The BOUSSOLE project technical reports; report #7-10, issue 1.

# BOUSSOLE buoy deployment & maintenance log. June 28, 2008 – April 05, 2009

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**BOUSSOLE project**

**ESA/ESRIN contract N° 17286/03/I-OL**

**Deliverable from WP#300/100**

*Month day, 2009*

# 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.

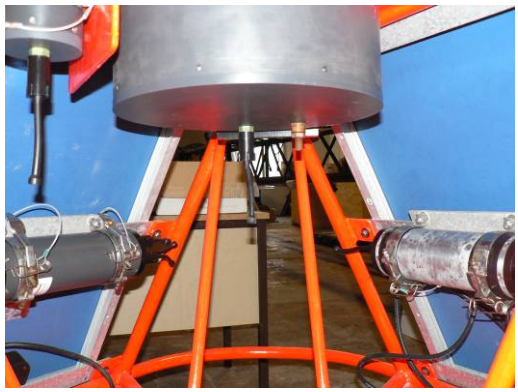
The present report concerns "buoy deployment VII", from June 28 of 2008 to April 05 of 2009.

# 2. DESCRIPTION OF OPERATIONS

## 2.1 UPPER SECTION PREPARATION (2008-06)

The buoy System (called system #1) was delivered from Satlantic on June 16th, and installation on the structure begun immediately since the deployment was scheduled for the following week.

The Buoy was equipped with the same sensors used for the previous deployment (Buoy VI) recovered and recalibrated after the accident of January 2007. 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).












## 2.2 MOORING DEPLOYMENT

### 2.2.1 Saturday 28th June 2008

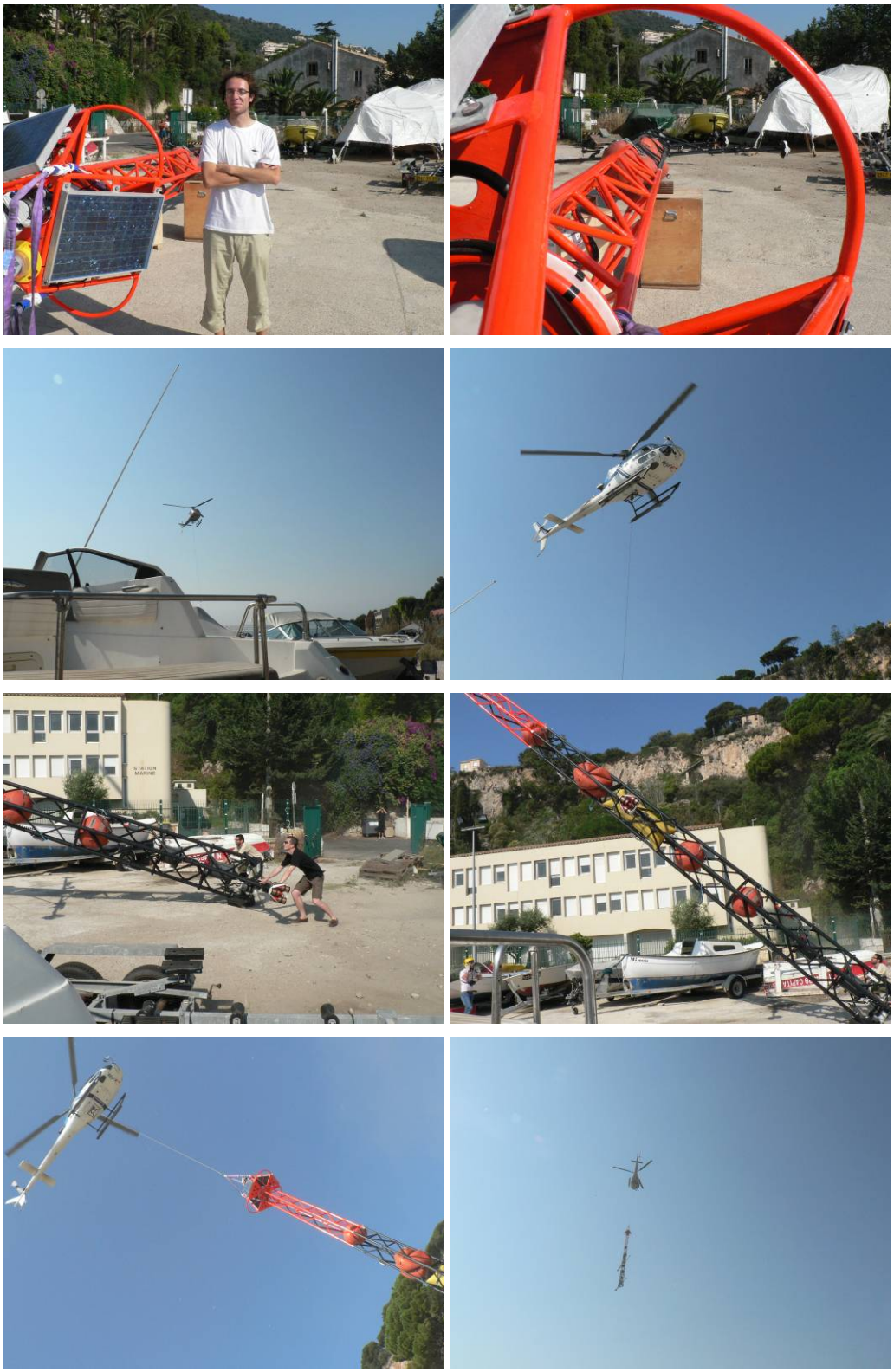
The upper structure to be deployed was brought to the Rochambeau field at 07:30am with the help of 4 people from the LOV. The 4 arms were assembled and connected to the buoy, the helicopter was called to get the buoy and bring it to the BOUSSOLE site at 10:00am.

As usual the go/return trip lasted about one hour.







**At this date, buoy is equipped with**

- **DACNet #011**
- **New Stan's rads set (OCI #035_Eu4m, #040_Ed4m, #047_Ed9m, #109_Eu9m #095_Es, OCR #035_Lu4m and #038_Lu9m), MVDS #053, OCP #040(4m) and OCP 041(9m)**

- **Hyper spectral units HOCR #241_Lu4m, #242_Lu9m, #279_Es, STOR-X #032.**
- **HS4 #H4070403**
- **Strain-100 #001**
- **Transmissometers C-Star #1057PR (4m) and #1058PR(9m)**
- **Fluorometer #726 (4m) and #727 (9m)**
- **ARGOS beacon #003 (prog id#26021)**
- **CTD #37SI 46113-5325**
- **Strain gauge GAROS #OML-CSCB40K**

**Note that no bio-shutters were installed with the HOCRs since with the actual schedule the system could crash for to the high current demand. The Strain-100 will not be connected to the strain gauge since the cable has not yet been delivered. Moreover the connector of the strain gauge was found without protection and damaged during one of the divers' inspections. Probably it had a shock during the deployment of the lower structure of the buoy.**

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

#### 2.2.2 Tuesday 15th July 2008

This day is part of the BOUSSOLE#77 mission. Divers found the buoy in perfect conditions after the deployment of June 28th, though the desired flotation point is about 70 cm over the sea surface. Data was successfully retrieved from the buoy through the CISCO antenna.

#### 2.2.3 Monday 4th August 2008

This day divers from the private company Mare Nostrum went at the BOUSSOLE site for cleaning the buoy system. From their report it is evident that the copper shutter of the ECO-FLNTU at 9m was blocked from the copper tape used to cover the instrument.

#### 2.2.4 Thursday 14th August 2008

The ARGOS messages from the buoy stopped since August 14.

#### 2.2.5 Wednesday 27th August 2008

This day is part of the BOUSSOLE#78 mission (during previous cruise days, CISCO and direct connections were attempted unsuccessfully).

When on site, divers went at sea for cleaning and inspection of the buoy that was found in good conditions except one of the anodes in the lowest part of the aluminium structure that seems not to work. The second emergency ARGOS beacon has been installed on the buoy lower structure along the opposite tube with respect to the first beacon. The copper tape that blocked the bio-shutter of the ECO-FLNTU at 9m was removed. A direct connection with the buoy was successfully attempted by forcing the DACNET start-up through the AK

connector. Data download was interrupted because of rapid discharging of laptop battery. Download was later completed through CISCO connection. Data files will result to be empty in the period between the 14 August and the restart of the DACNET. Data collected between the DACNET restart and CISCO connection were instead good.

**At this date, the buoy is equipped with a second and new emergency ARGOS beacon #74605 (prog. id. #12237).**

#### 2.2.6 Sunday 31st August 2008

The ARGOS messages from the buoy stopped since August 31st. The buoy was then seen in good conditions during the MOOSE cruise on September 11th.

#### 2.2.7 Tuesday 16th September 2008

This day is part of the BOUSSOLE#79 mission. Divers went at sea (strong surface currents) for inspection and cleaning of the buoy that was found in good conditions. At the same time, the ARGOS connection was cleaned, messages dispatch restarted.

#### 2.2.8 Tuesday 16th September 2008

From this day transmissometers showed high values from ARGOS data.

#### 2.2.9 Monday 29th September 2008

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

#### 2.2.10 Wednesday 15th October 2008

This day is part of the BOUSSOLE#80 mission (data was retrieved through CISCO on 13th October). When on site, divers went at sea for a general inspection of the buoy that was found in good conditions. Then a hydrophone for cetacean was installed along one of the tube under the sphere (at ~20 m), and sensors were cleaned. In the meantime, sensor on the buoy head were cleaned too and contact grease was put on the ARGOS connector.

#### 2.2.11 Friday 17th October 2008

The ARGOS stops to send messages. (Later we will discover data to be collected until 21 October).

#### 2.2.12 Monday-Wednesday 16-19 November 2008

These days are part of the BOUSSOLE#81 mission. Several CISCO connections and one direct connection from the top of the buoy were attempted unsuccessfully. The CISCO and ARGOS connectors were also cleaned.

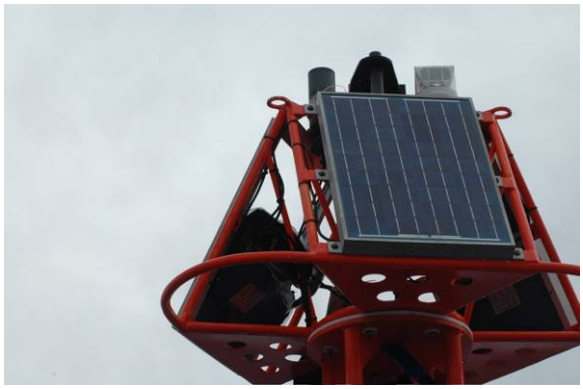
### 2.2.13 Tuesday 9th December 2008

This day a boat (Lollipop) from a private company in Villefranche (DARKPELICAN) was rent to go at the BOUSSOLE site. Sophie Laran, Grigor Obolensky, Vincenzo Vellucci were on board with the skipper (Frank) and three divers (Léo Gimenez and two colleagues). When near the buoy we could see one of the solar panels broken (see pictures), but not completely detached from its crane. The major part of this solar panel was removed to avoid problems to the Junction Box switch.

Then the Dacnet was taken at surface and branched to a battery to try a connection with it. No connection was possible, the Microdrive was substituted and the Dacnet worked normally.

Other operations were made underwater while working on the Dacnet. The Acoustic Hydrophone was dismounted and taken at surface to be brought in the lab for data retrieval. The Strain connector was cleaned and the Strain 15m cable installed. Sensors were cleaned. The transmissometer at 4m has not been changed with the one of the DT-INSU since we realized that connectors were different (6 pins male instead of 4 pins female).

Finally the Dacnet was reinstalled and the buoy restarted. The ARGOS began again to send messages.



### 2.2.14 Monday 22th December 2008

The ARGOS messaged from the buoy stopped again since December 22.

### 2.2.15 Monday 5th January 2009

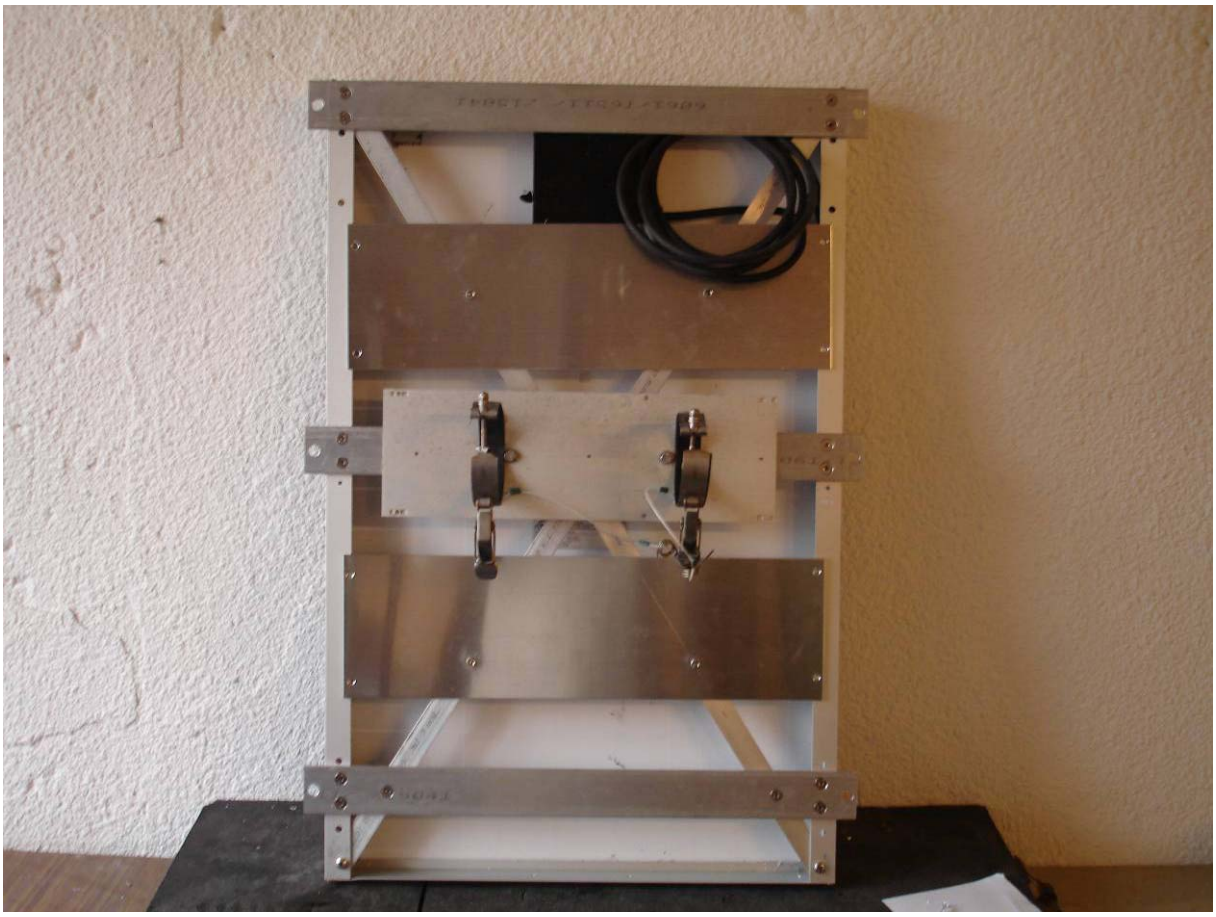
This day divers from the private company Mare Nostrum went at the BOUSSOLE site for cleaning the buoy system. A second solar panel was missing. A system reboot was attempted without success (later we will discover it was only an ARGOS problem).

### 2.2.16 Sunday-Thursday 18-21 January 2009

These days are part of the Boussole #83 mission. The first day the buoy was underwater. It was seen at surface on the last cruise day. No intervention was made since the new system should have been deployed in the next days.

### 2.2.17 Tuesday 16th February 2009

During an emergency mission to recover a Glider at the BOUSSOLE site (private boat from Darkpelican) Grigor Obolensky installs a new solar panel taken from the next buoy to deploy. This solar panel has been reinforced on its back with two aluminium plates with the aim to minimize the crash probability. The new solar panel had different dimensions so it was fixed with only three screws on one side and Colson on the other side.



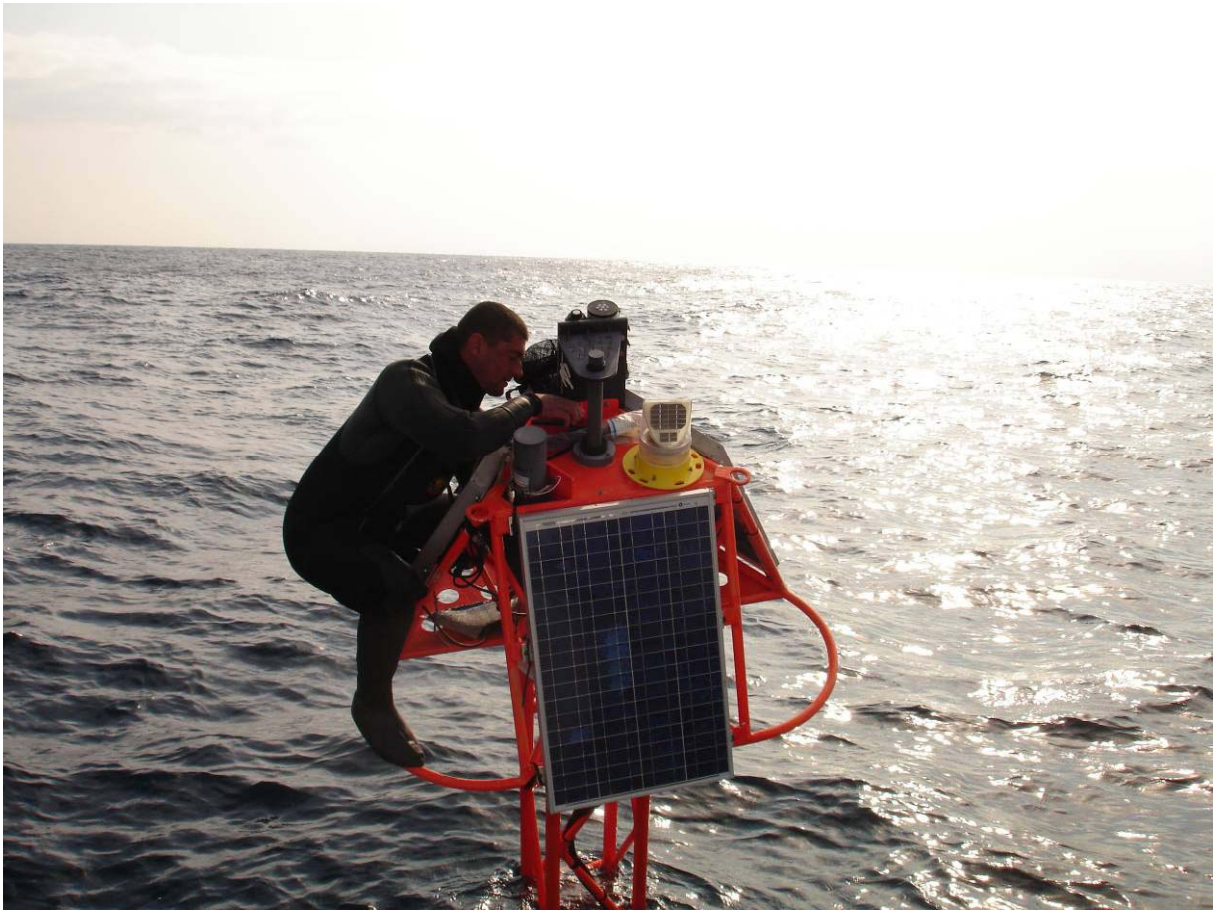
### 2.2.18 Wednesday 17th February 2009

This day is part of the Boussole #84 mission. The only available cruise day diving on the buoy was too risky due to weather that was rapidly worsening.

### 2.2.19 Thursday 19th February 2009

This day a boat (Lollipop) from the Darkpelican company in Villefranche-sur-mer was rent to go at the BOUSSOLE site for troubleshooting the buoy system. Grigor Obolensky, Vincenzo Vellucci and three divers were on board with the captain Frank. First Vincenzo Vellucci climbed on the buoy to attempt a direct connection but the buoy suddenly sank and the operation was interrupted. Then divers went at sea for rebooting the system and a CISCO connection was surprisingly obtained and data retrieved. What was supposed to be a system arrest was just an ARGOS arrest; in fact data were continuously recorded since the last data retrieval. Nonetheless some low power arrest occurred during the period with only one solar panel installed. The OCP4 stopped working since December 26th (constant data).

Sensors were cleaned and one of the divers mounted on the top of the buoy to clean the ARGOS connectors and to put other Colson on the new solar panel. The ARGOS messages dispatch restarted.



### 2.2.20 Monday 2nd March 2009

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

### 2.2.21 Saturday 14th March 2009

This day is part of the Boussole #85 mission. Divers went at sea for cleaning the buoy and changing the OCP_9m-DACNet cable. The OCP didn't restart working. The following day data was retrieved through a CISCO connection.

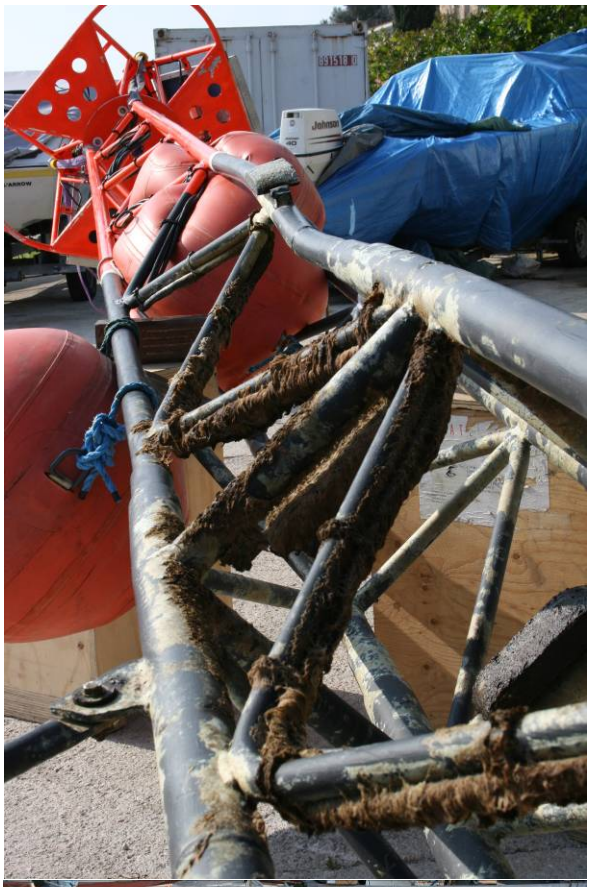
### 2.2.22 Saturday 04nd April 2009

This day Léo Gimenez with other divers from its company shortened the buoy chain of about 70 cm. The system was shutdown and prepared to be dismounted the following day.

### 2.2.23 Sunday 05nd April 2009

This day the buoy upper structure was dismounted for the rotation with the system #2. The helicopter delivered the buoy at about 10h00. The structure presented an evident shock impact, probably from a ship, ad about 1.5 m under the floating point. One of the OCP-OCI cables was also cut. All the radiometers at 4m and the arm upon which they were hosted present signs of hydrolysis. 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. The instruments were shipped for calibration on April 22nd, whereas the alluminium structure was sent to the CNB on April 28th.



## 3. QUANTITATIVE SUMMARY

The deployment lasted 281 days, among which 61 days were without data acquisition, for problems with DACNet microdrive.

## 4. INSTRUMENT SCHEDULE

1 minute acquisition every 15 minutes.

## 5. ANY PROBLEMS ENCOUNTERED ?

1- The DACNet Microdrive was corrupted, the first time it appeared to be a partial corruption on the disk: the system restarted after a forced reboot (AK connector). The second time the disk definitively crashed.

2- The ARGOS messages frequently stopped their dispatch.

3- The ARGOS messages frequency with the beacon #003 was less than half of the previous beacon.

4- Hydrolysis on the 4m arm and radiometers. Probably linked with the cut of a OCI-OCP cable.

5- The buoy upper structure had an impact at about 1.5 m underwater.

6- Two Solar Panels were broken.

## 6. LESSONS LEARNED

1- The ARGOS message dispatch stop is often non due to a system stop.

2- Microdrives reboot 17280 times during a 6 month buoy deployment. Their corruption maybe due to this high reboots number.

3- New generation solar panels are thinner and more fragile than previous ones, they need to be protected from waves' impacts.

## 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.

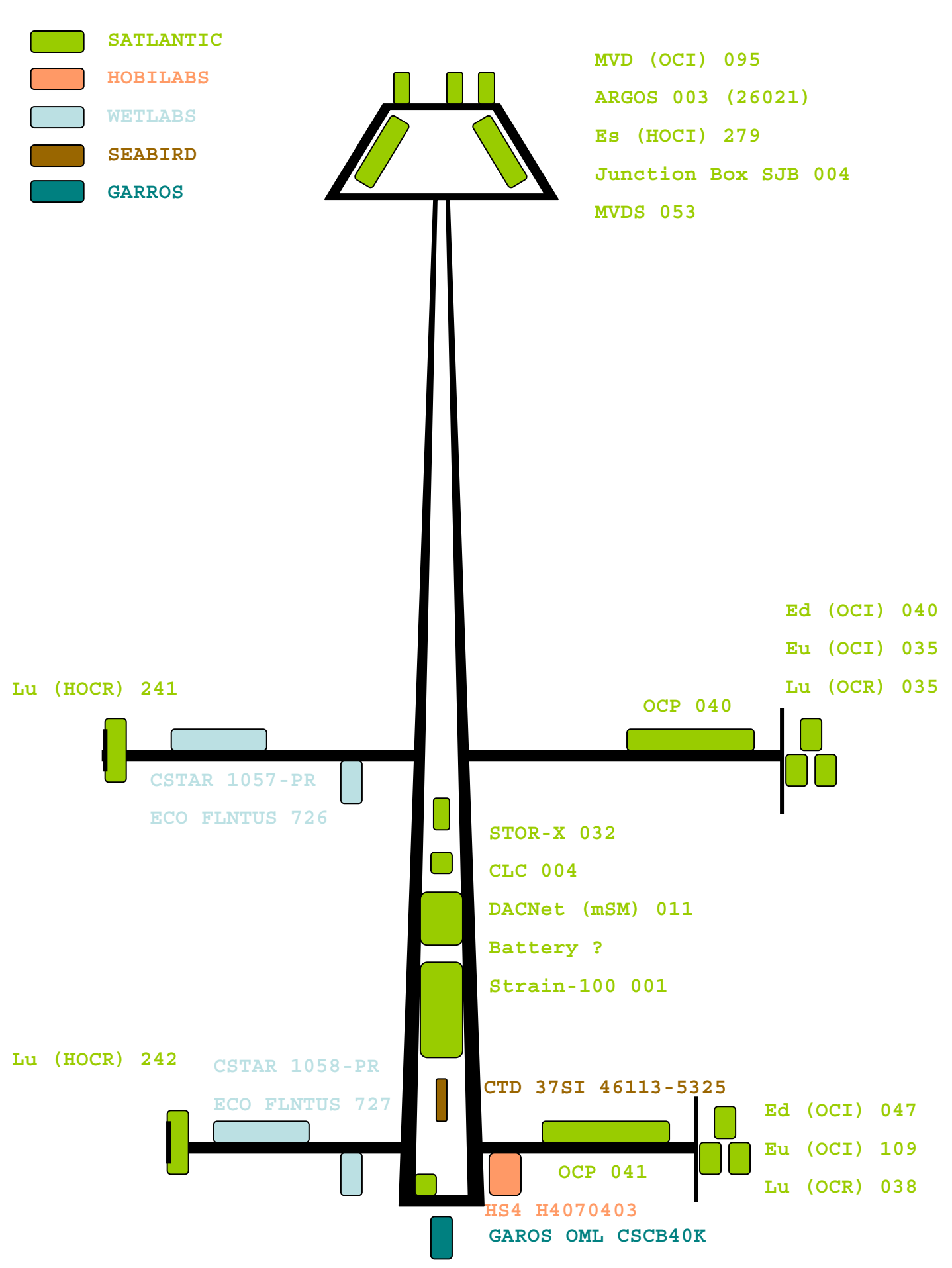
The French institute IFREMER and the Norvegian Marintek company are also thanked for their help and fairness in the engineering studies that were ordered to them after the major failure of the buoy in spring of 2002.

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) 095
ARGOS 003 (26021)
Es (HOCI) 279
Junction Box SJB 004
MVDS 053
Ed (OCI) 040
Eu (OCI) 035
Lu (OCR) 035
Lu (HOCR) 241
OCP 040
CSTAR 1057-PR
ECO FLNTUS 726
STOR-X 032
CLC 004
DACNet (mSM) 011
Battery ?
Strain-100 001
Lu (HOCR) 242
CSTAR 1058-PR
ECO FLNTUS 727
CTD 37SI 46113-5325
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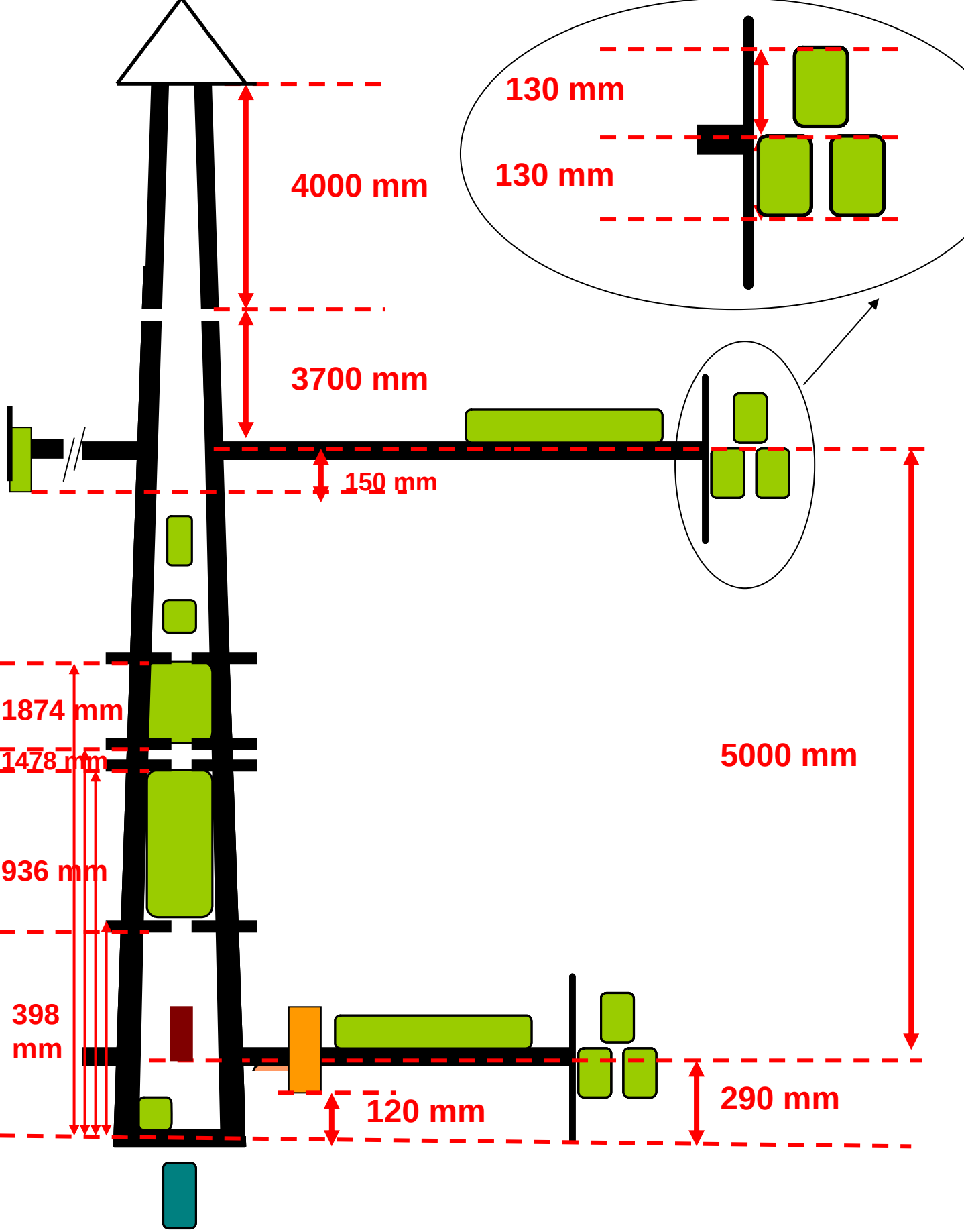
Lu (OCR) 038
OCP 041
HS4 H4070403
GAROS OML CSCB40K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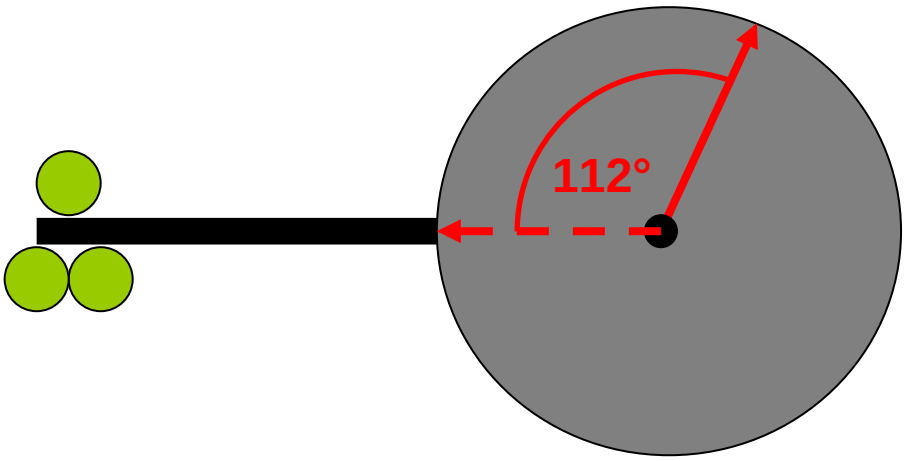
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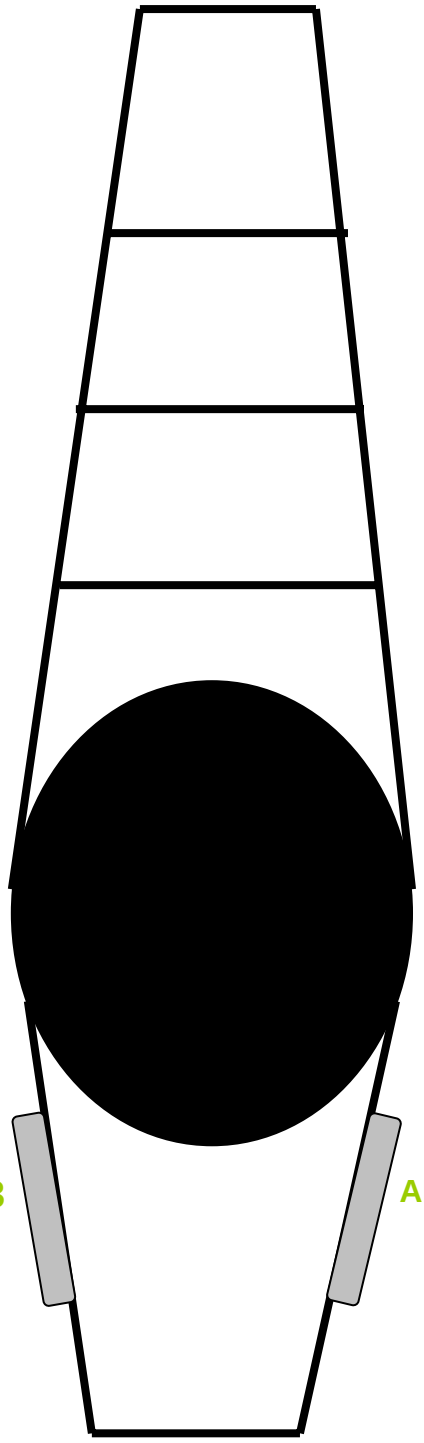
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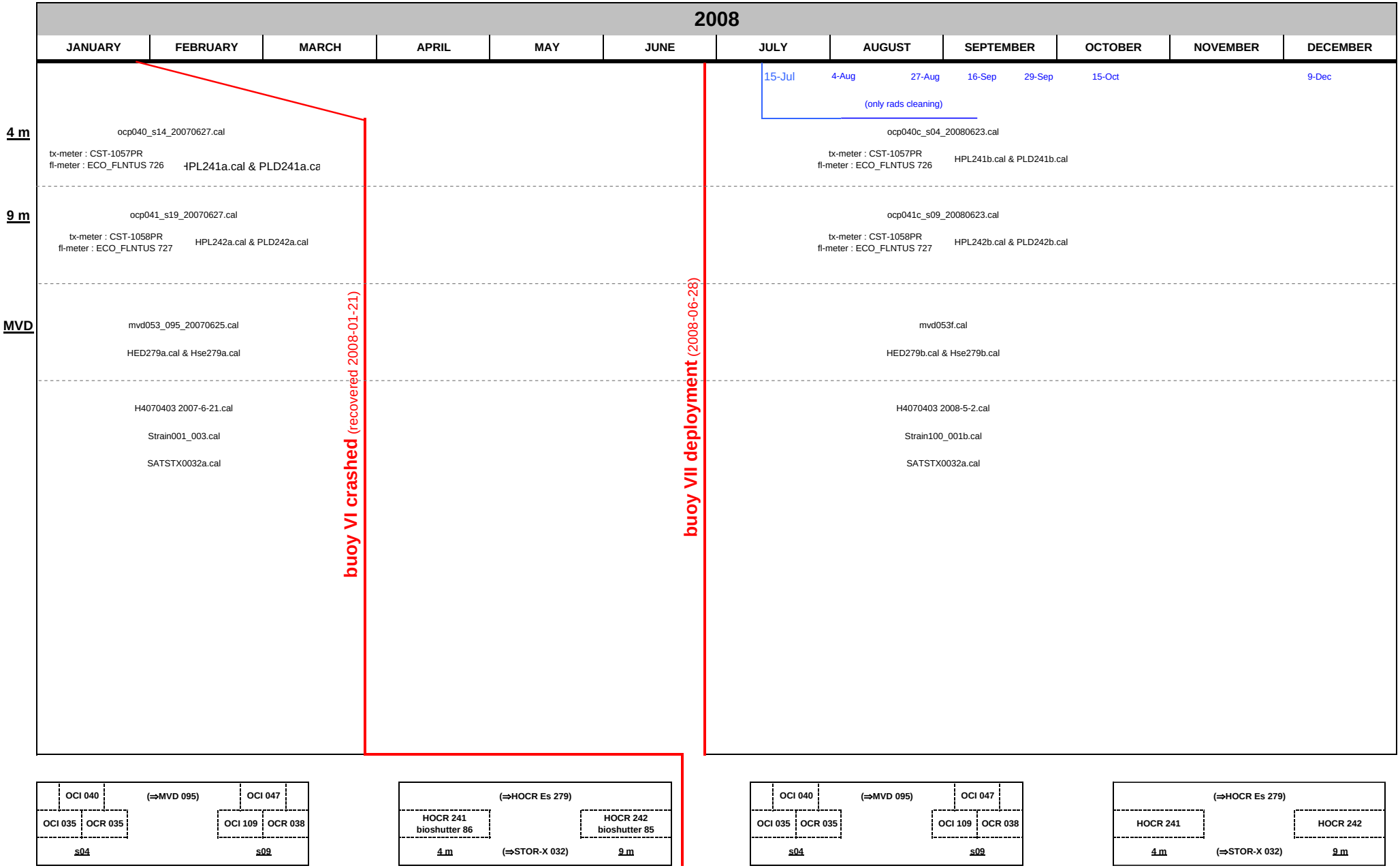
ARGOS 74605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SEPTEMBER
OCTOBER
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DECEMBER
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4-Aug
27-Aug
16-Sep
29-Sep
15-Oct
9-Dec
(only rads cleaning)
4 m
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ocp040c_s04_20080623.cal
tx-meter : CST-1057PR
fl-meter : ECO_FLNTUS 726
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 : ECO_FLNTUS 727
HPL242b.cal & PLD242b.cal
MVD
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HED279a.cal & Hse279a.cal
mvd053f.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)
OCI 040
(⇒MVD 095)
OCI 047
OCI 035
OCR 035
OCI 109
OCR 038
s04
s09
(⇒HOCR Es 279)
HOCR 241
bioshutter 86
HOCR 242
bioshutter 85
4 m
(⇒STOR-X 032)
9 m
OCI 040
(⇒MVD 095)
OCI 047
OCI 035
OCR 035
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HOCR 242
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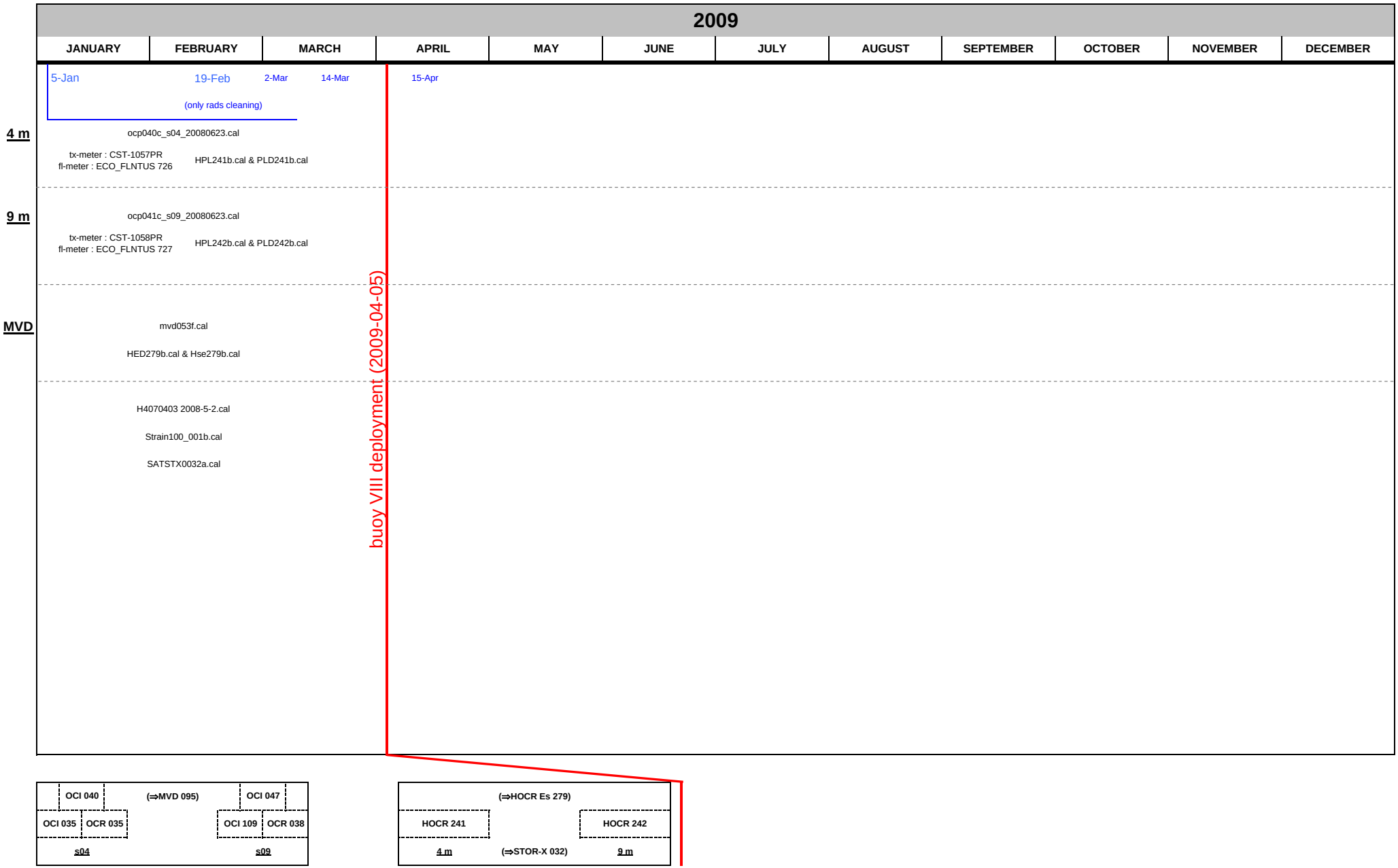
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19-Feb
2-Mar
14-Mar
15-Apr
(only rads cleaning)
4 m
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HPL241b.cal & PLD241b.cal
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fl-meter : ECO_FLNTUS 727
HPL242b.cal & PLD242b.cal
MVD
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buoy VIII deployment (2009-04-05)
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OCI 047
OCI 035
OCR 035
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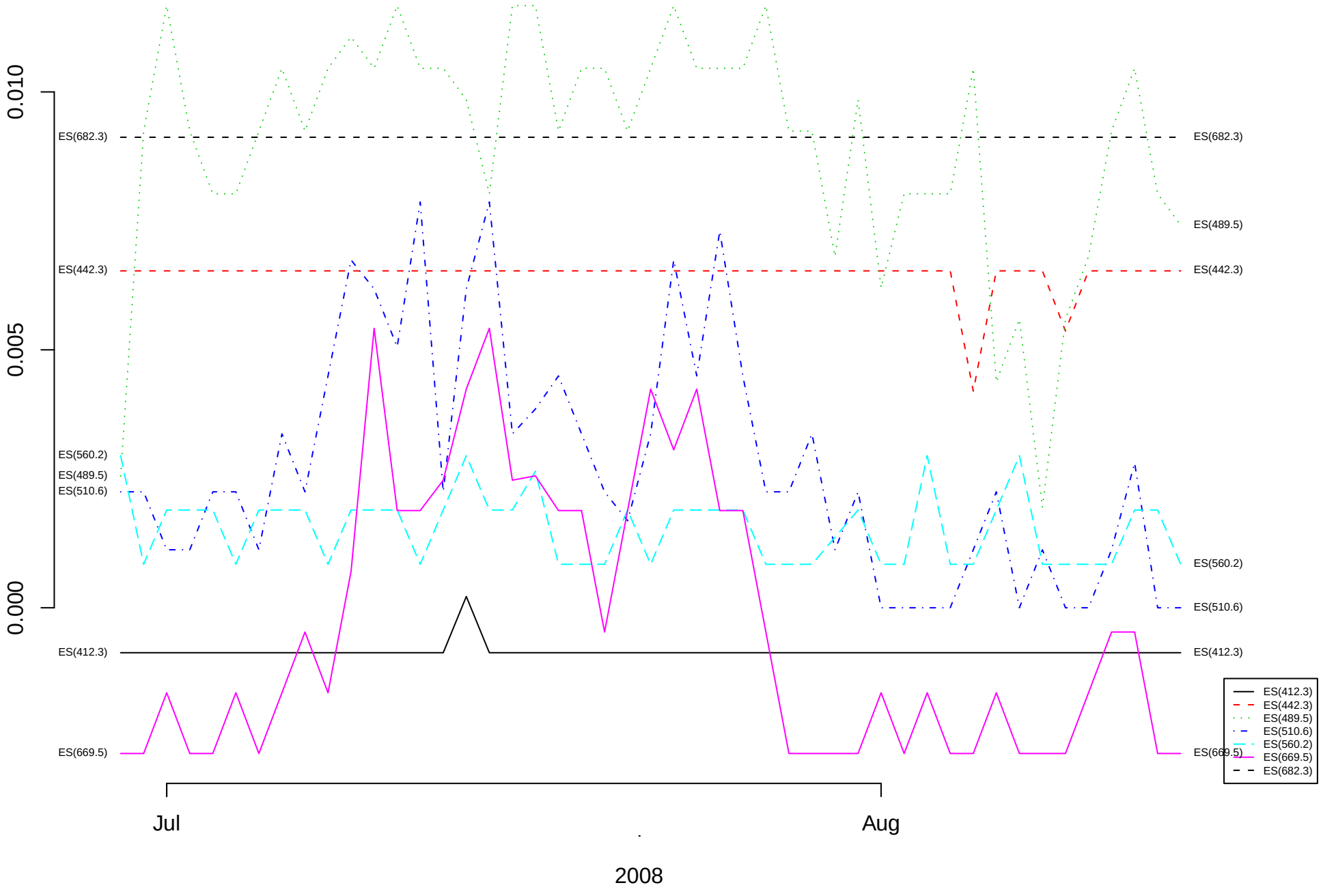
(⇒HOCR Es 279)
HOCR 241
HOCR 242
4 m
(⇒STOR-X 032)
9 m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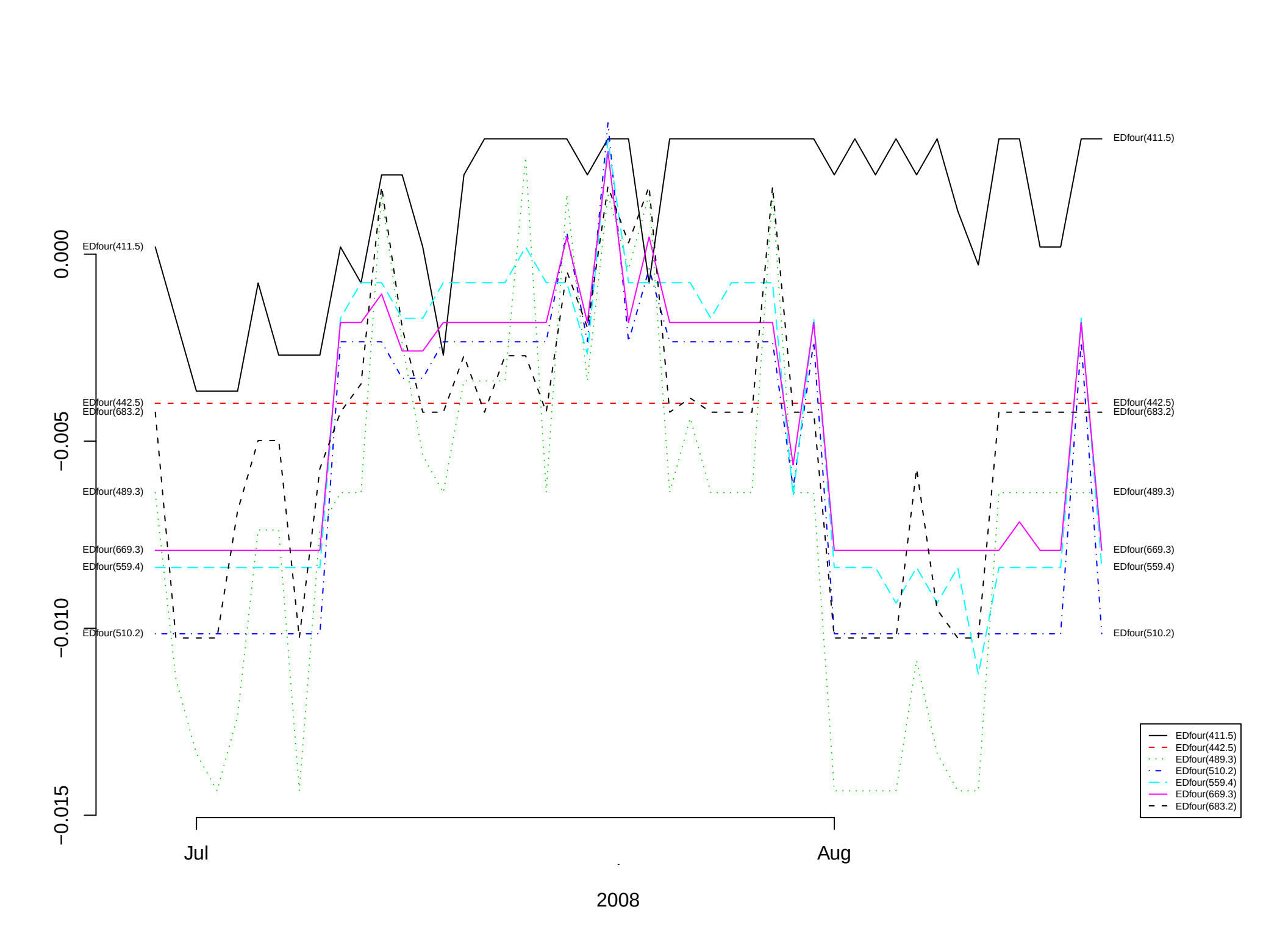
2008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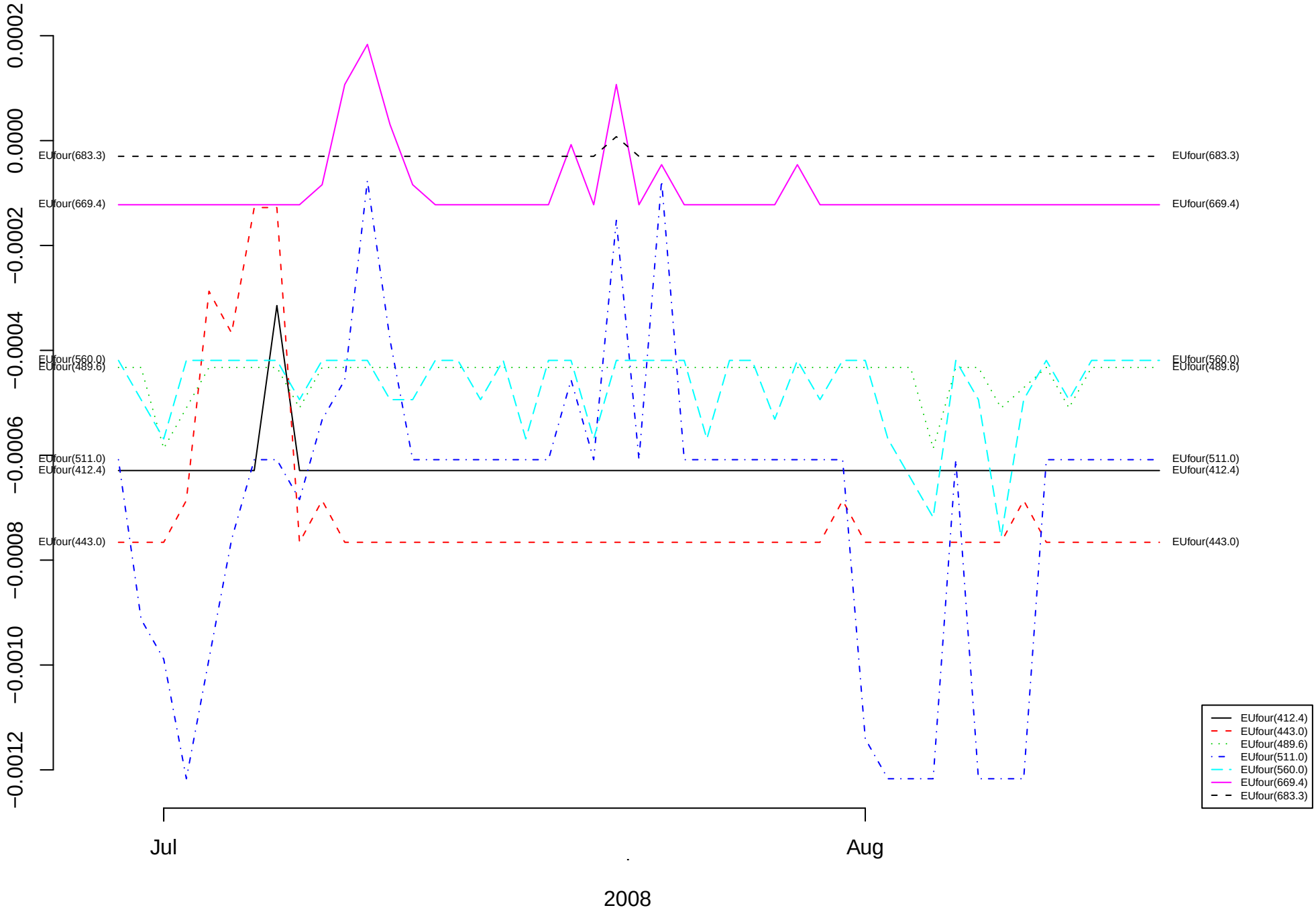
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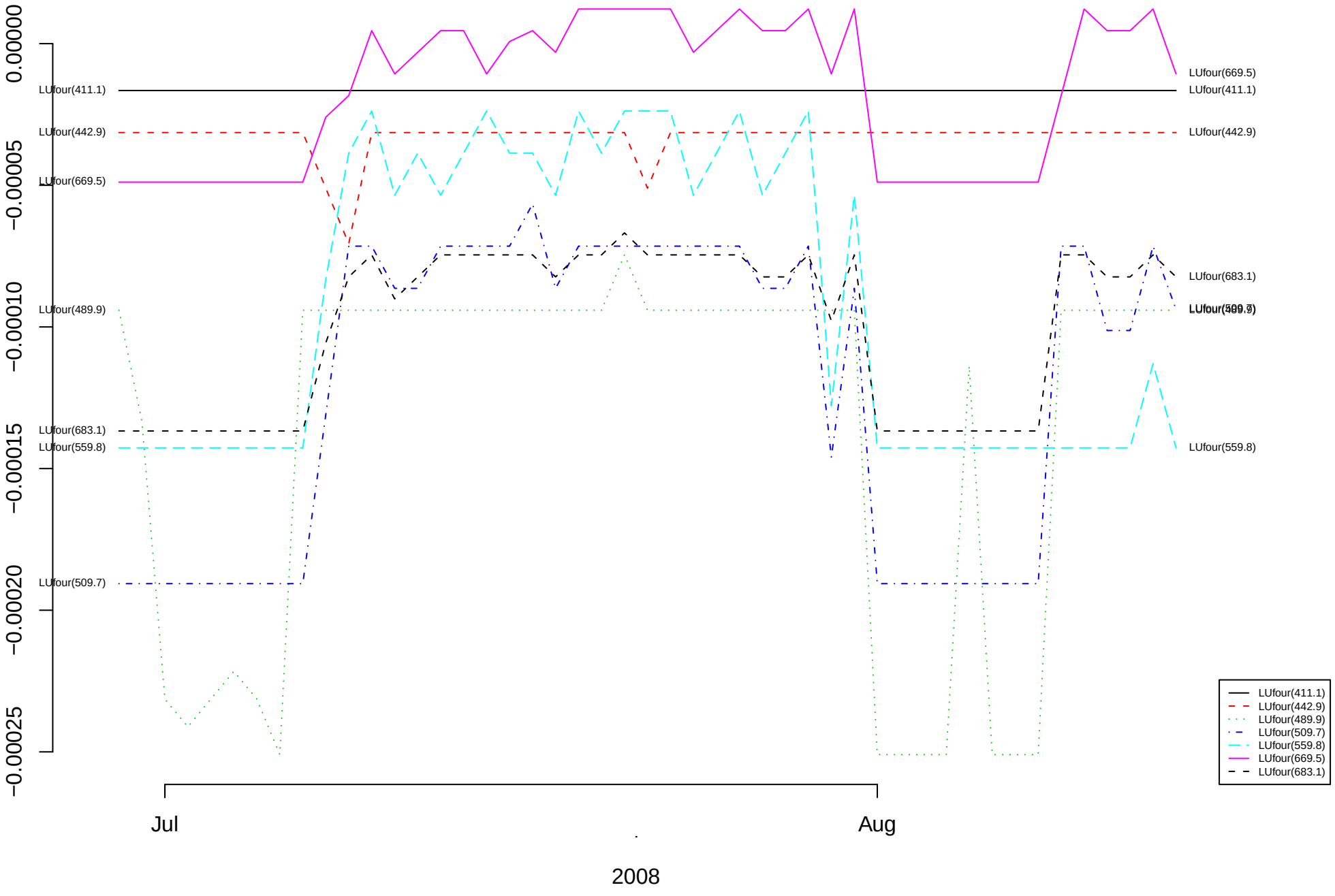
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LUfour(559.8)
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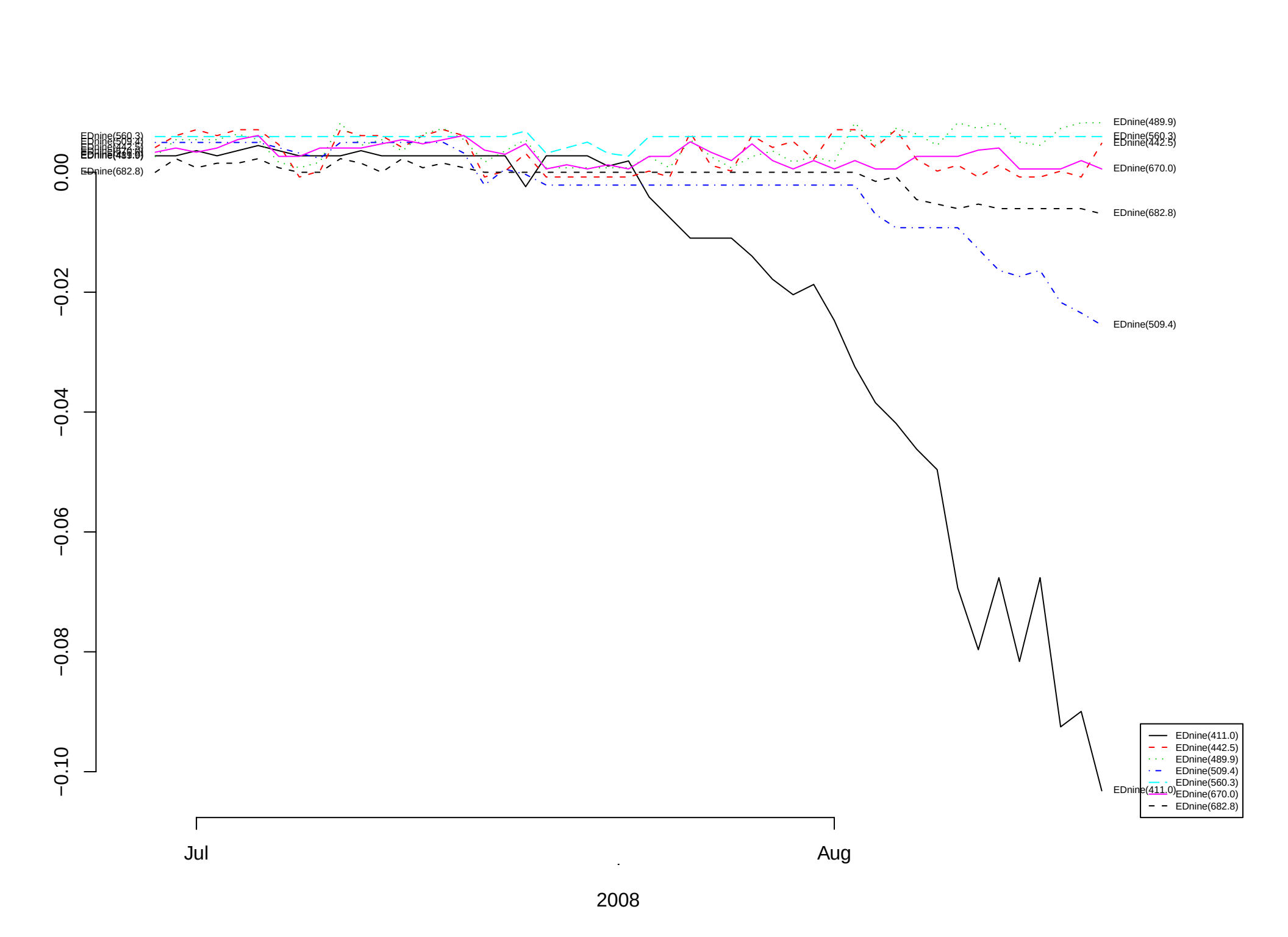
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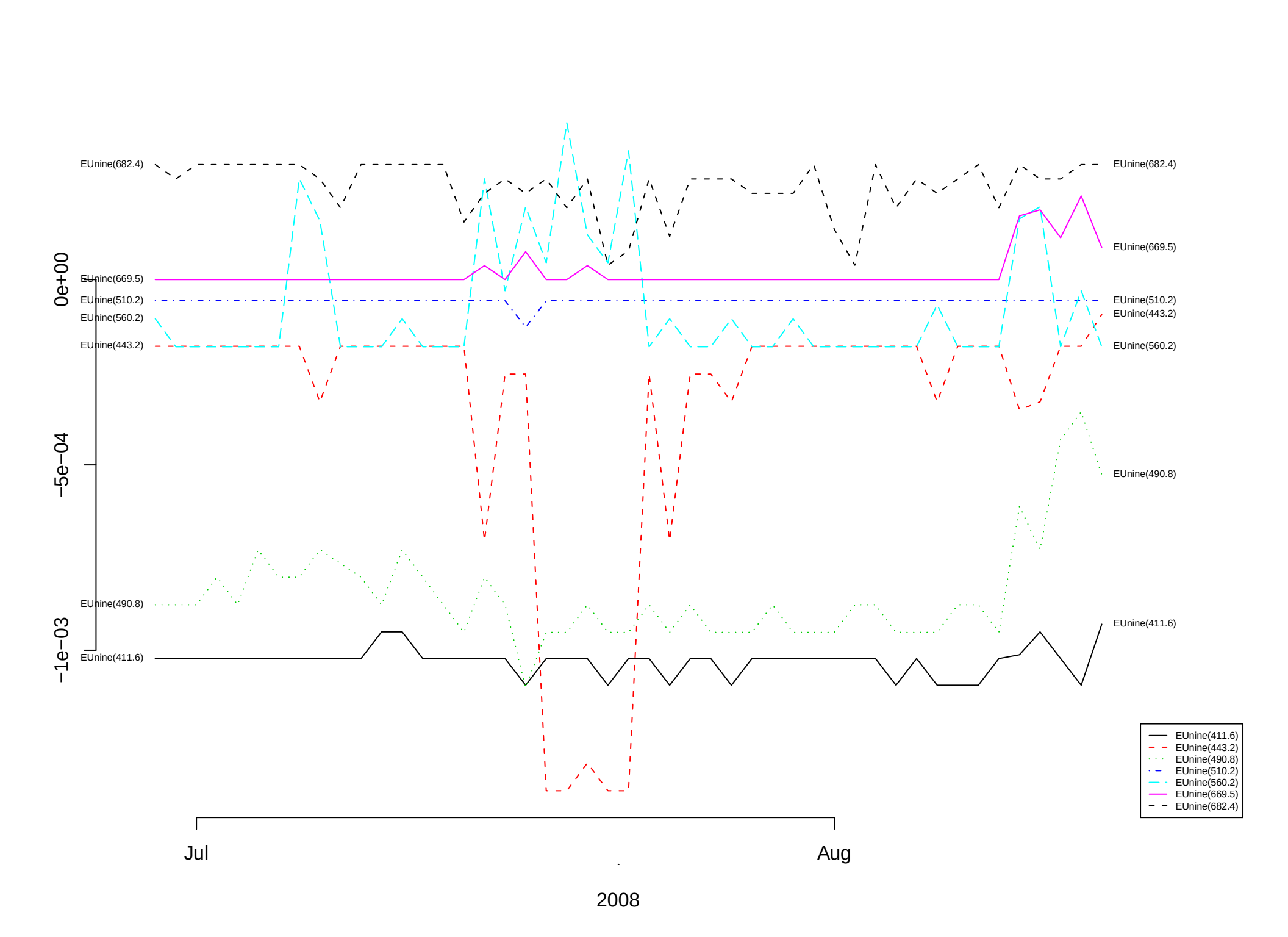
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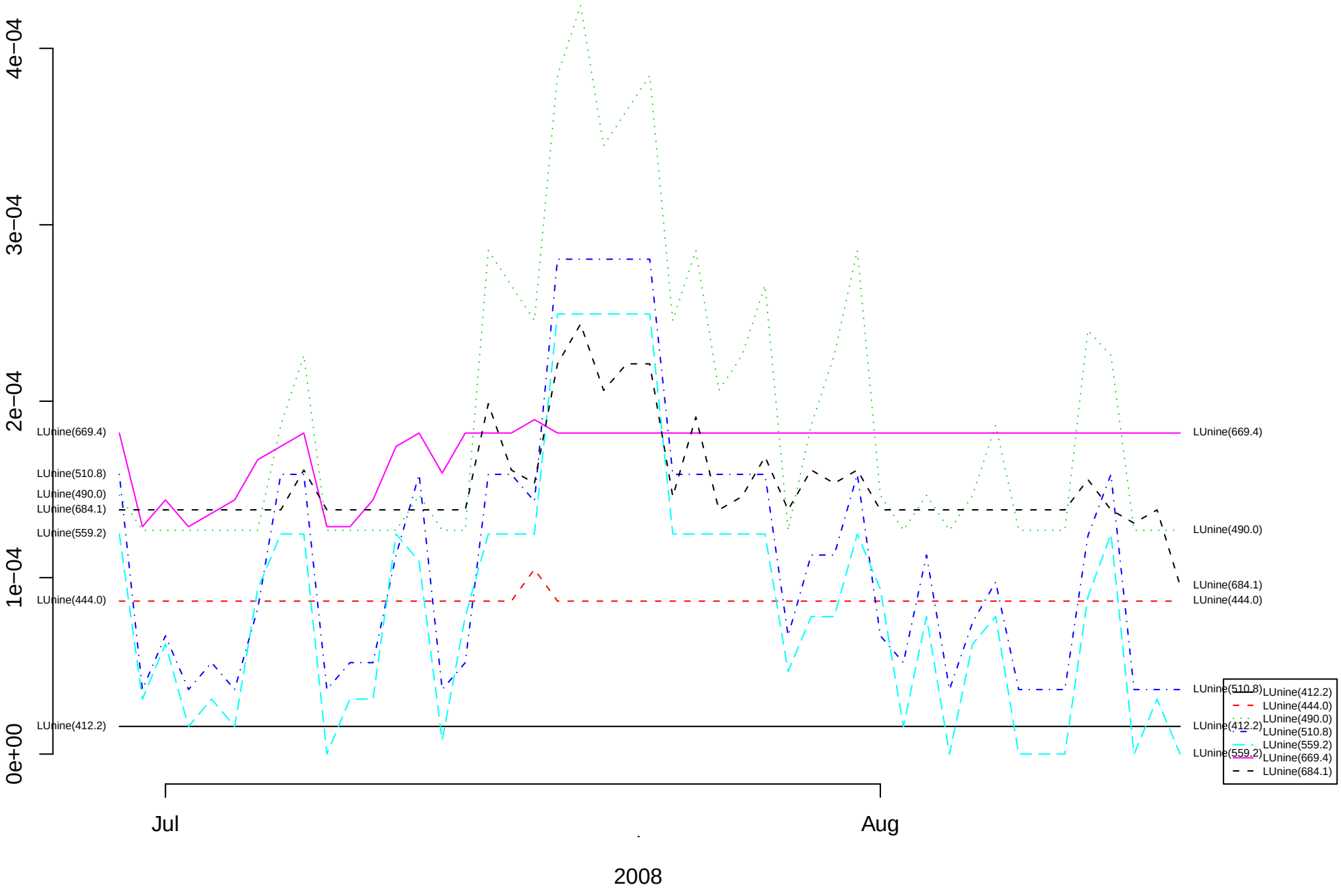
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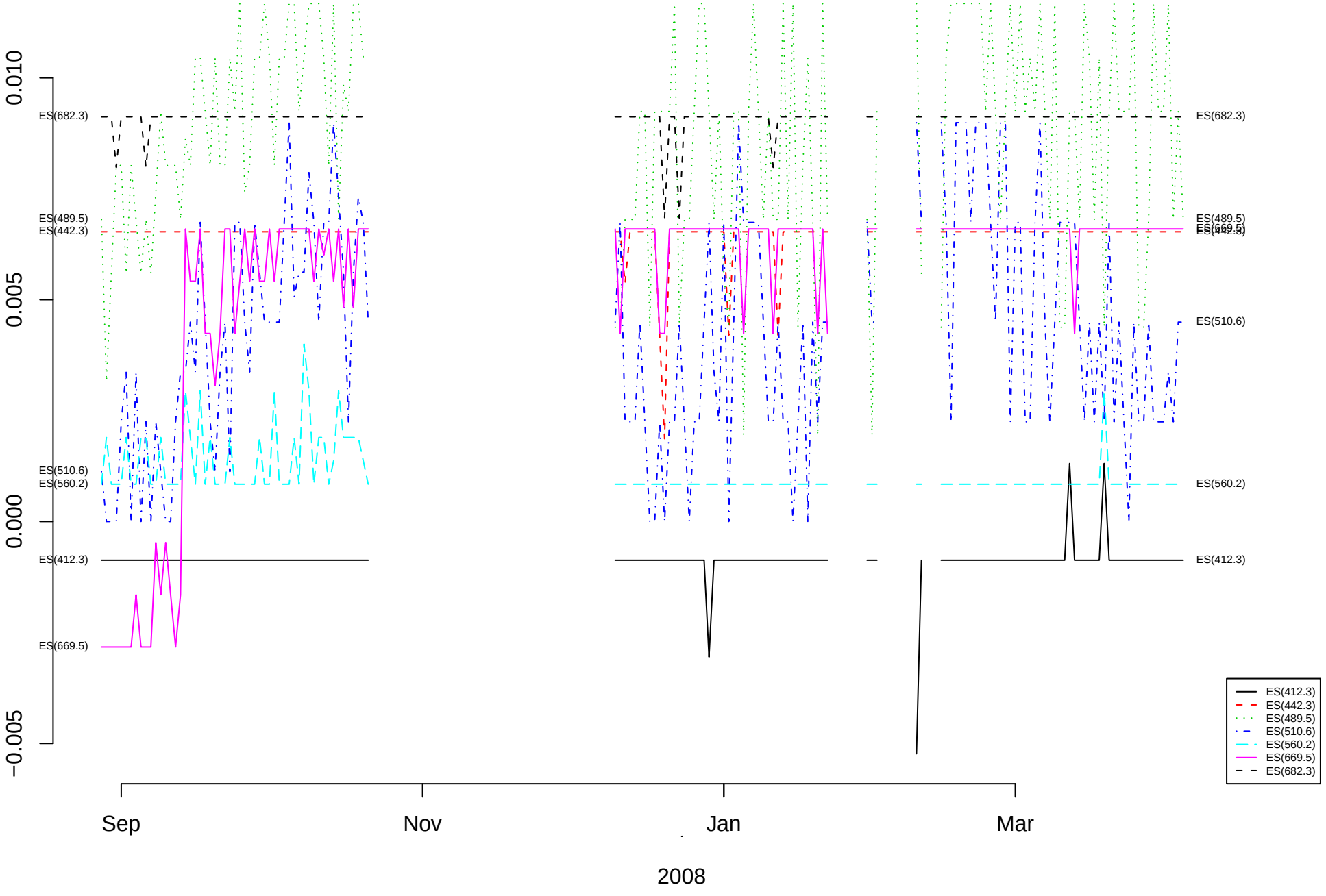
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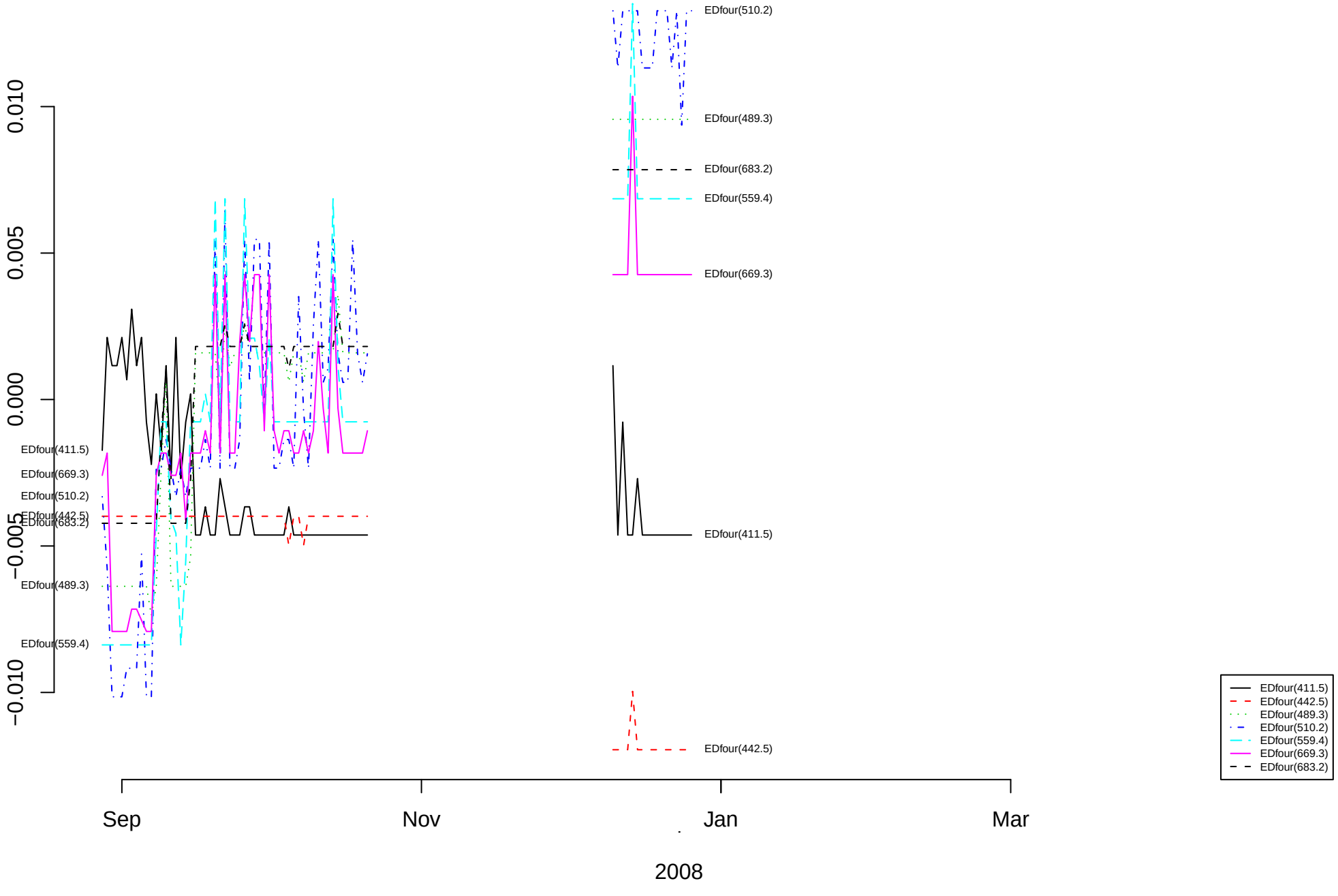
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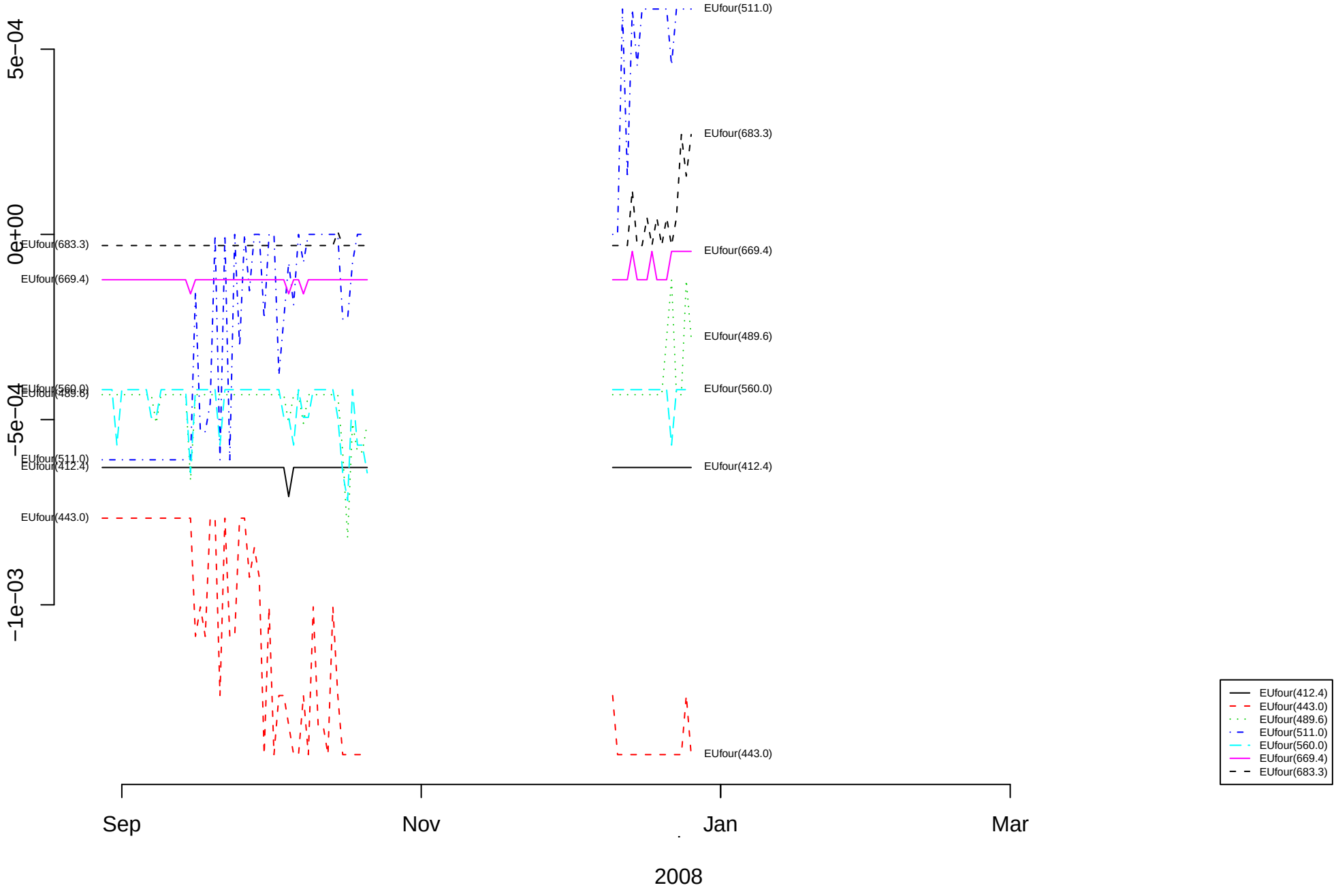
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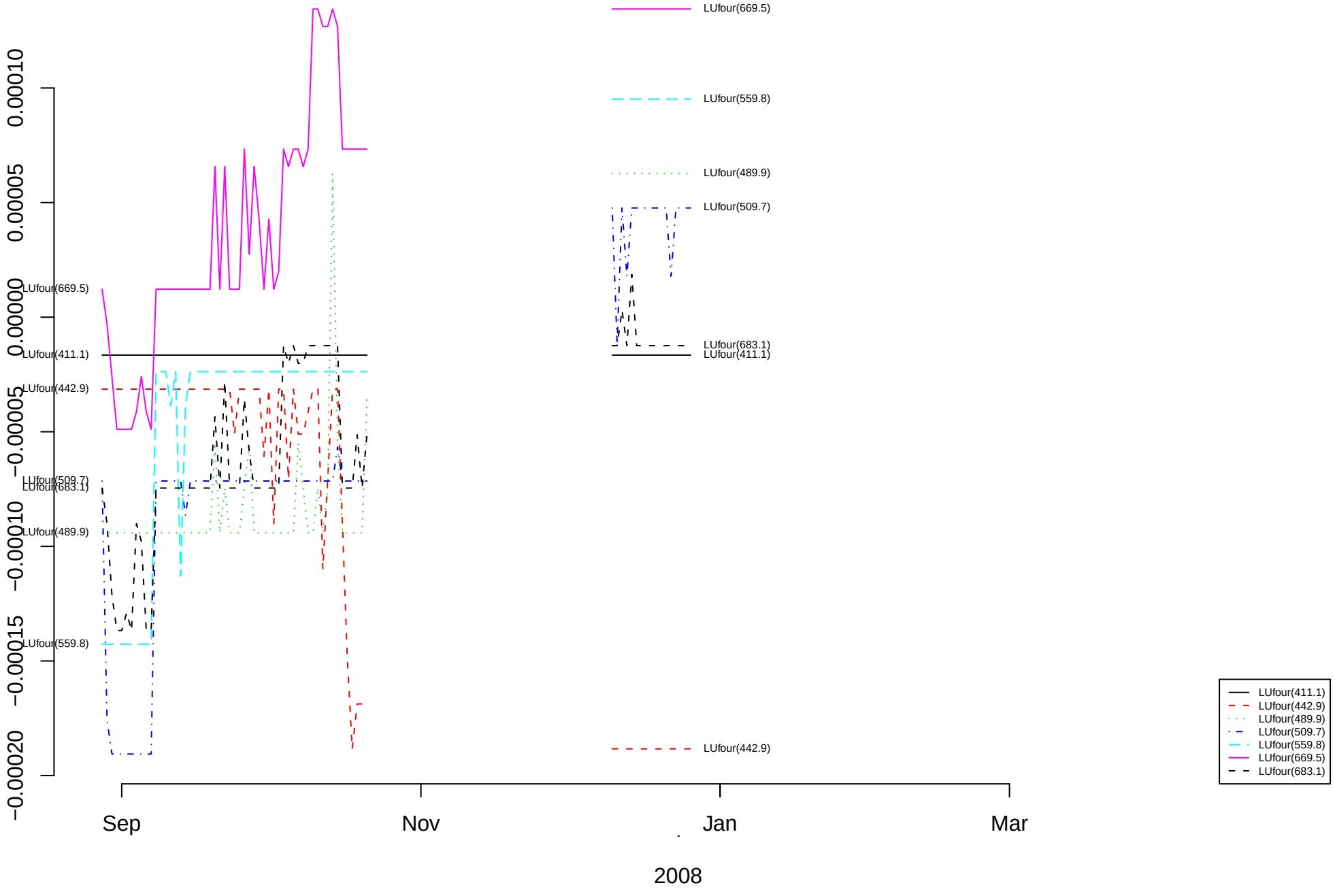
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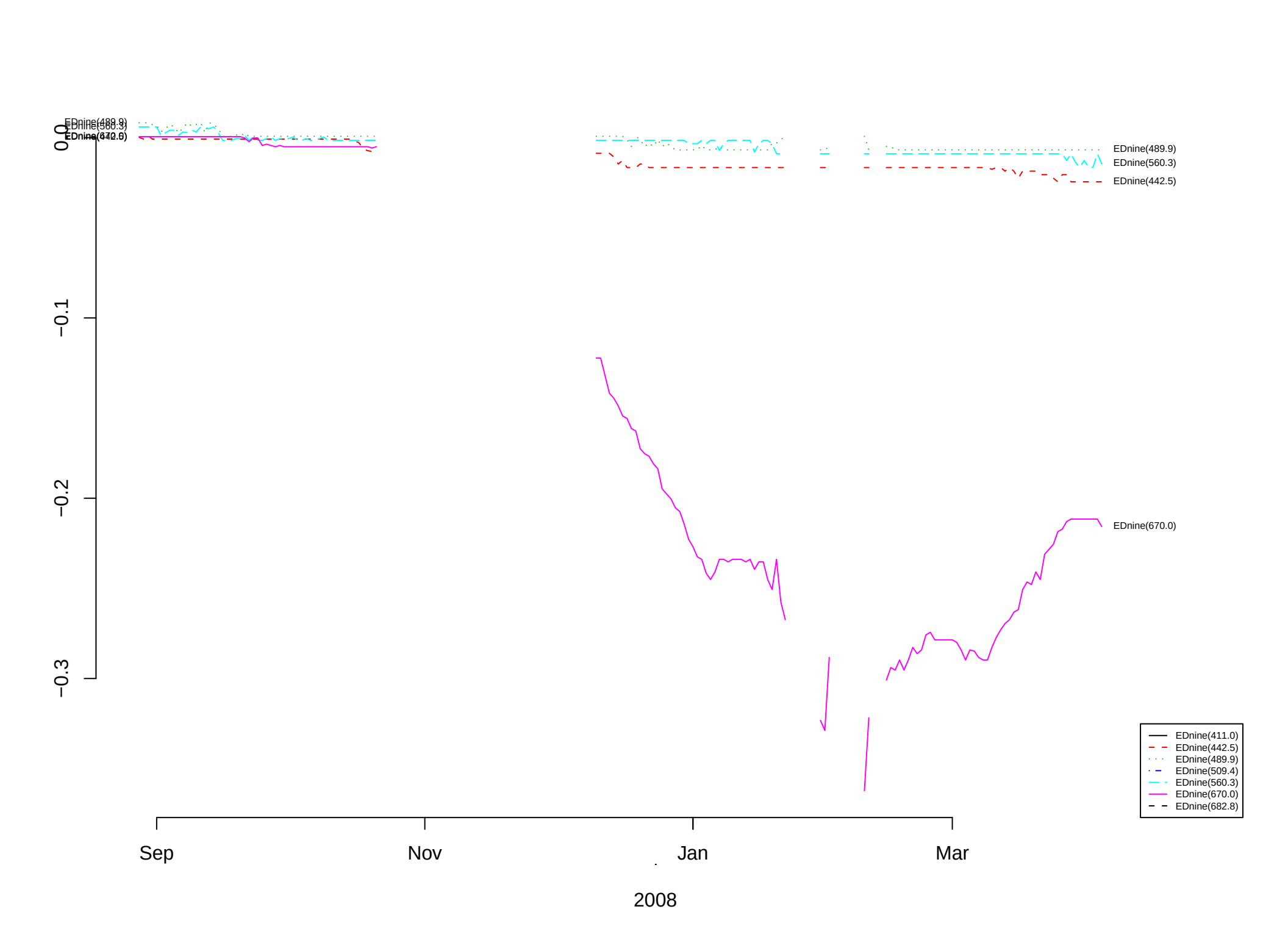
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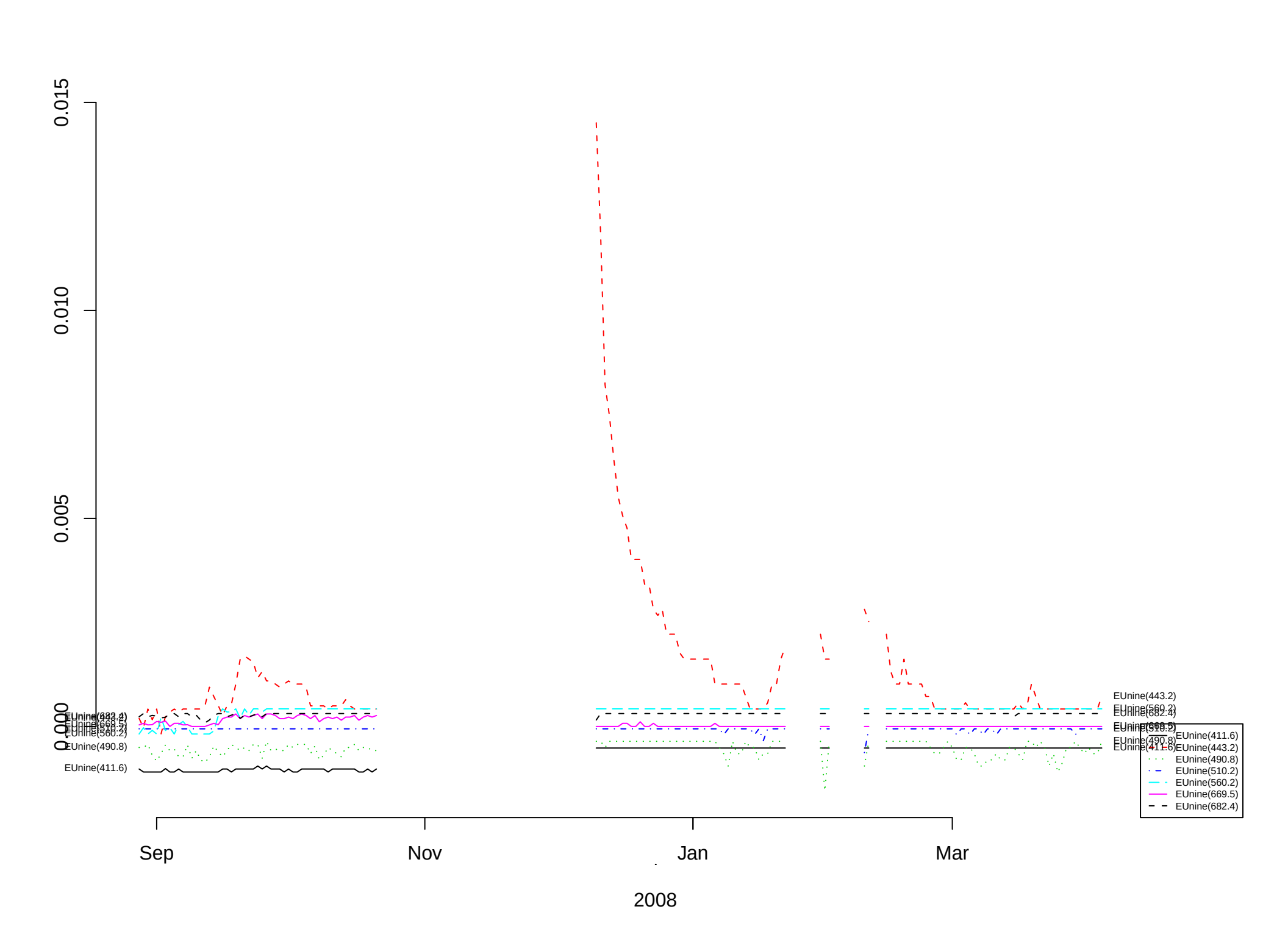
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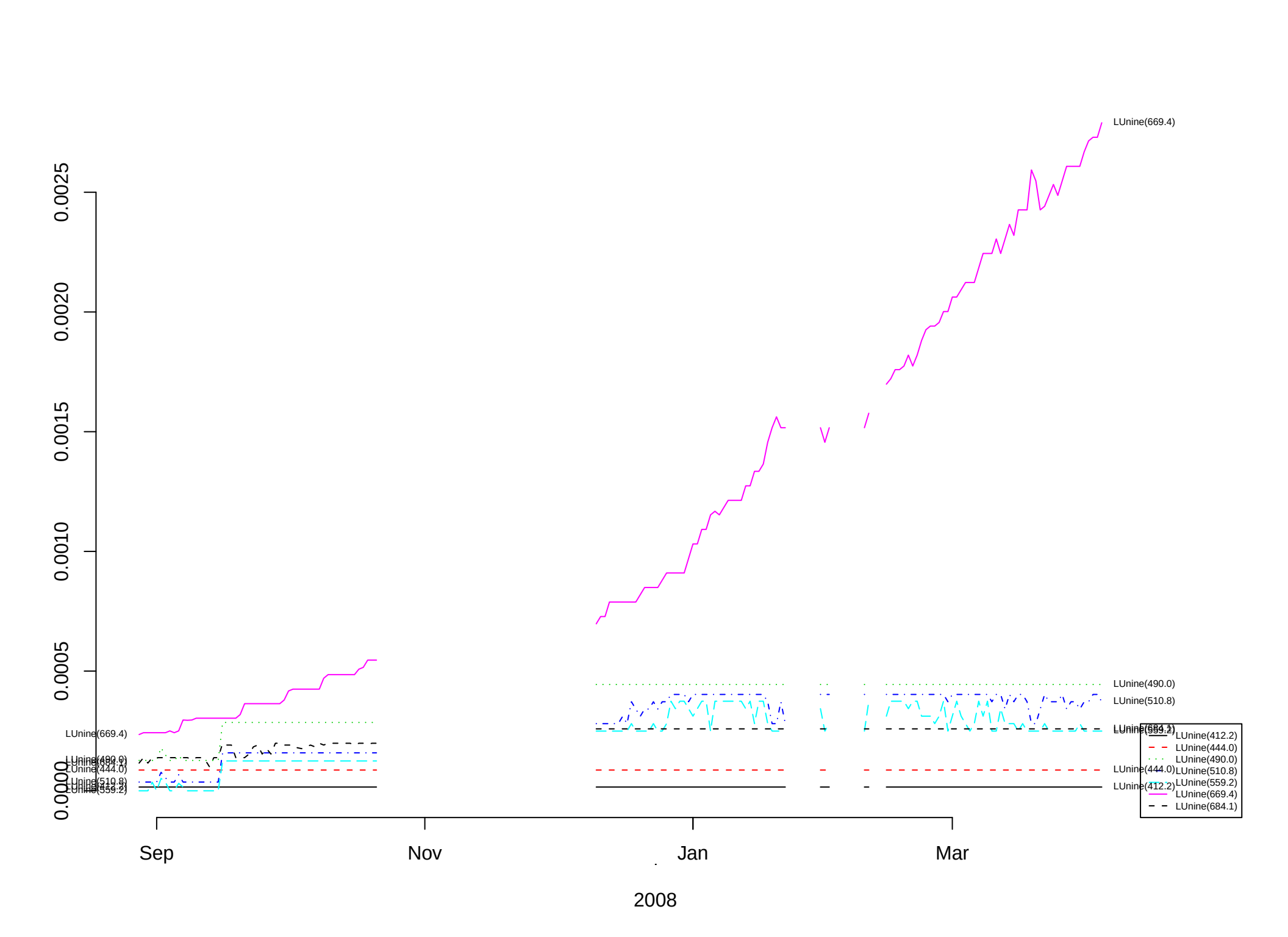
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