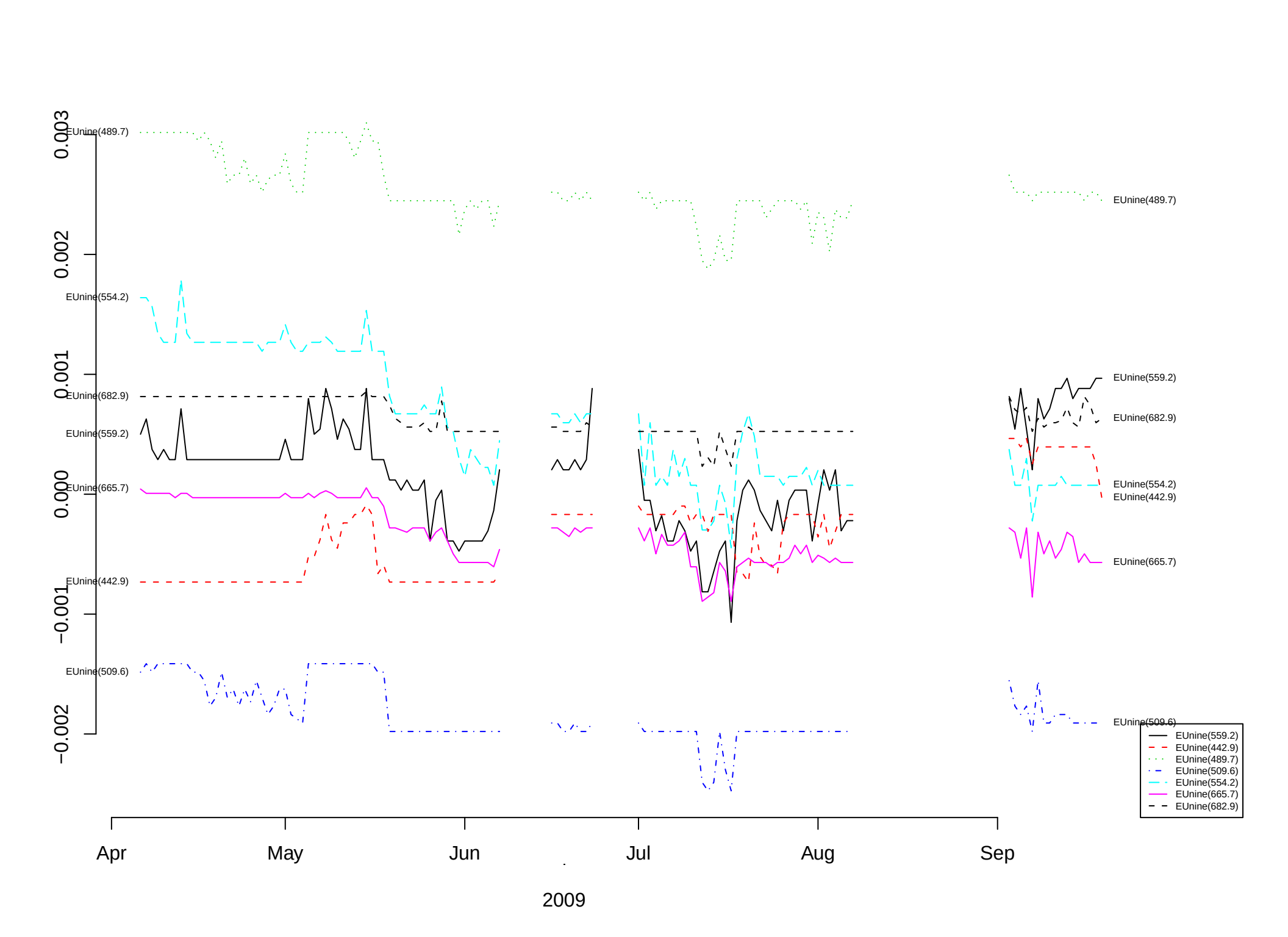
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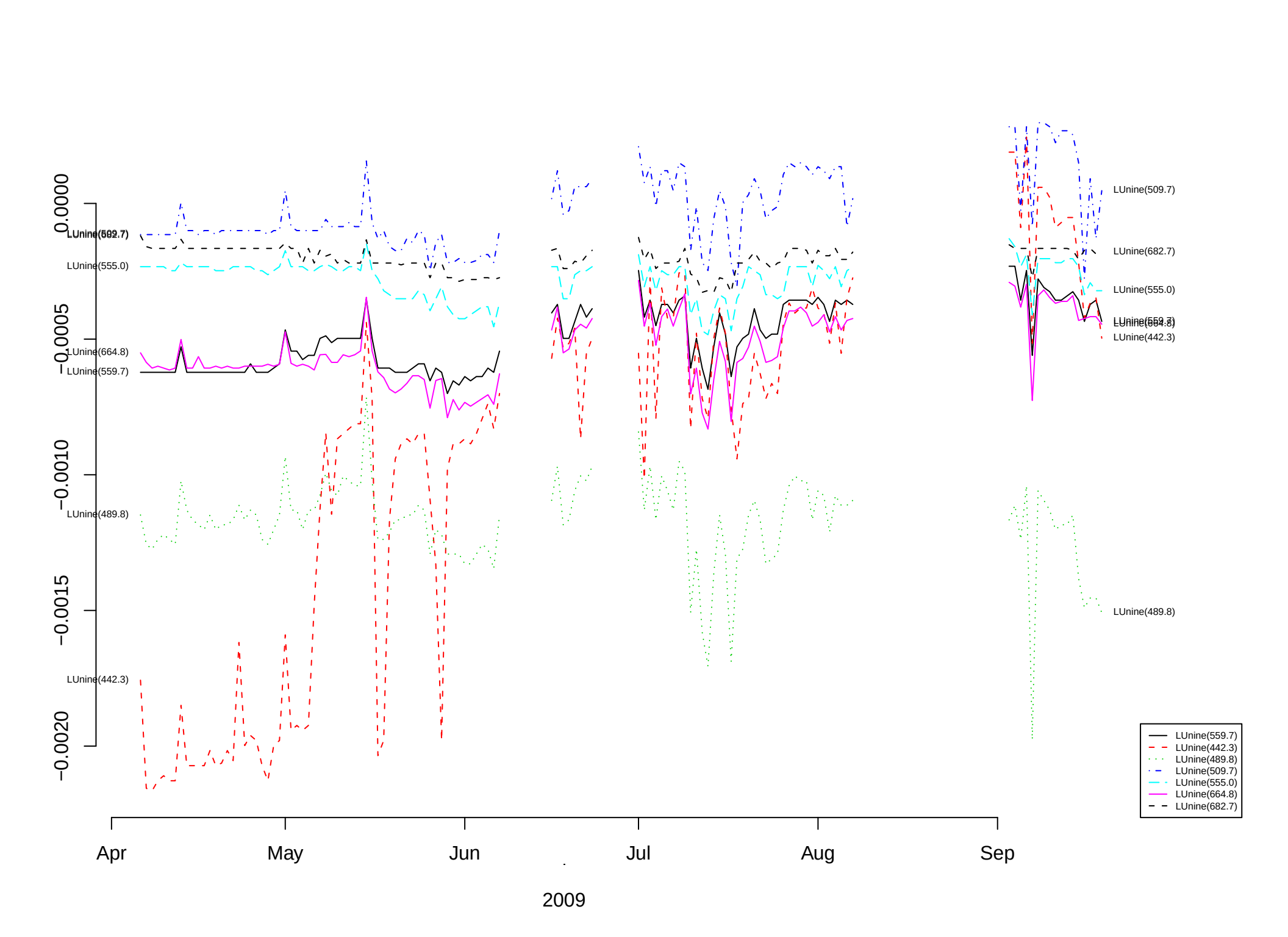
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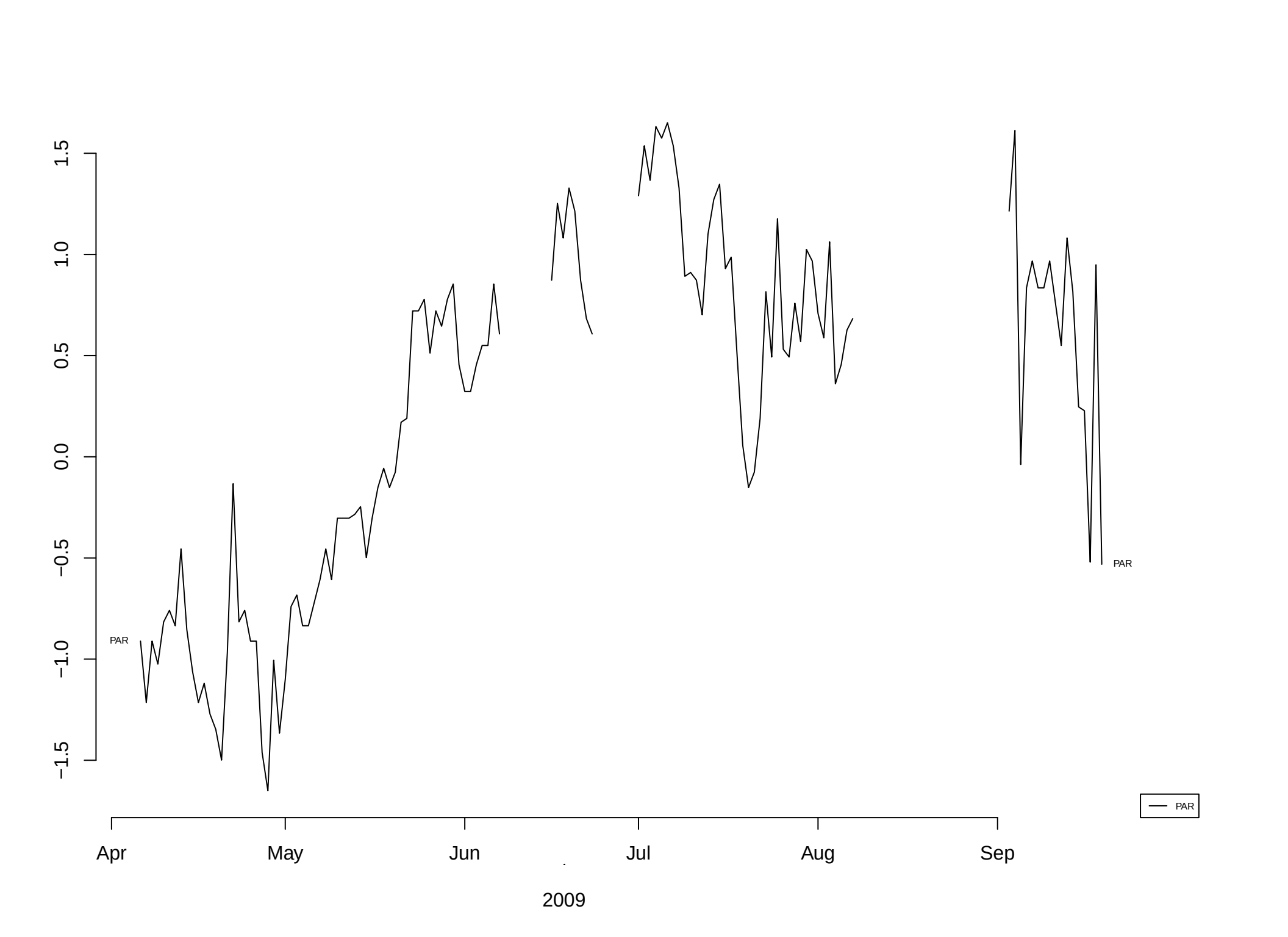
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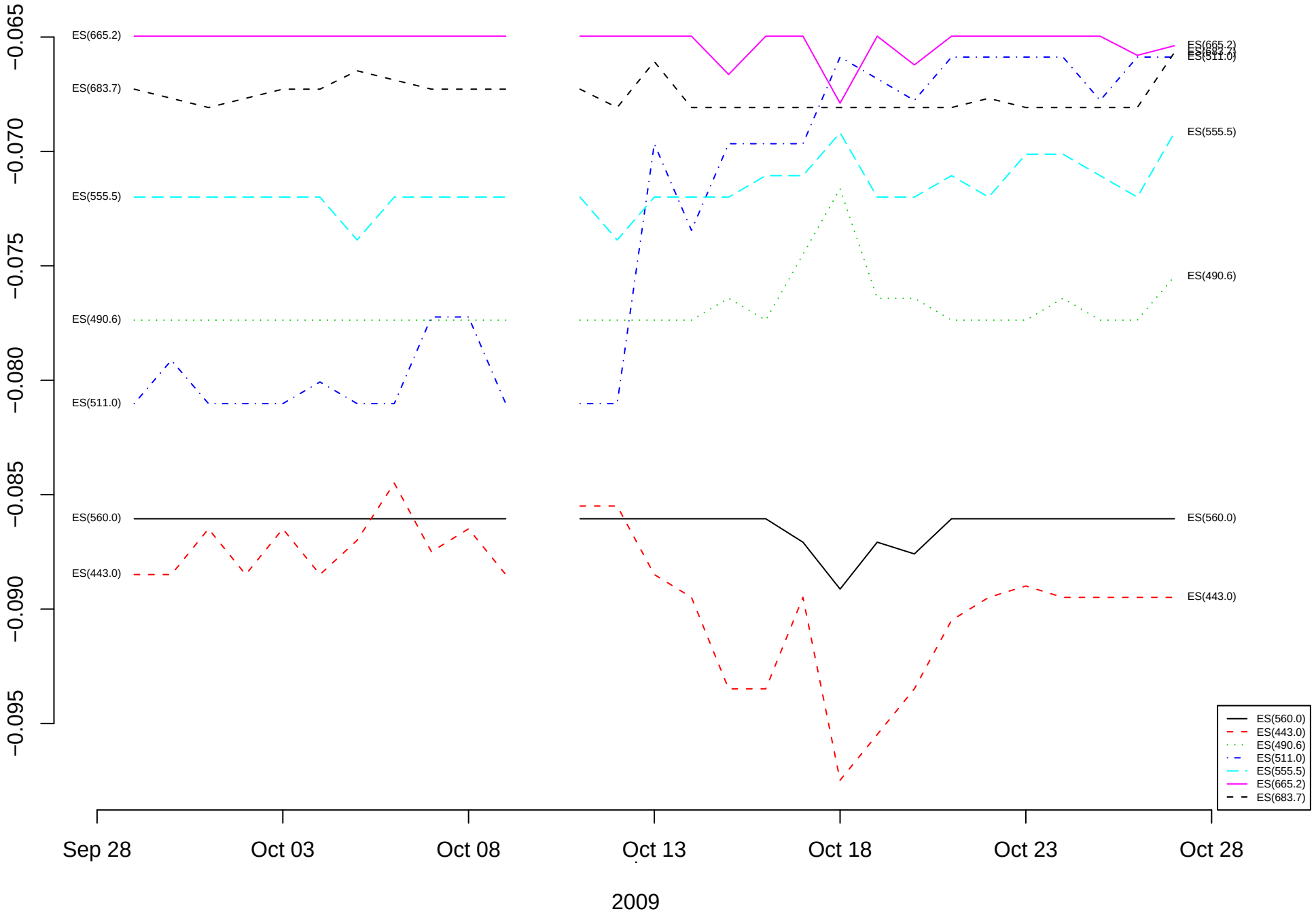
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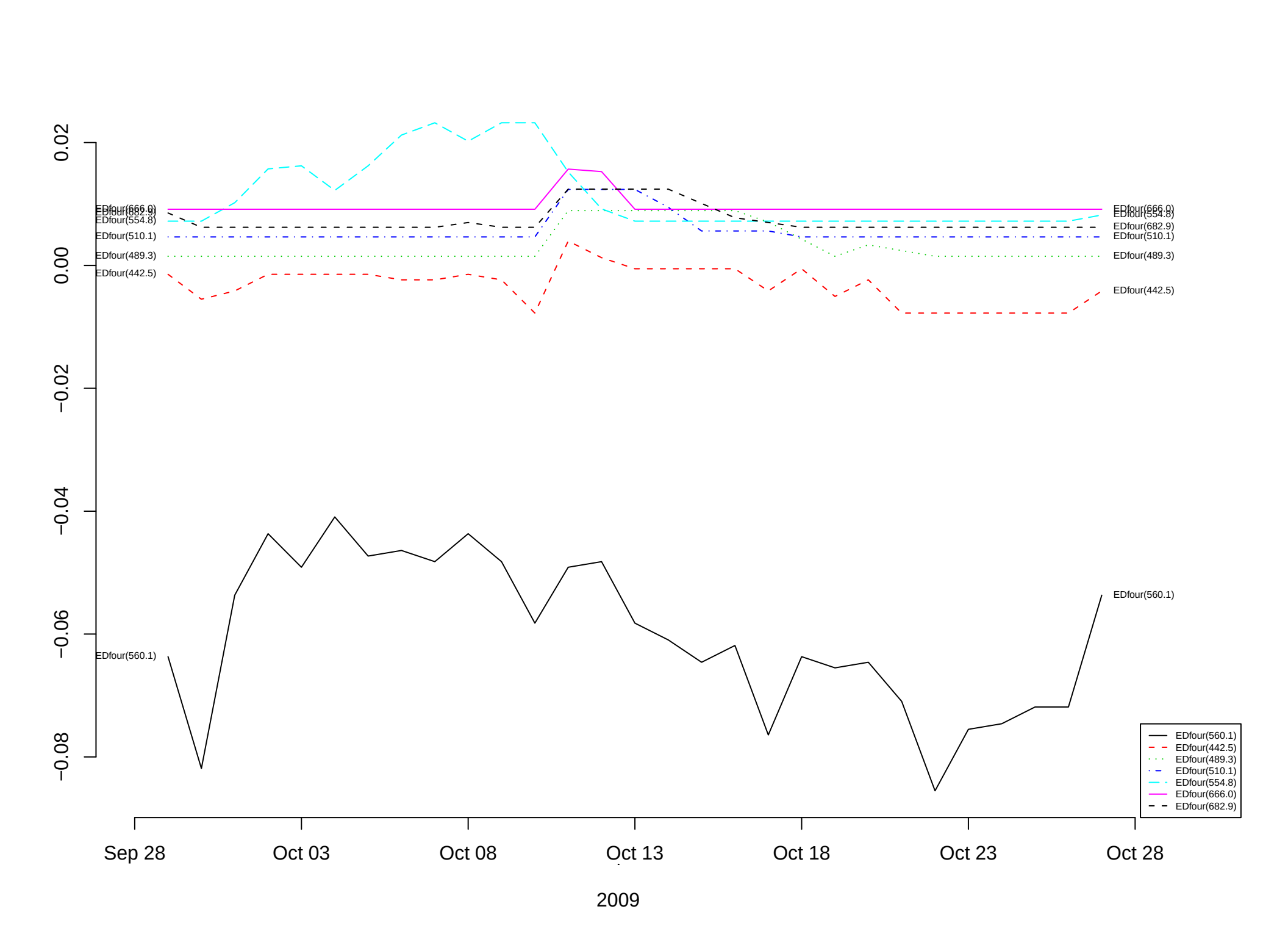
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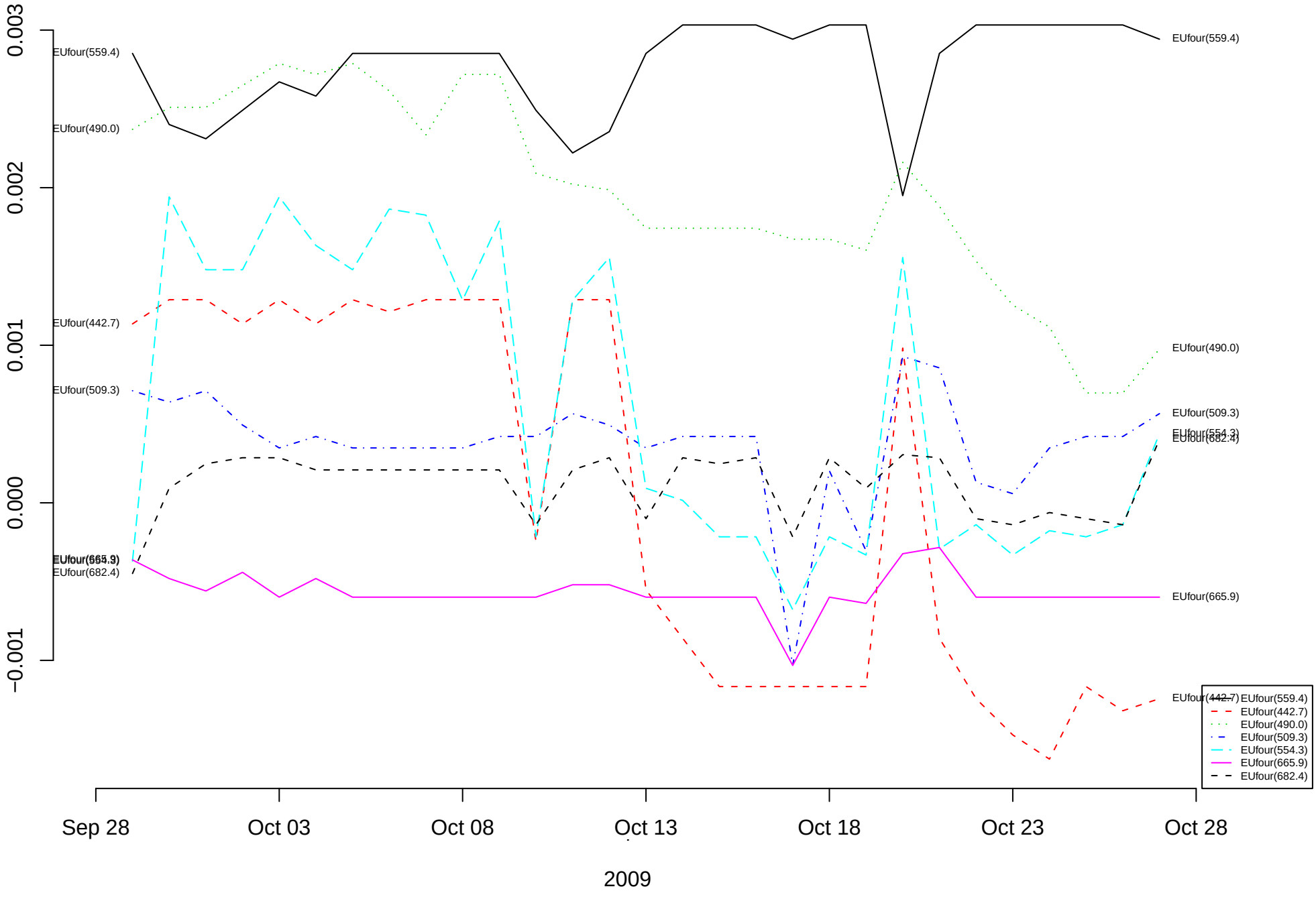
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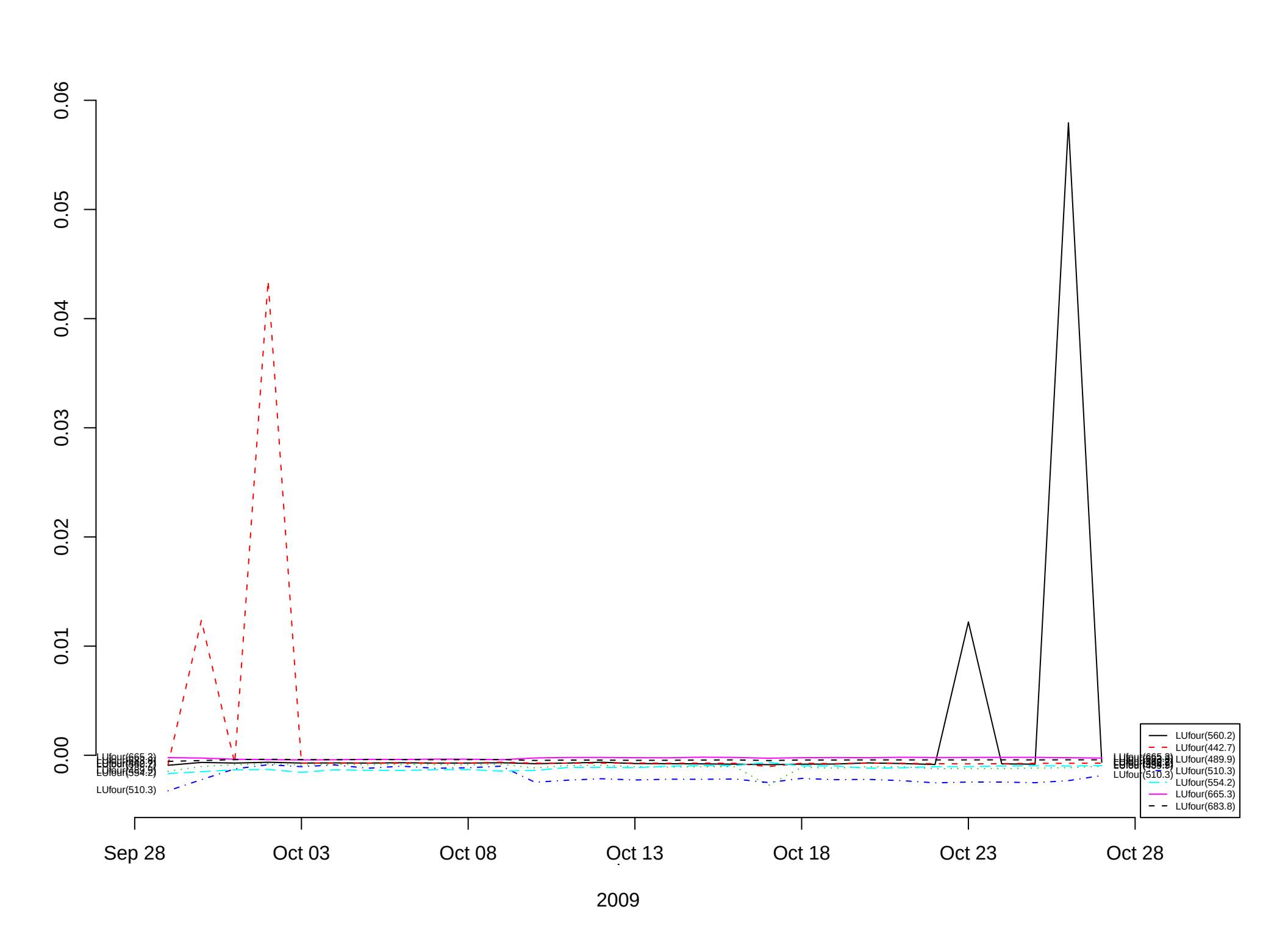
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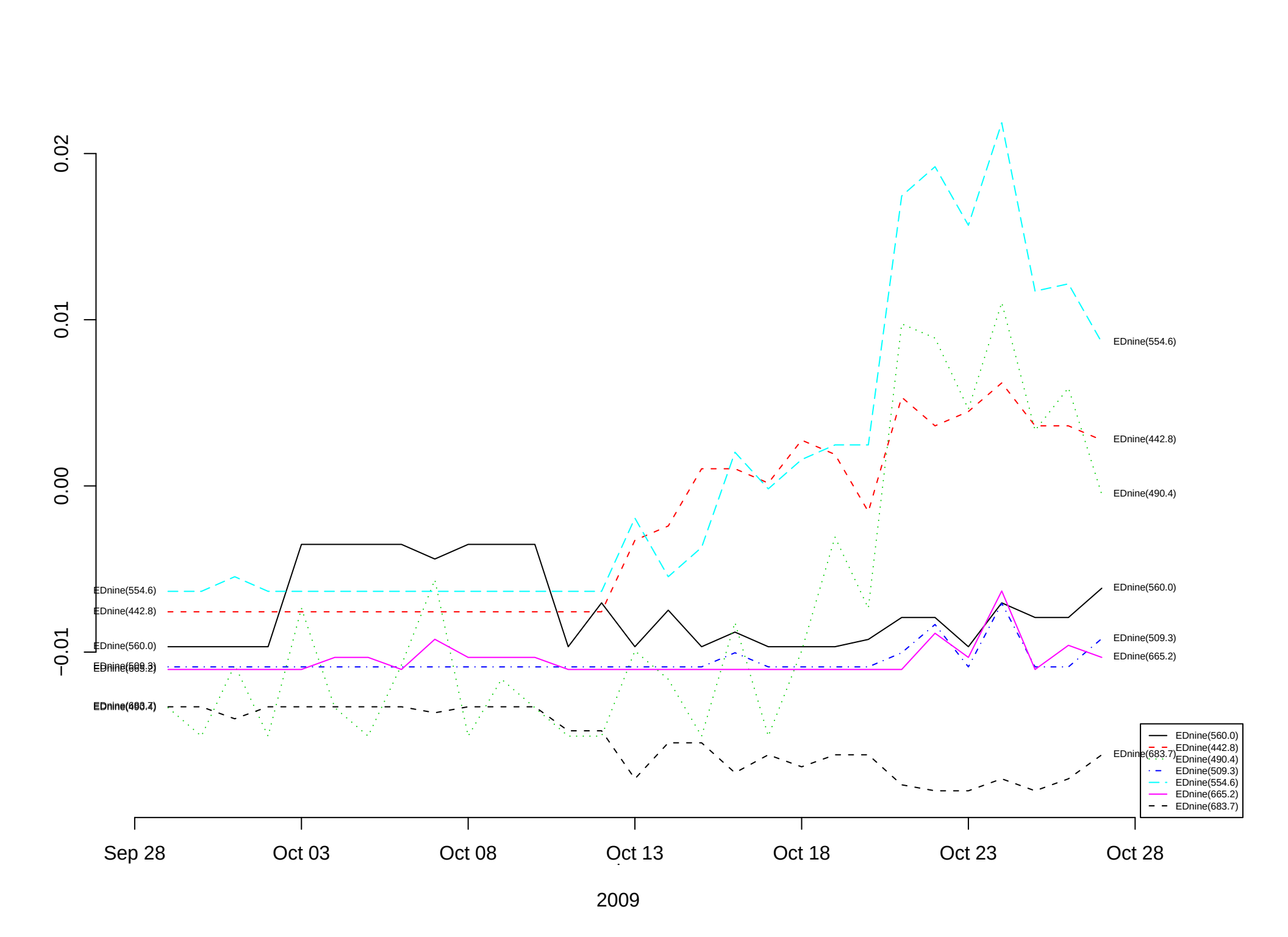
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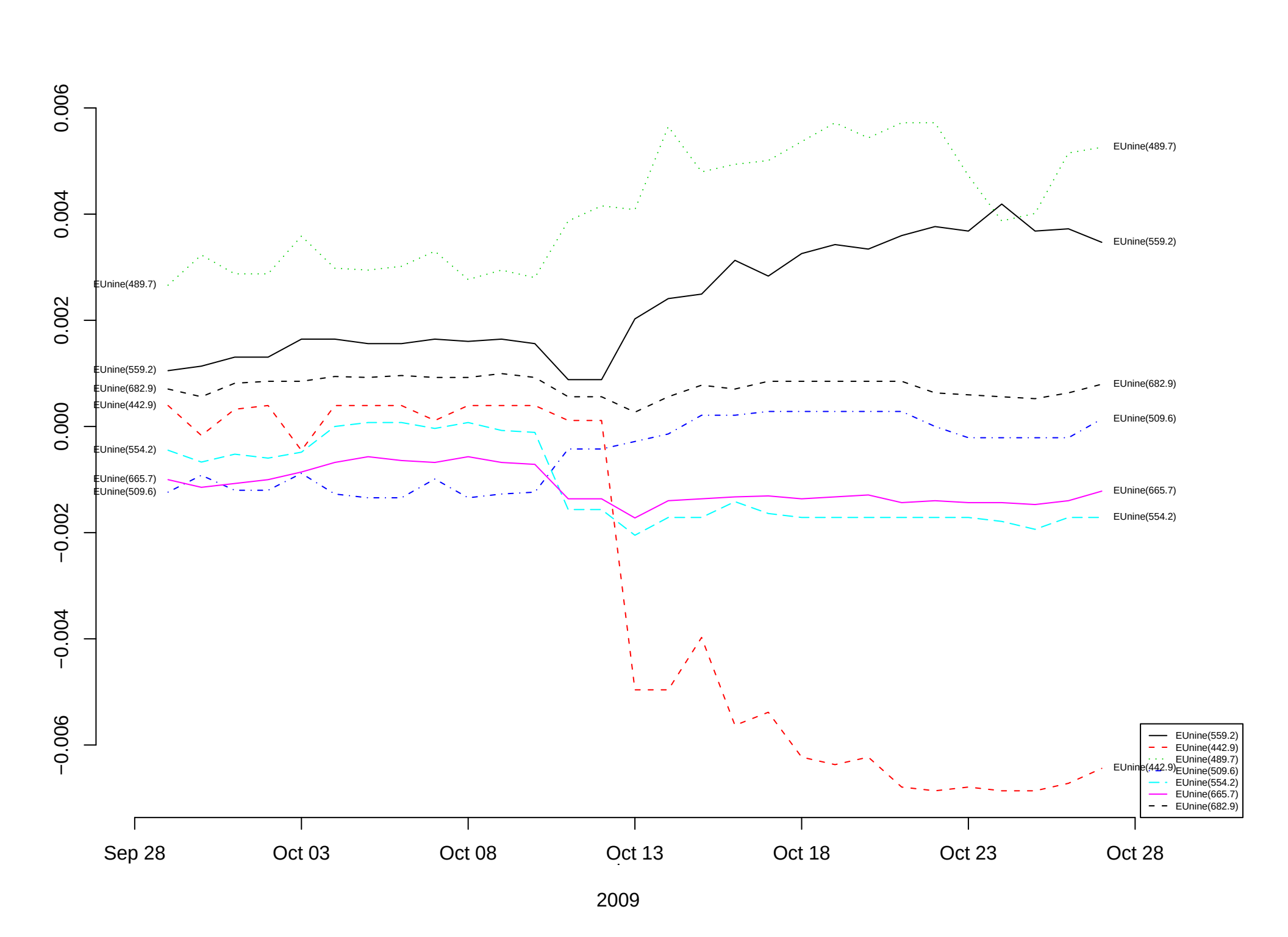
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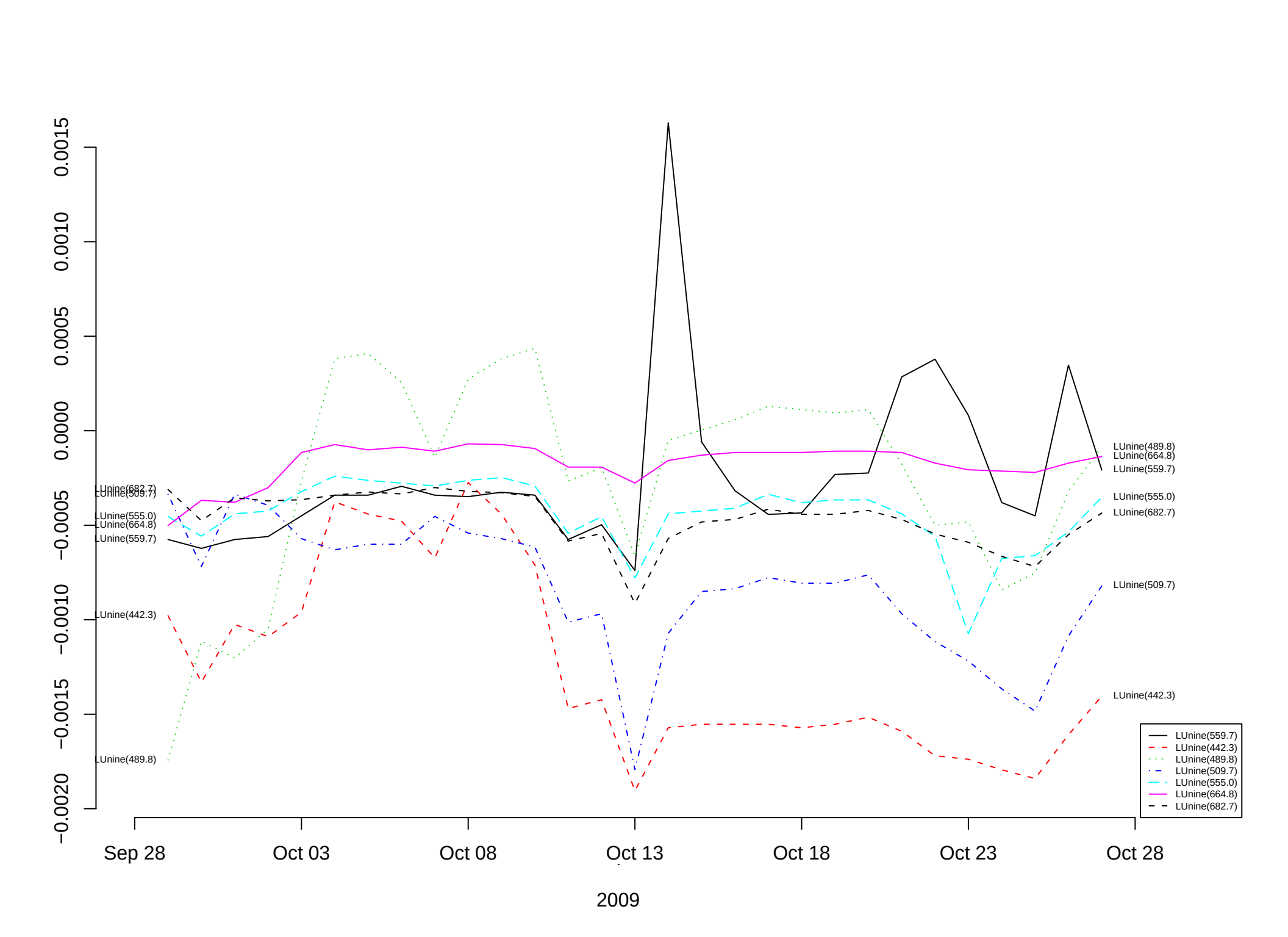
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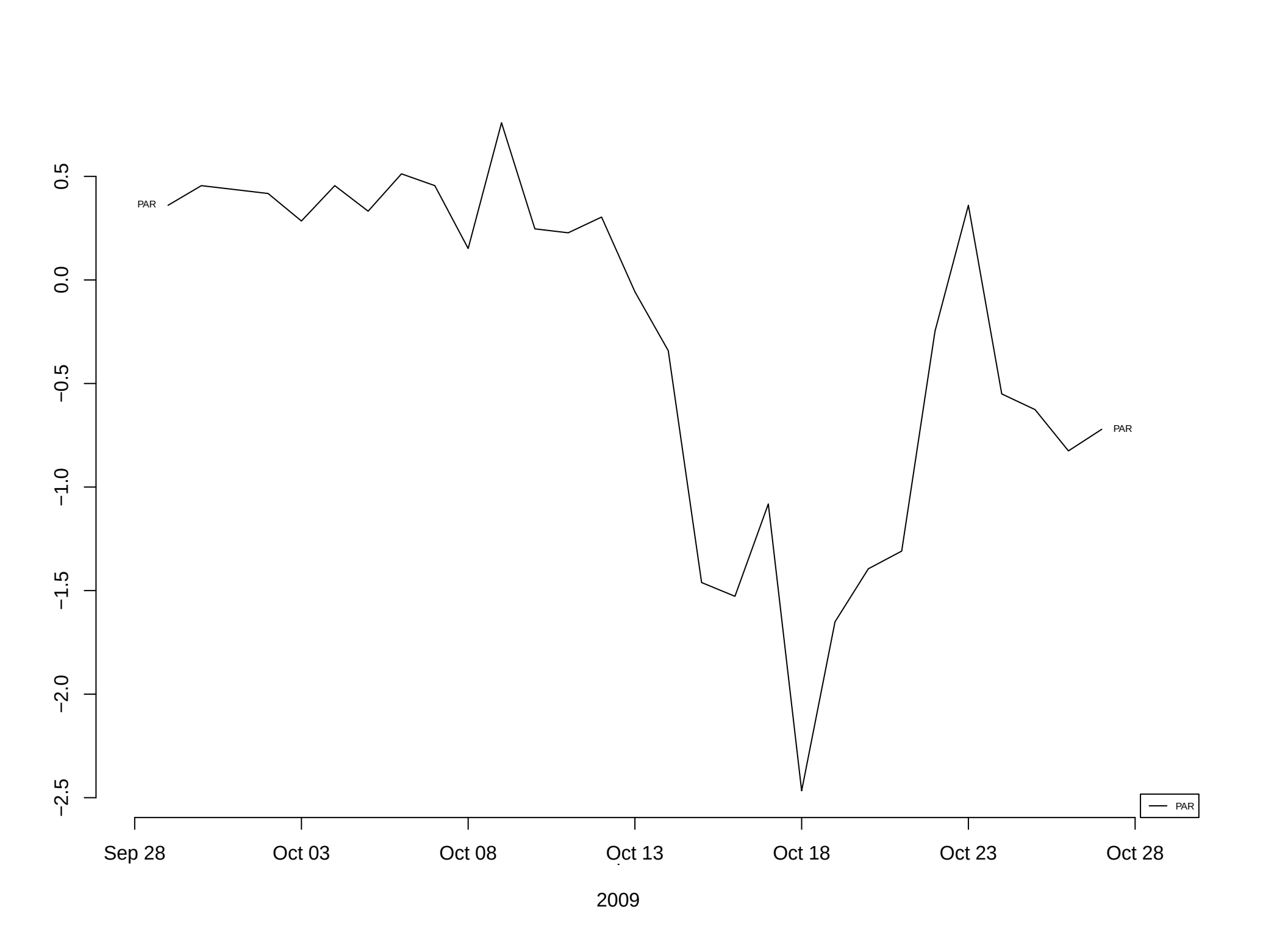
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