

The BOUSSOLE project technical reports; report #7-17, issue 1.

BOUSSOLE buoy deployment & maintenance log.

September 07, 2012 - June 13, 2013

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Foreword

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

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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 XII", from April 01 of 2011 to September 16 of 2011.

2. DESCRIPTION OF OPERATIONS

UPPER SECTION PREPARATION (2012-07)

The buoy System (called system #2) was delivered from Satlantic on January. Since works were in progress to renovate the CCI local, the deployment scheduled in April was delayed. The installation operations started soon after the CCI local was available and the buoy was ready on August 29th. The deployment had place on 07th September 2012.

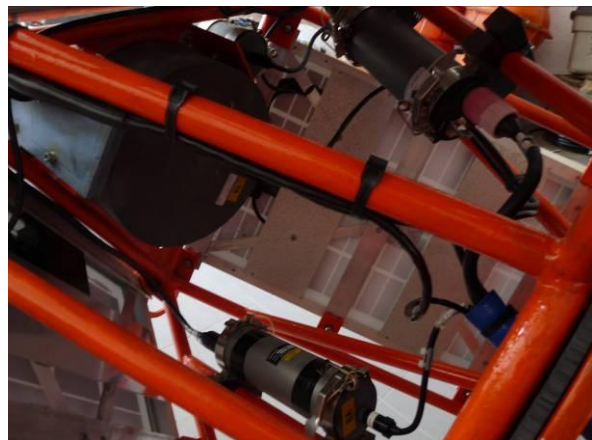
The Buoy was equipped with sensors used for the deployment of the buoy XII recovered on September 2011. The system was prepared in the renovated CCI local in Villefranche-Sur-Mer. Copper sheets and pieces were again fixed wherever possible to avoid biofouling arising.

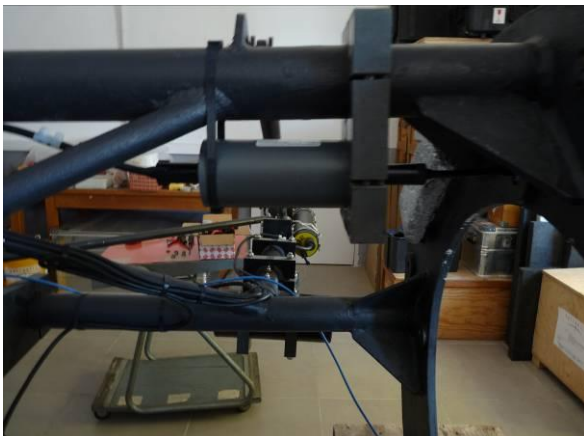
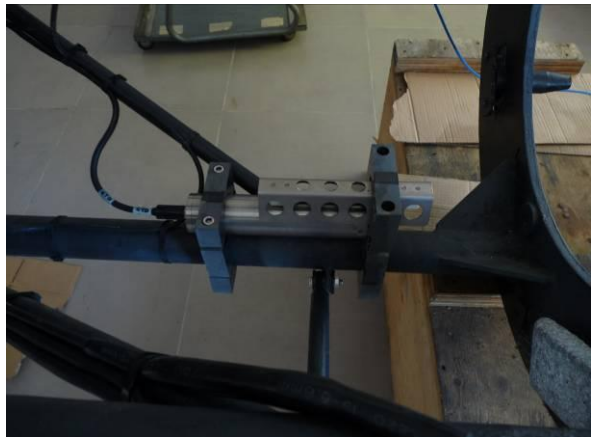
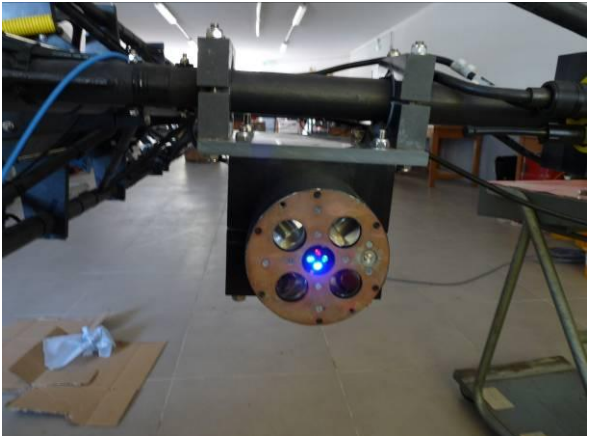
New Hyperspectral Ed sensor were installed at 4 and 9 meters.

The system was tested for some days running both with solar panel and battery. No anomalies were observed:

Dark IOPs measurements were also made for dark corrections.

An "in air" data collection was also performed on July 19th to verify the consistency among similar radiometers before deployment (see appendix).

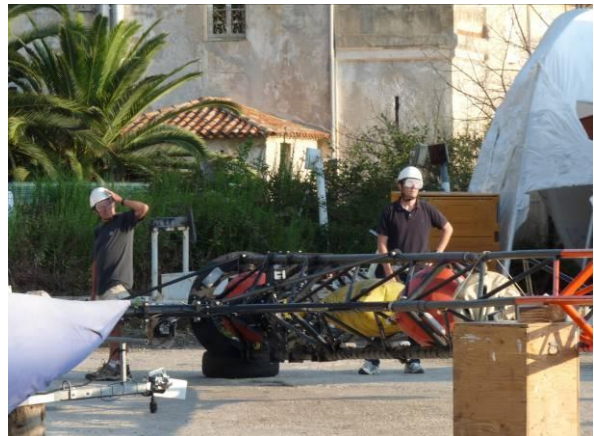




MOORING DEPLOYMENT

2.1.1 Friday 07th September 2012

The upper structure to be deployed was brought to the Rochambeau field at local 06:15 am with the help of 6 people from the LOV. The 4 arms were assembled and connected to the buoy, the helicopter left Carros at about 08:15 am. As usual the go/return trip lasted about one hour. ARGOS messages arrived regularly few hours after except for the Strain sensor, whose data arrived only at night for a wrong configuration of the schedule. A GOPRO camera was installed on the 4 m arm to take a video of the buoy flight.





At this date, buoy is equipped with

- DACNet #11
- CLC #004
- Junction Box #002
- Rads set: OCI #048_Eu4m, #050_Ed4m, #163_Eu9m, #164_Ed9m #030_Es, OCR #036_Lu4m and #037_Lu9m), MVDS #062, OCP#040(4m) and OCP#037(9m)
- Hyper spectral units HOCR-RW #276_Lu4m, #277_Lu9m, HOCR-IW #327_Es, HOCR-IW #421_Ed4, #422_Ed9, STOR-X #068 (no bio-shutters).
- HS4 #H4080705
- Strain-100 #001
- Transmissometers C-Star #626-PR (4m) and #847-PR(9m)
- ECOFLNTUs #608 (4m) and #609 (9m)
- ARGOS beacon #003 (prog id#26021)
- CTD #37SI 30260-2404
- Strain gauge OML CSSPE00356
- PAR #061

The lower part of the buoy is still equipped with the two emergency ARGOS beacons.

2.1.2 Friday 15th September 2012

This day the private boat Lollipop from Darkpelikan was rented from Thalassa for a documentary on the *Regalaecus glesne*. E. Diamond was on board and downloaded data on the top of the buoy. Connectors on the buoy head were also cleaned.

2.1.3 Sunday-Tuesday 23th-25th September 2012

This day is part of the B#127 cruise.

2.1.4 Friday 05th October 2012

This day the private boat Lollipop from Darkpelican company in Villefranche went to the Boussole site with two divers from Thalassa for a documentary on the *Regalaecus glesne*. 1 diver from LOV was also on board and cleaned the sensor.

2.1.5 Wednesday-Saturday 24th-27th October 2012

This day is part of the B#128 cruise.

2.1.6 Wednesday 21th November 2012

This day a private boat went to the Boussole site with two divers from Thalassa for a documentary on the *Regalaecus glesne*. 1 diver from LOV was also on board for cleaning the sensors and the ARGOS beacon connector and for performing dark measurements.

2.1.7 Friday-Monday 23th-26th November 2012

This day is part of the B#129 cruise.

2.1.8 Thursday 29th November 2012

This day the ARGOS dispatch from the buoy stopped after a buoy diving and rise.

2.1.9 Thursday 7th-10th December 2012

This day is part of the B#130 cruise.

2.1.10 Thursday 20th December 2012

This day the private boat Papetee from the MEDITERRANEE PECHE DECOUVERTE in Beaulieu-sur-mer was rent with Yann Hello from Geoazur for going to the BOUSSOLE site for the buoy management and to deploy two floats. Three divers were onboard and went at sea for cleaning the optical sensors and perform dark measurements at about 08h30 UTC. The CTD+Optode from Laurence Beaumont (Dt-INSU) was also installed at about 3 m on the buoy. In the meantime data were downloaded from the top of the buoy (AK connection to avoid loss of time), and connectors and sensors were cleaned too.

2.1.11 Friday 21th December 2012

This day the ARGOS message dispatch stopped.

2.1.12 Friday 4th January 2013

This day divers from private company MARE NOSTRUM went to the Boussole site for cleaning the optical sensors and perform dark measurements.

2.1.13 Thursday 24th January 2013

This day is part of the B#131 cruise. Sea state was not optimal during this cruise. A CISCO connection was however possible and data downloaded.

2.1.14 Saturday 26th January 2013

This day divers from the private company MARE NOSTRUM went to the Boussole site for cleaning the optical sensors. No dark measurement was possible since sea state was still not good enough.

2.1.15 Thursday-Saturday 14-16th February 2013

This day is part of the B#132 cruise. The first day divers were on board to clean the optical sensors and perform dark measurements. They also installed the pCO₂ at the same depth of the CTD+optode. Its cable was then fixed along the main structure up to the top of the buoy and the start connector was plugged (the magnet being removed before putting it at sea). Connectors and solar panels on the head of the buoy were cleaned too. Then data were downloaded, however the DACNet software had many message errors and many files were not downloaded, fortunately the connection was not lost and data were downloaded through FTP, though very slowly (about 1h for the whole data). Some old data appeared on the disk and were all removed since they could be the cause of the slow download rate. The ARGOS dispatch did not restart after the connector cleaning. The last day the buoy was half immersed. Since the captain observed that the surface current was not strong, a CISCO connection was successfully attempted to retrieve data and verify that thrust on the cable had the nominal behaviour. Then the ARGOS cable connector was checked on the top of the buoy and no power supply was arriving to the beacon.

2.1.16 Tuesday 12th March 2013

This day the *Tethys II* went to the BOUSSOLE during the MOOSE cruise and reported a broken solar panel on the buoy. The cruise B#133, scheduled on the following four days, could not take place due to a problem to the *Tethys II* engine.

2.1.17 Friday 22nd March 2013

This day the private boat *Moguntia* in Antibes was rent from the Saint-Thomas production staff for the documentary on the *Regalaecus glesne*, two persons from LOV were onboard. A first direct connection on the top of the buoy was unsuccessful, and three attempts of AK connection too. Since no RJ45 "availability" with the DACNet was got, the decision to dismount the DACNet and exchange the microdrive was taken. The fuses and internal battery were also checked and verified to be working. After the DACNet re-installation three connection attempt were made with the AK unsuccessfully, however the RJ45 availability with the DACNet was got each time, and probably the battery was not charged enough. This did not allow to load the correct configuration on the DACNet that will have to be done as soon as possible. The broken solar panel was exchanged with a spare, and connectors and sensors on the head cleaned. The optical sensors on the buoy were also cleaned from divers. Some attempts of connection with the CARIOCA pCO₂ sensor were also made unsuccessfully. The verification of the microdrive in the lab confirmed that the disk was corrupted and stopped to work on March 19th at 10h45 UTC.

2.1.18 Thursday-Sunday 11th-14th April 2013

These days are part of the B#134 cruise. The first day the buoy was about 2 m above water with one of the solar panel out of its axe but still in good conditions. A CISCO connection attempt was not successful, and a direct connection was not feasible. The solar panel was secured with a cord. The last day divers were on board and went at sea to clean the underwater sensors and perform dark measurements. In the meantime a direct connection was attempted unsuccessfully through the AK connector. However the head sensors were heard working (though not at the nominal hour), meaning a possible malfunctioning of the laptop or the communication cable. Divers also dismantled the pCO2 Carioca sensor. Once on board the pCO2 data were downloaded and the cable and laptop connectors cleaned. A second dive allowed the re-installation of the pCO2 sensor and a direct connection with the buoy (AK). Data were downloaded and the clock synchronised:

1970-01-23_19-00-42 = 2013-04-14_11-27-12

The correct schedule was also loaded on the DACNet. Only data from fluorometers, HS4, CTD, Stain and Tilt will be exploitable for the period between 22 march and 14 April.

2.1.19 Thursday 2nd May 2013

This day divers from MARE NOSTRUM company went to the Boussole site for cleaning the instruments and perform dark measurements.

2.1.20 Wednesday-Friday 15th-17th Mai 2013

This day is part of the B#135 cruise. The first day data were downloaded through the CISCO antenna at the second attempt. However only a small part of data were downloaded. No diving operation was possible for bad weather.

2.1.21 Wednesday-Friday 22th-23th Mai 2013

The first day the private boat PAPETEE was rent from the MEDITERRANEE PECHE DECOUVERTE in Beaulieu-sur-mer. Two divers from LOV and 1 diver from MARE NOSTRUM were on board. When at the BOUSSOLE site divers went at sea to clean optical sensors and put neoprene caps on IOPs sensors. In the meantime several connections were attempted on the buoy, both nominal and AK connections. So the decision to dismount the DACNET was taken. When divers went to switch OFF the battery they realized the battery to be already turned OFF. Then the battery was switched ON and a direct connection was obtained. However the laptop battery was discharged in the long wait on the buoy head and only a small fraction of data was downloaded. Since it was not possible to charge the laptop on the boat, a second mission was organized the day after on the NARWHAL from the same company. The nominal connection was got at the first attempt and data were downloaded. However several files were difficult to download (and for most of them it had to be made through an FTP, not with the Node manager software) and it took more than 1h. So some "telemetry" files had to be deleted without being fully downloaded, and most of "eventlogs" files were deleted without

downloading them as a choice (eg: to make space on the disk before the laptop battery stopped).

2.1.1 Saturday-Monday 8th June 2013

This day is part of the B#136 cruise. The first day divers went at sea to clean the optical sensors and to perform dark IOP measurements. They also dismantled the emergency ARGOS beacon #5433 that have to be prepared for the next lower superstructure rotation. In the meantime a direct connection on the buoy head was successful and data downloaded. Optical sensors on the buoy head were cleaned too.

2.1.2 Thursday-Friday 13th-14th June 2013

The first day the buoy system was switched off at 7h22 (local) and then the buoy mast dismantled from divers onboard the Castor 02 for the rotation with the system #1. The day after The helicopter delivered the buoy at about 09h10. The structure was in good conditions but with much biofouling. The buoy was cleaned with the Karcher before being transported into the CCI local where it was dismantled in the following days. Data into the DACNET could not be recovered with an Ethernet (AM) connection. Instruments were shipped for calibration on July 11th, whereas the aluminium structure was sent to the CNB on July 1st.

3. QUANTITATIVE SUMMARY

The deployment lasted 279 days, with 246 days of successful records. Few interruptions in data acquisition were due to microdrive failure and emptying of microdrive free space. Some data were also lost for problems during download, and about 10 days were lost for human error (permanently deleted before backup).

4. INSTRUMENT SCHEDULE

1 minute acquisition every 15 minutes.

5. ANY PROBLEMS ENCOUNTERED ?

- 1- Microdrive failure.
- 2- Microdrive empty.
- 3- Loss of data for human error.
- 4- ARGOS dispatch failure.
- 5- Slow data download.

6. LESSONS LEARNED

- 1- Always bring a spare laptop with DACNet software on small cruises.

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, the GG-IX from the Samar company and the Lollipop, Moguntia and Papetee (on-demand short operations on site). Pilots and crew members of HDF helicopter company are also thanked for the deployment and recovery of the instrumented mast.

The French institute IFREMER and the Norwegian 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, the list of the calibration files and a summary of the test made with the radiometers before the deployment.

Radiometer Test

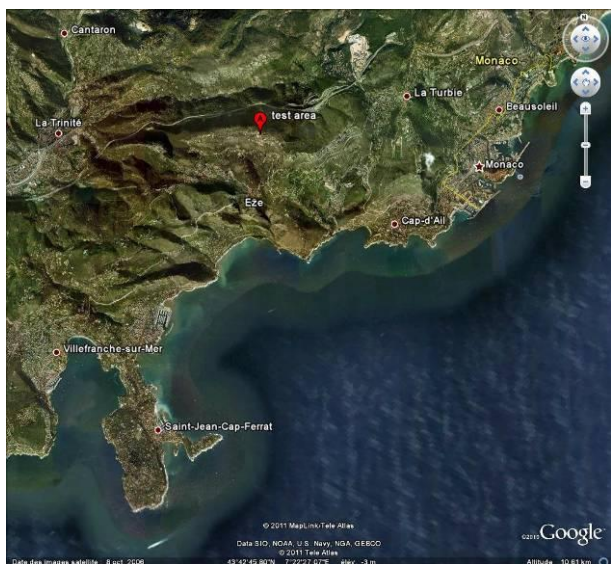
On July 19th 2012 a field campaign to test the buoy radiometers relative performances was organized at the Fort de la Revere. The fort is located at north of the Eze village at about 700m on the sea level (see images below), and near the fort there's a plane field free of obstacles that could cause shadow or glint above radiometers.

All the radiometers used for the buoy were fixed upon a table facing the zenith. The Lu and Eu sensors were covered with polyethylene caps produced at LOV. The material in use revealed not to be optimal for this application as the level or solar flux under covers was still over the instrument saturation limits for the multispectral radiometers.

The instruments were all connected as for the buoy deployment (OCPs, DACNet, cables etc.) and powered with a battery. The schedule was modified to acquire data every 10 minutes instead of 15.

Data were acquired for about 8 hours.

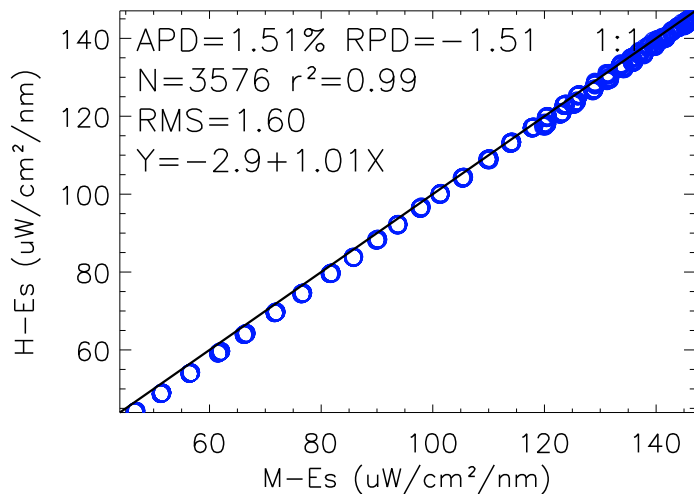
Sky conditions were good. The choice to compare single data by using the TIMETAG variable recorded in data files was maintained.



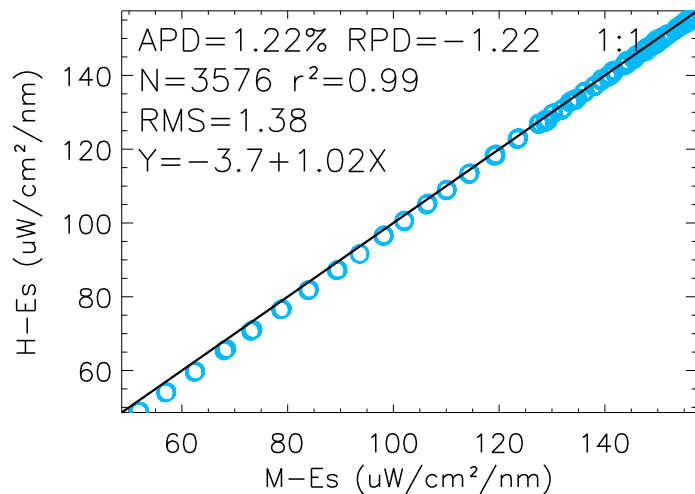


Results of the tests are displayed in the figures below.

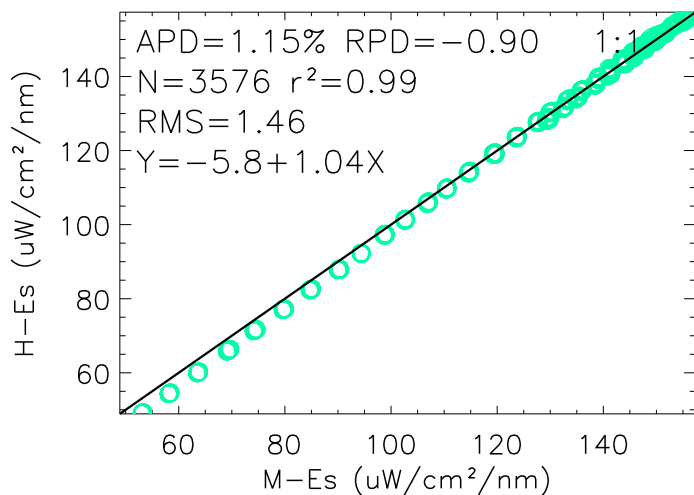
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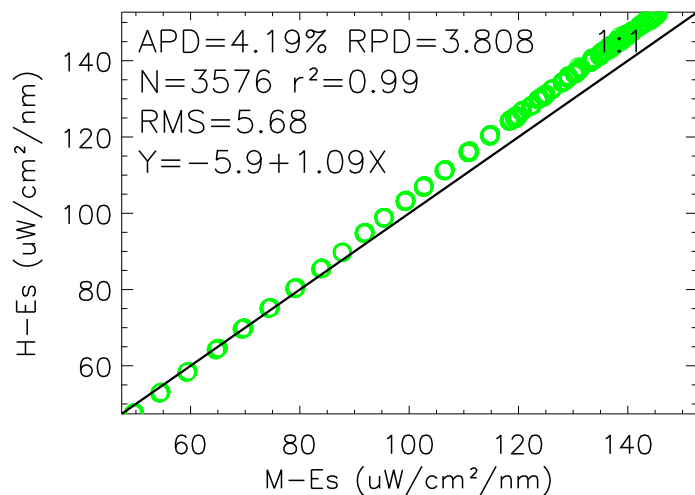
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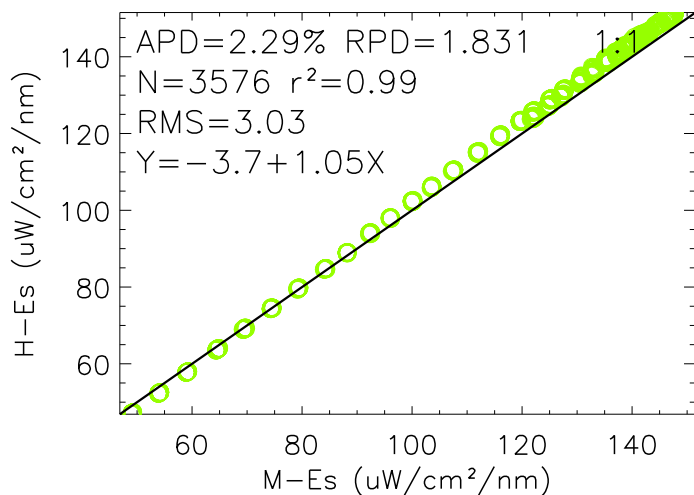
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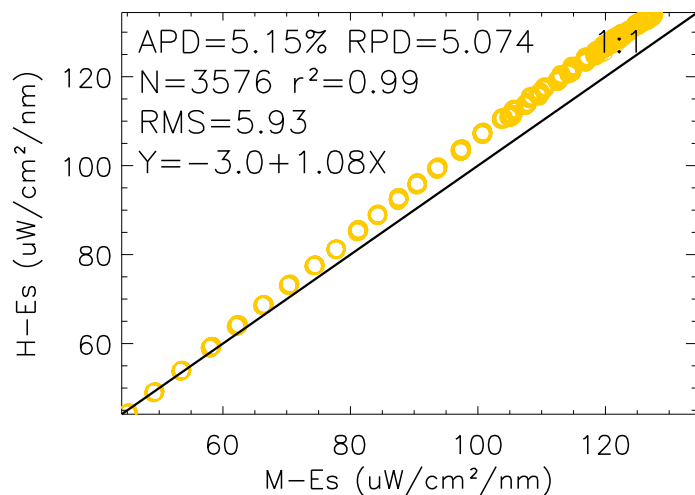
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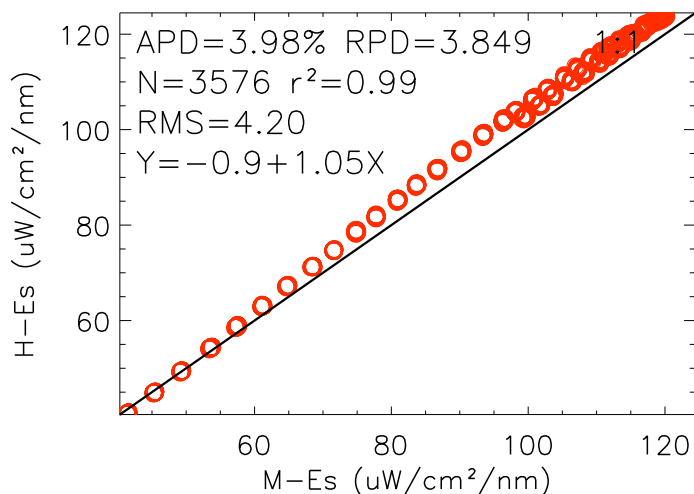
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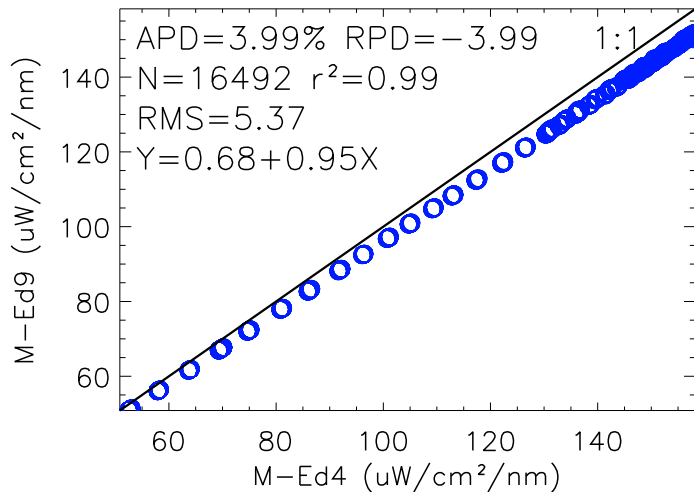
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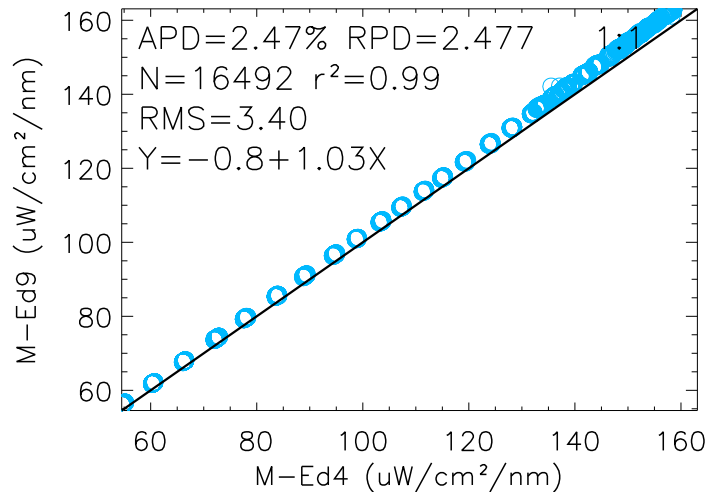
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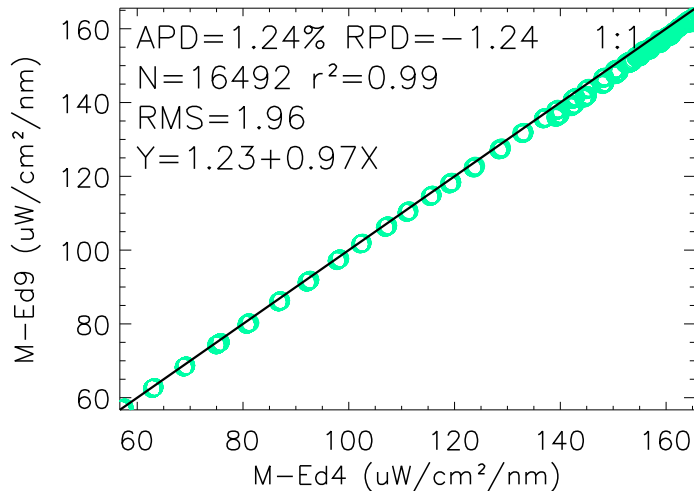
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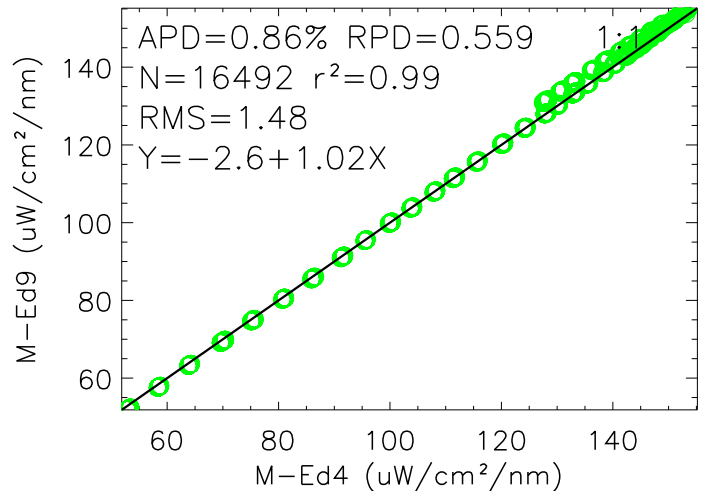
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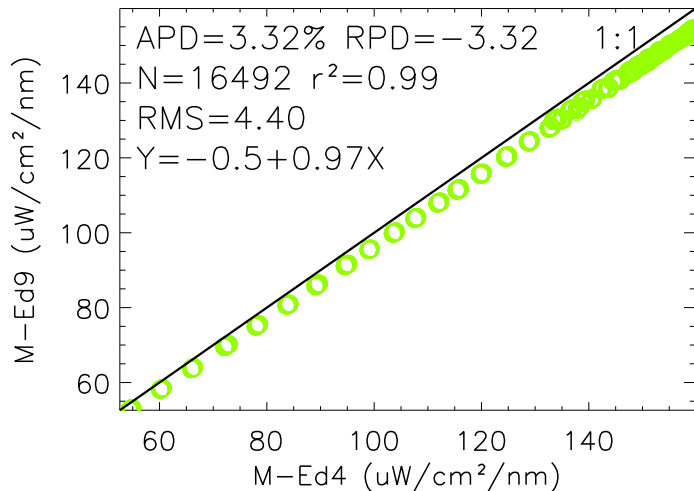
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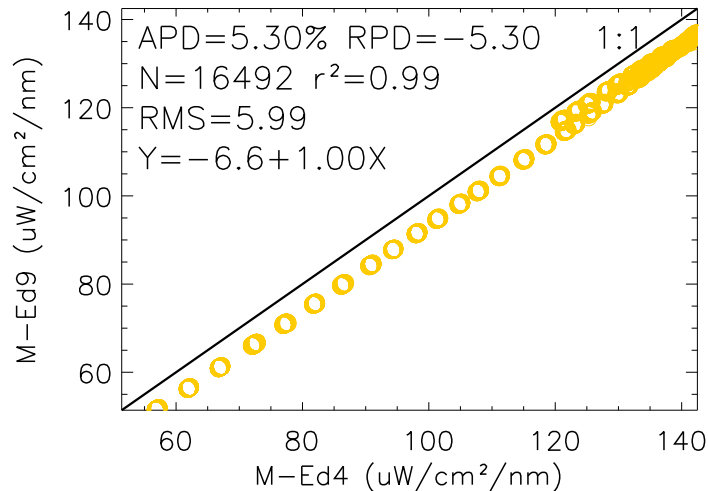
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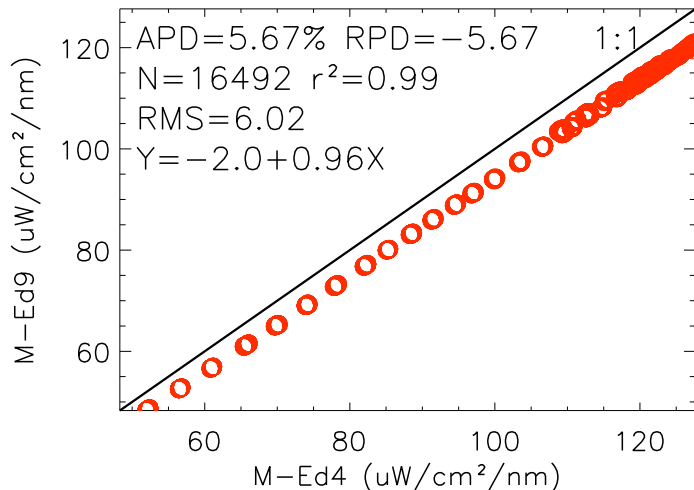
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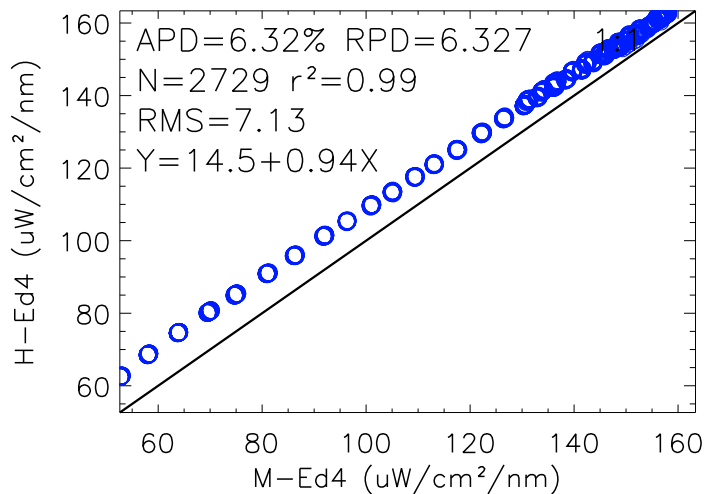
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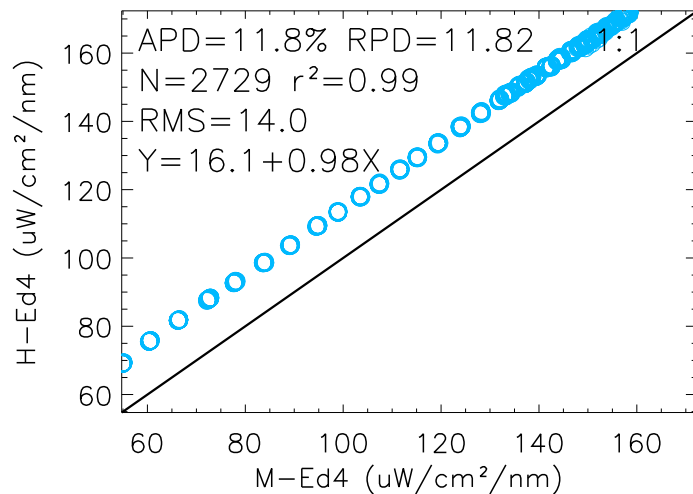
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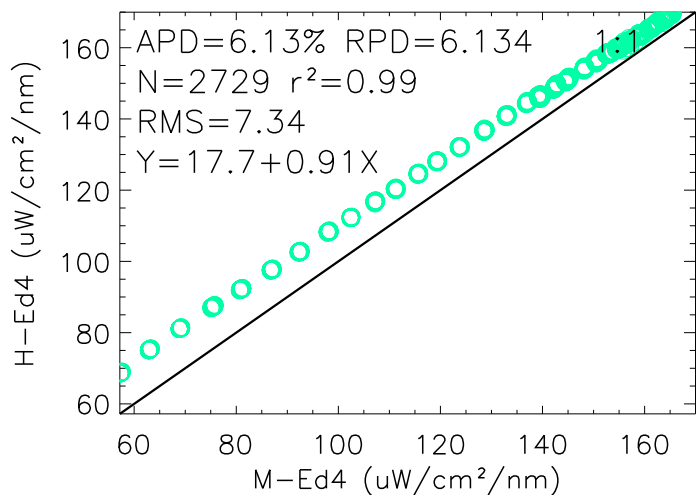
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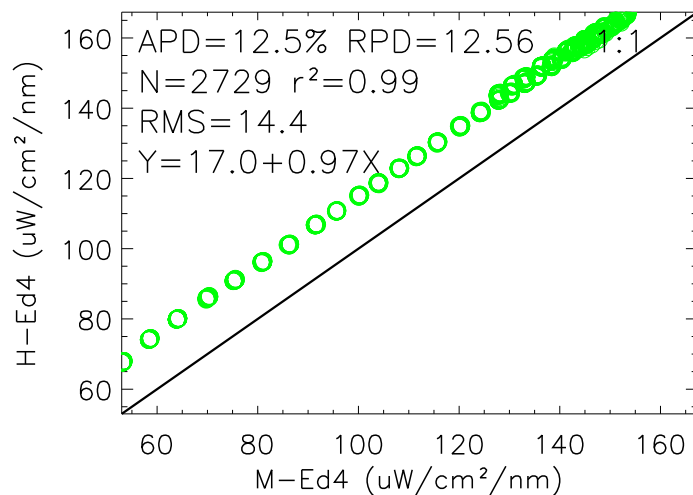
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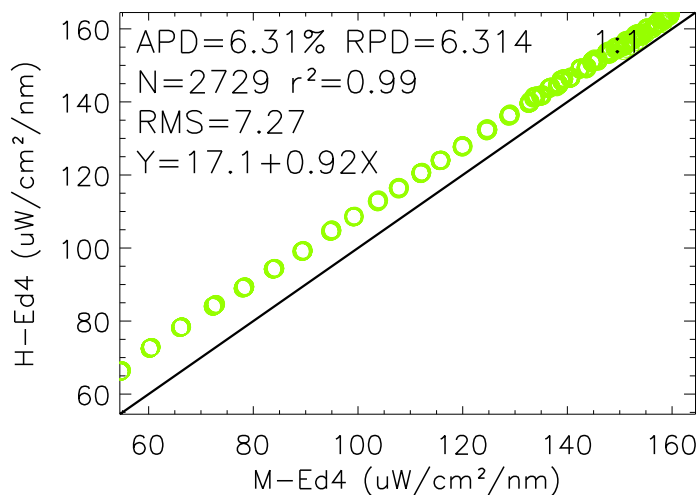
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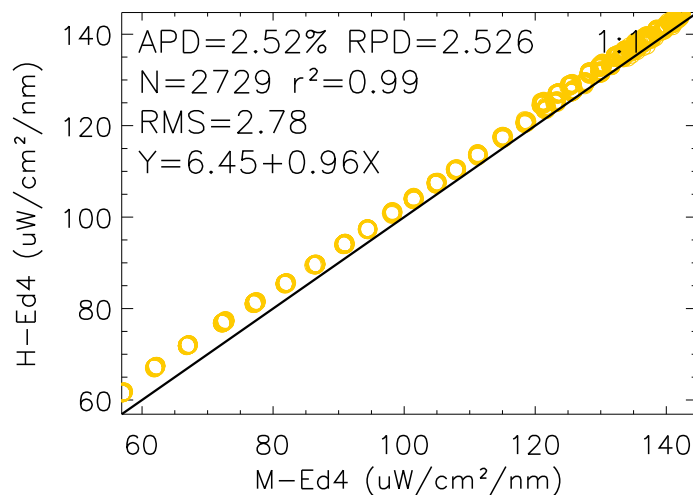
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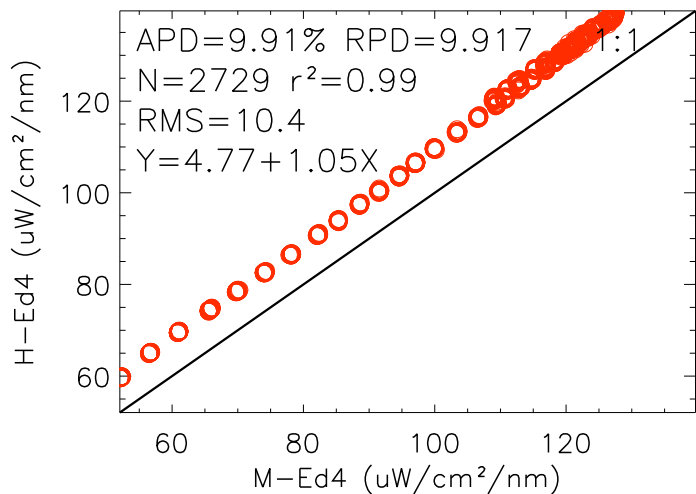
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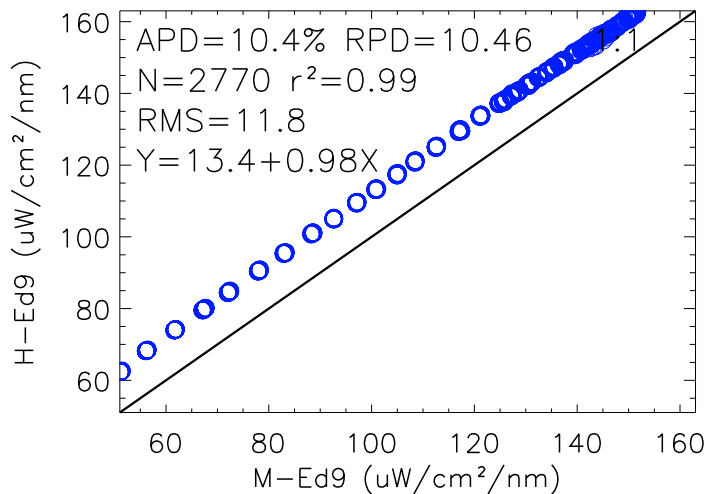
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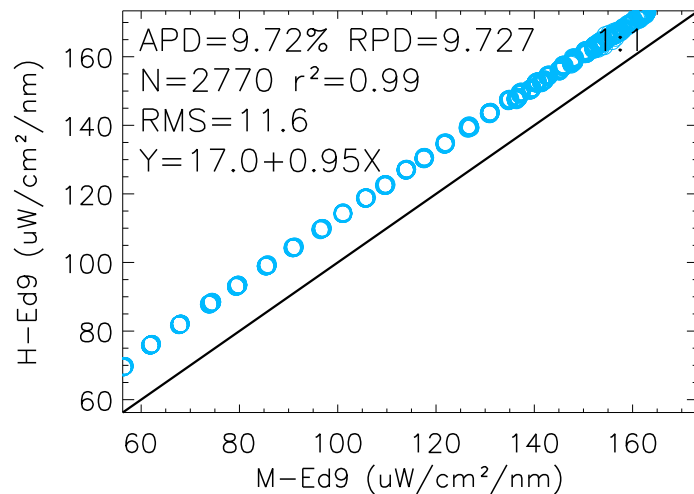
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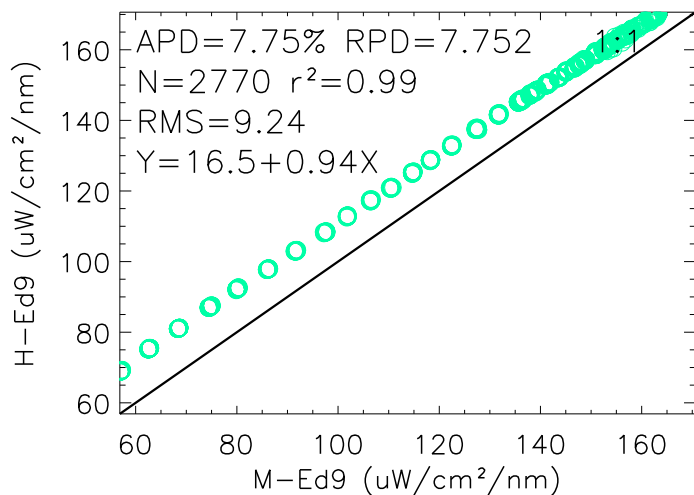
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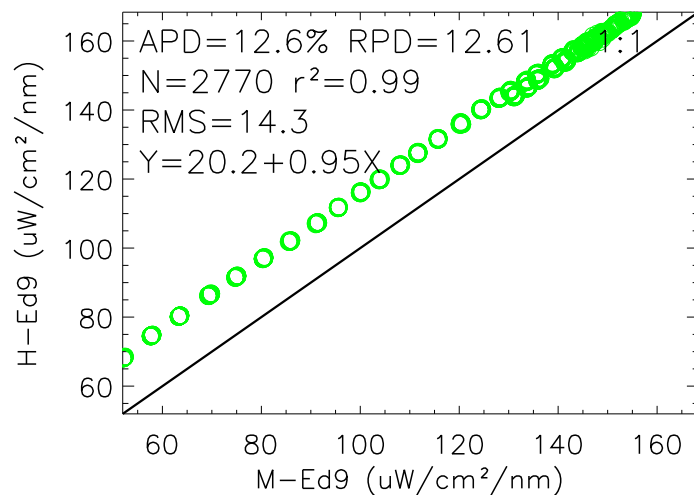
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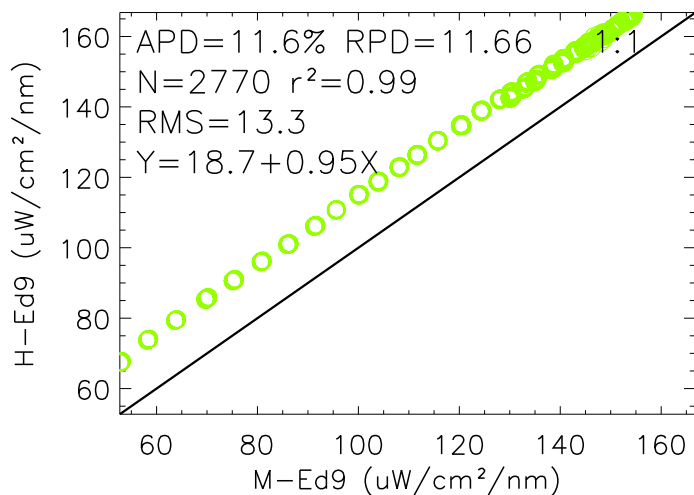
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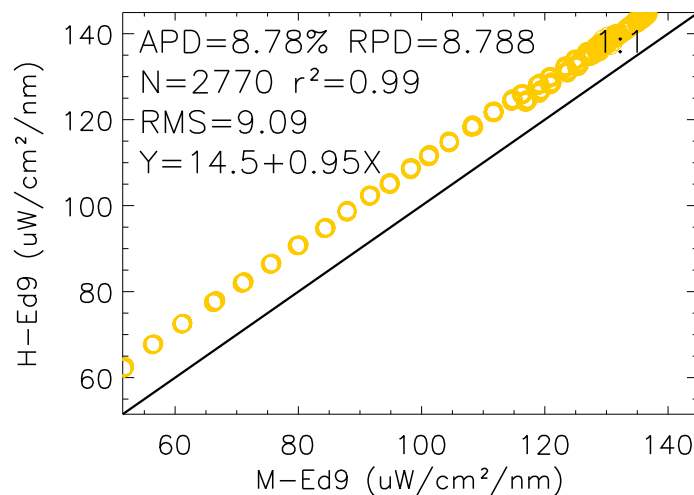
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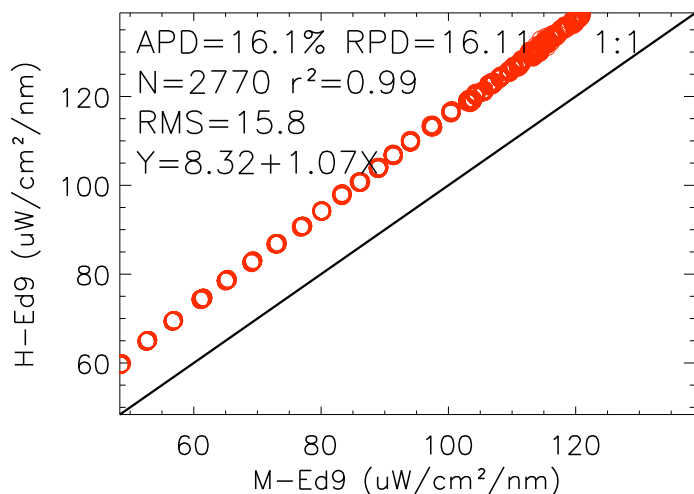
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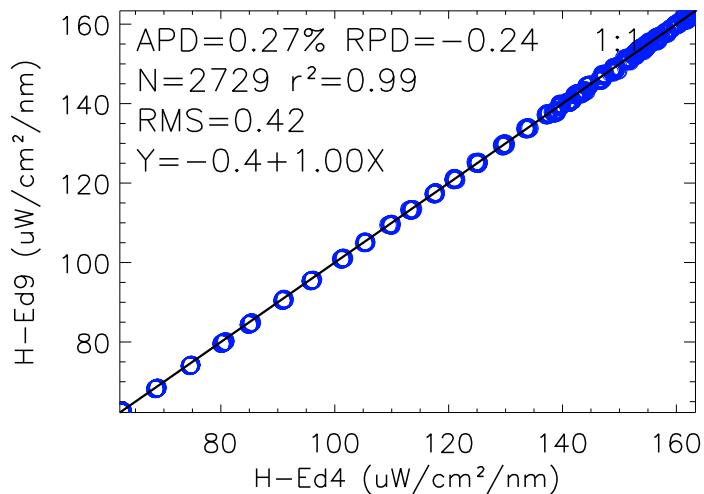
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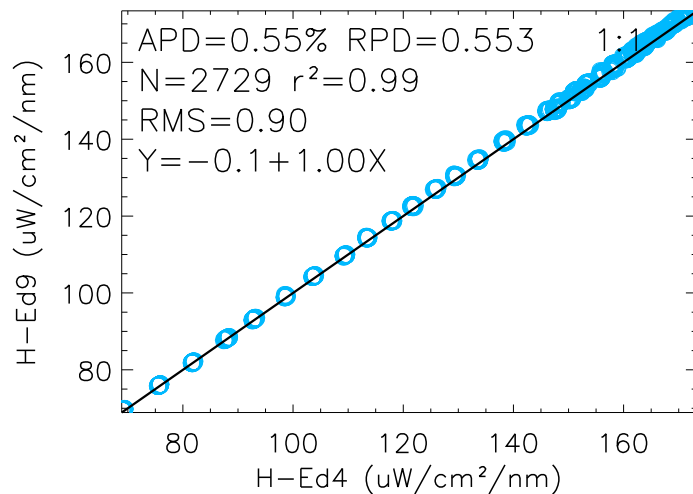
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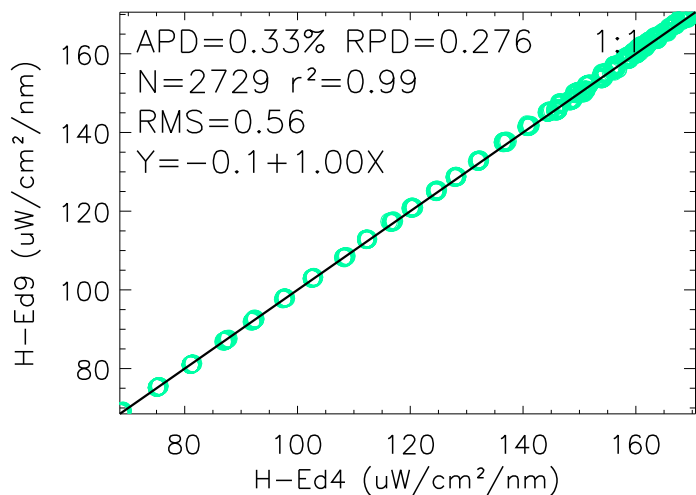
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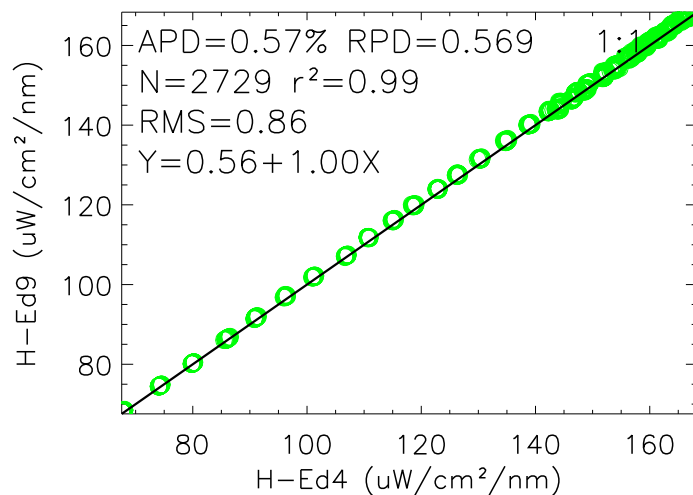
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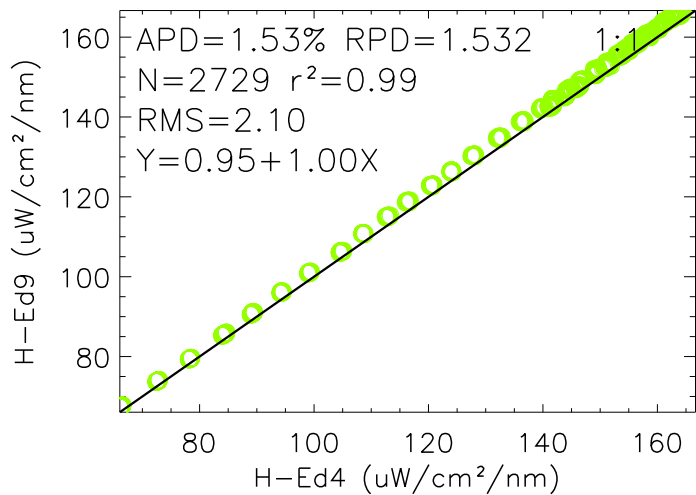
511.000



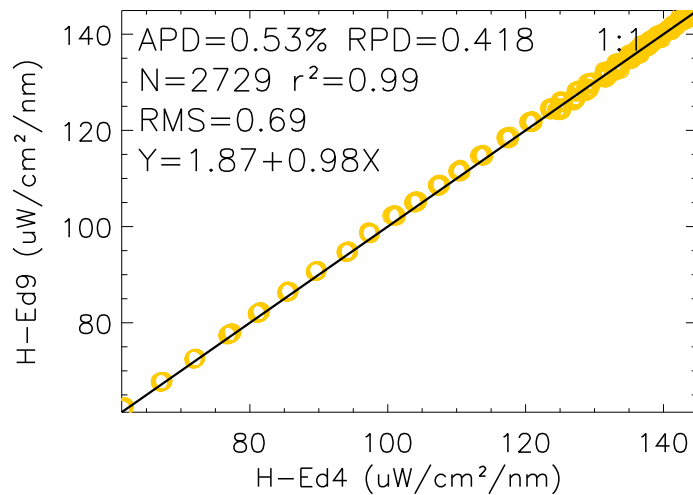
555.500



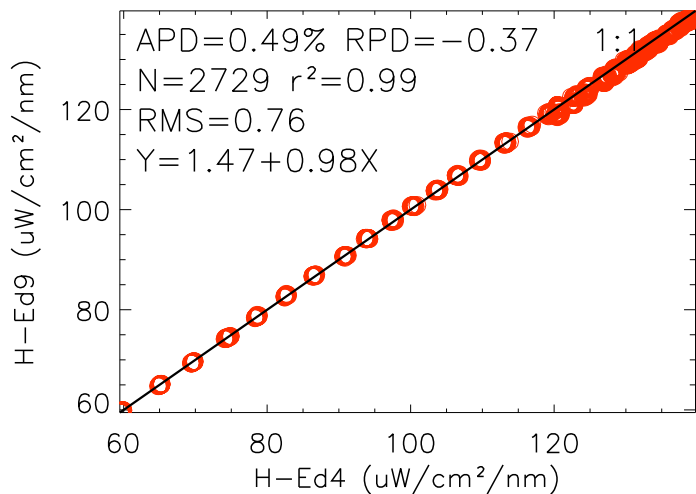
560.000



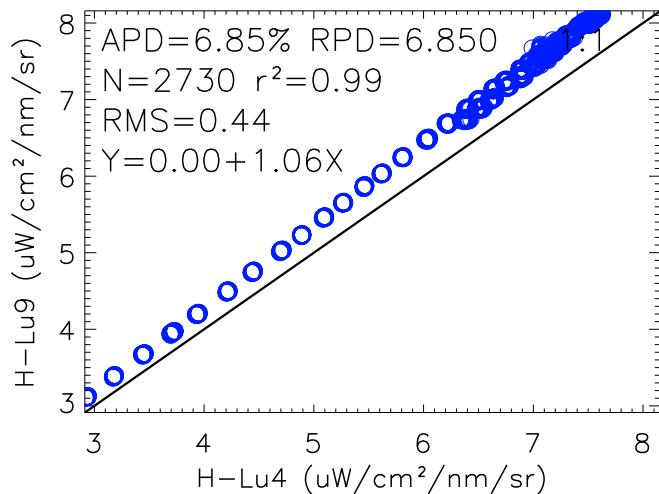
665.200



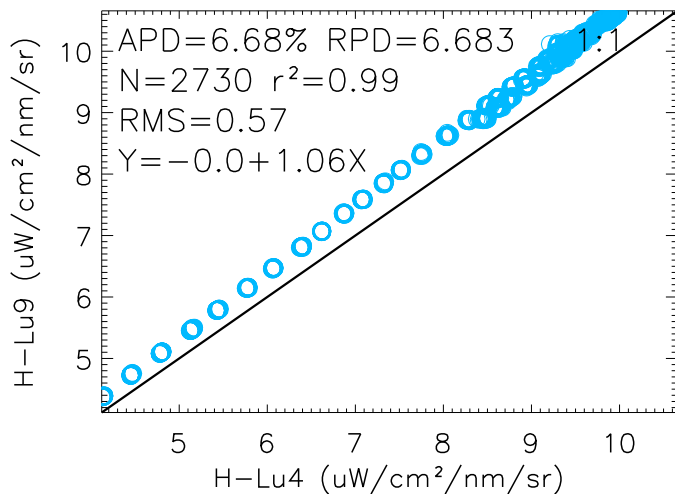
683.700



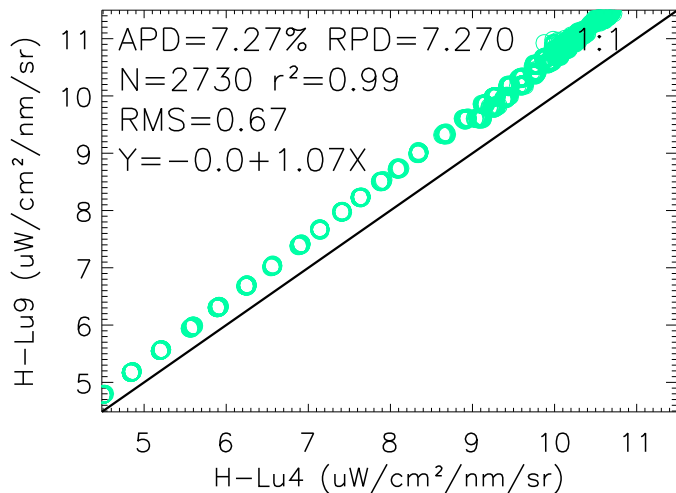
442.700



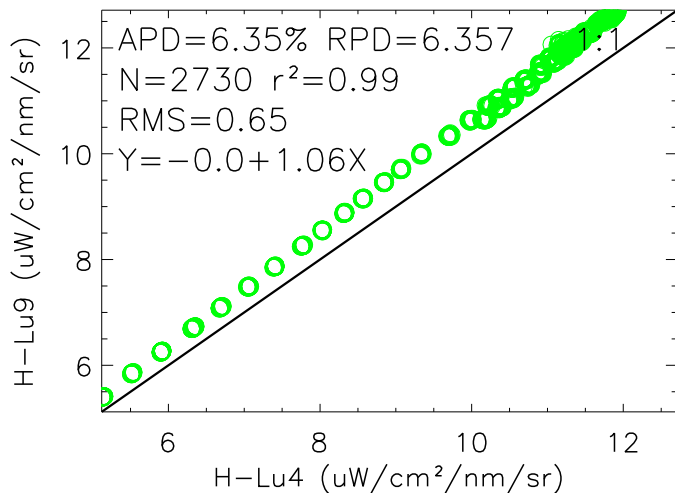
489.900



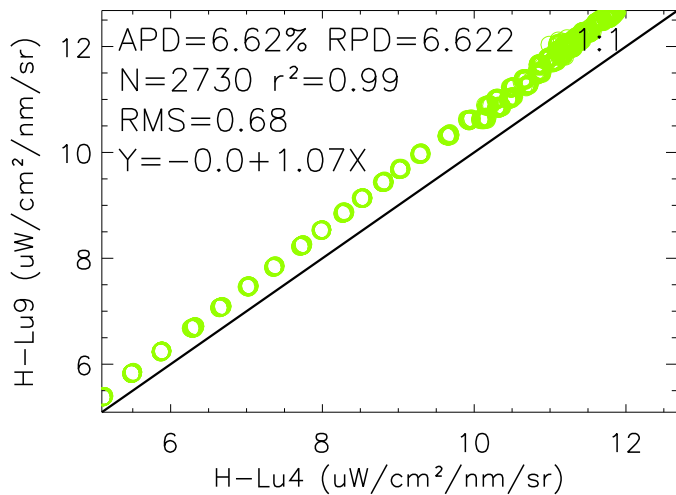
510.300



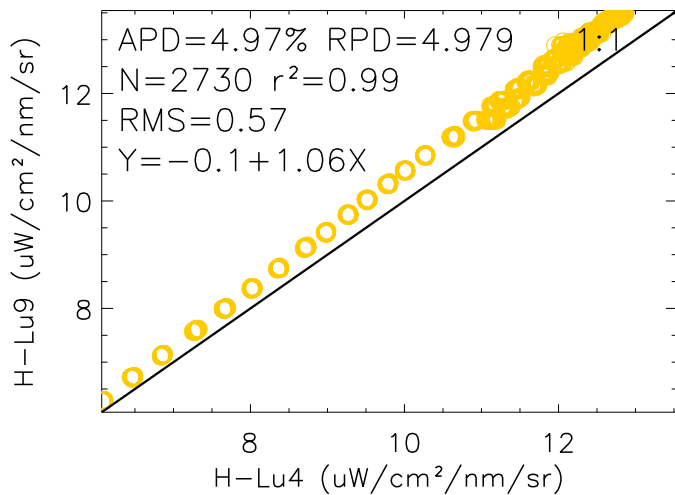
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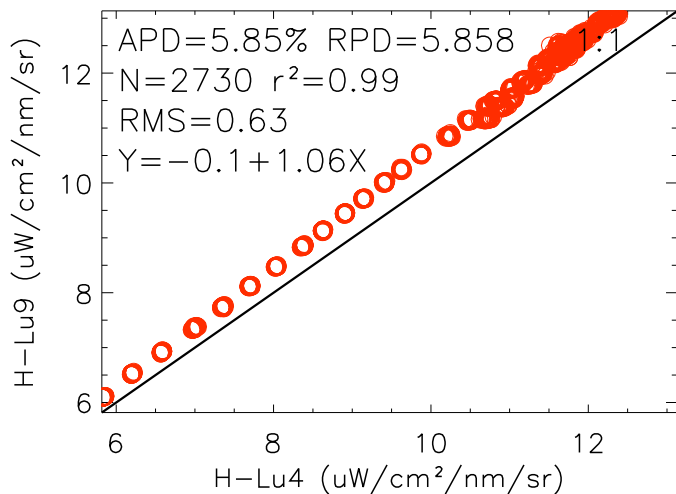
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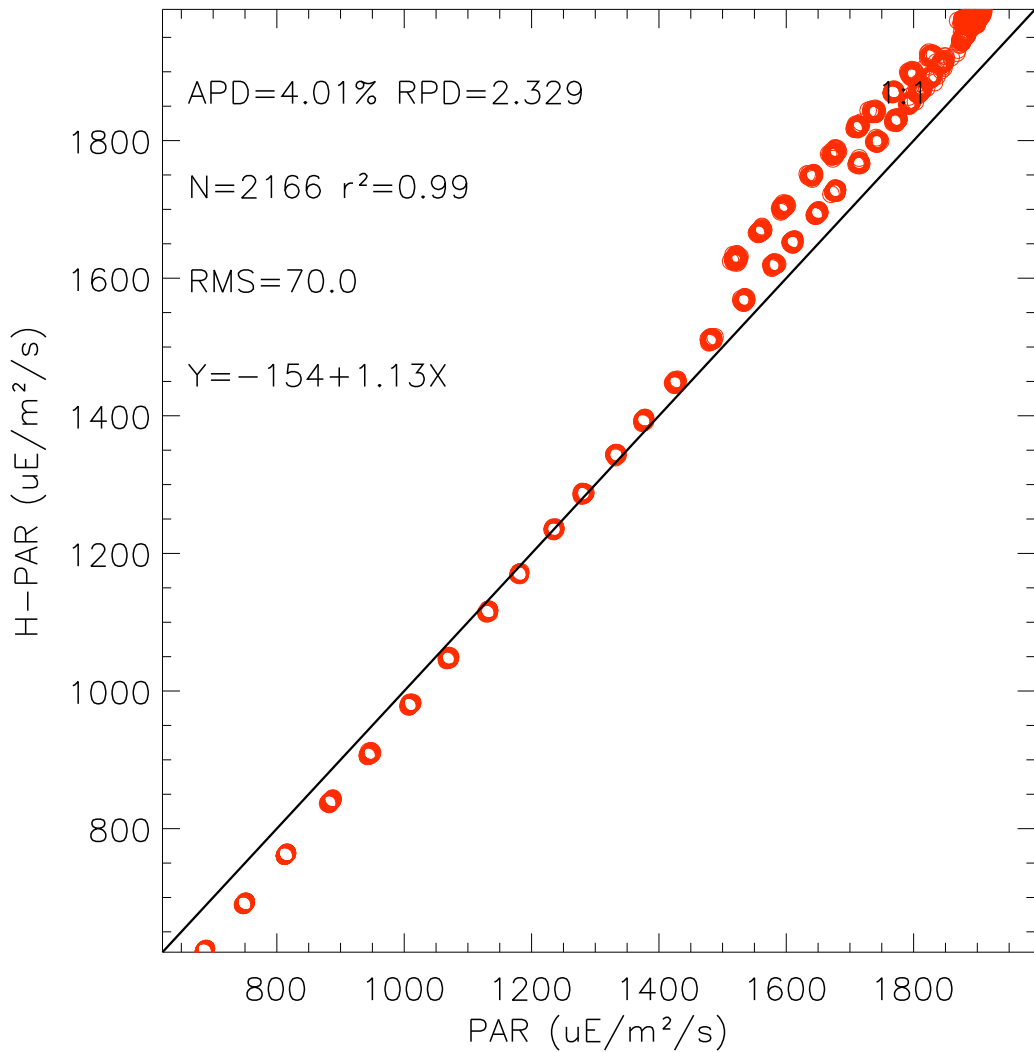


665.300

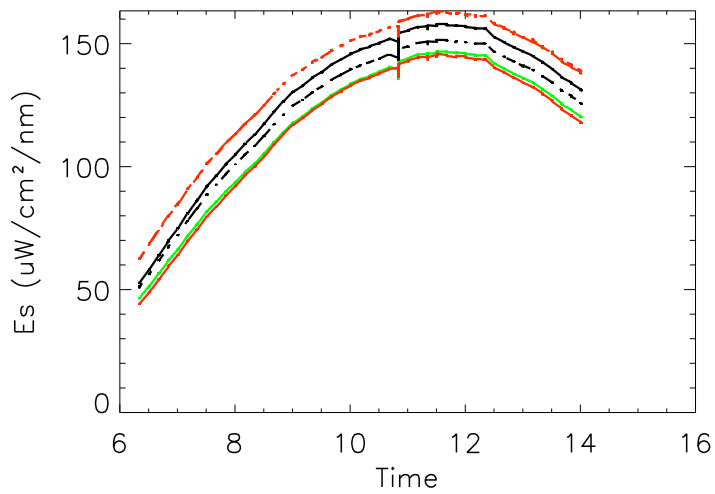


683.800

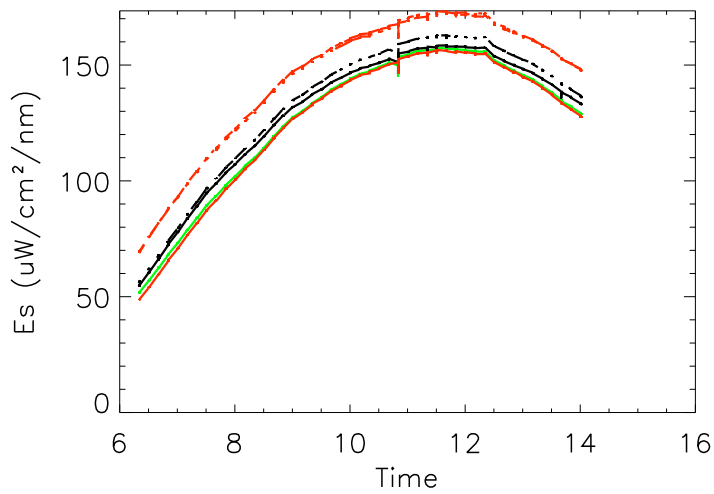




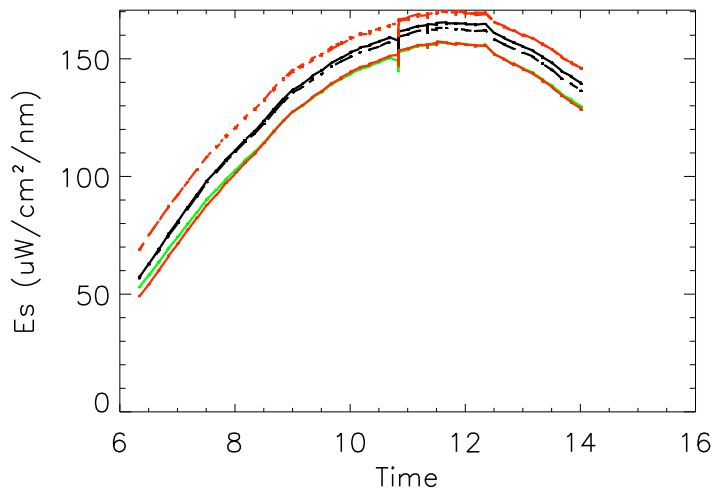
443.000



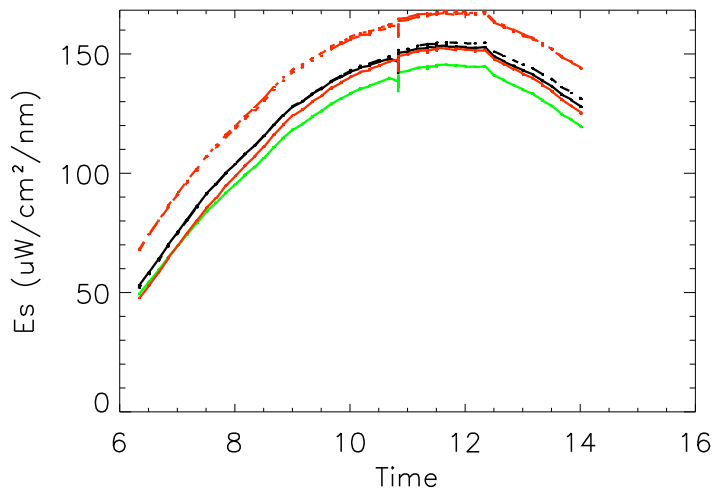
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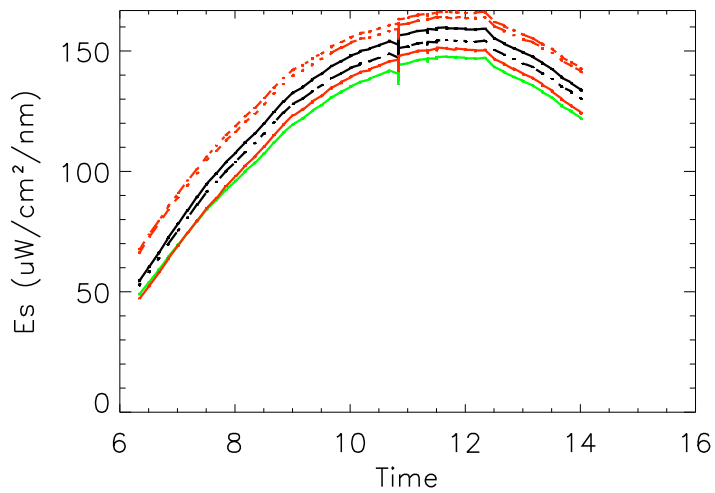
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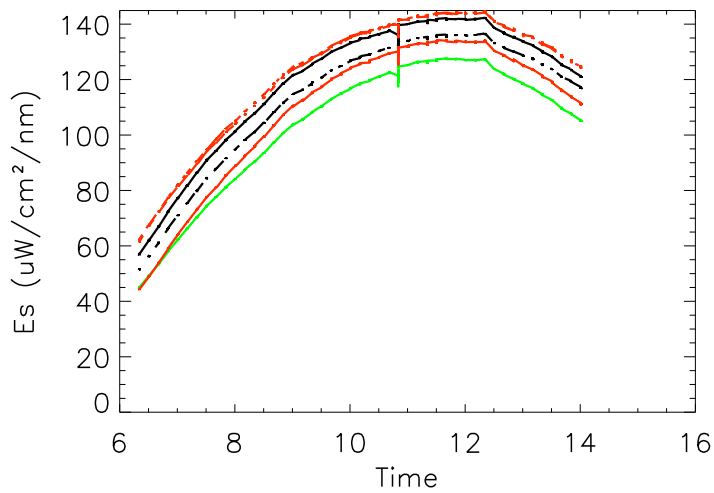
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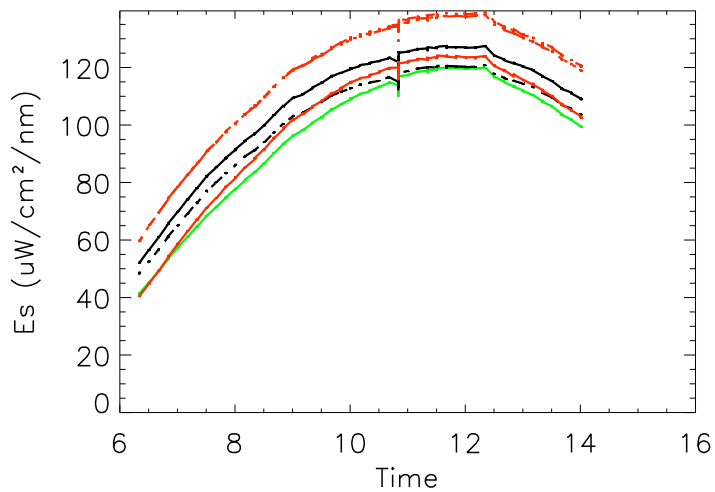
560.000



665.200



683.700

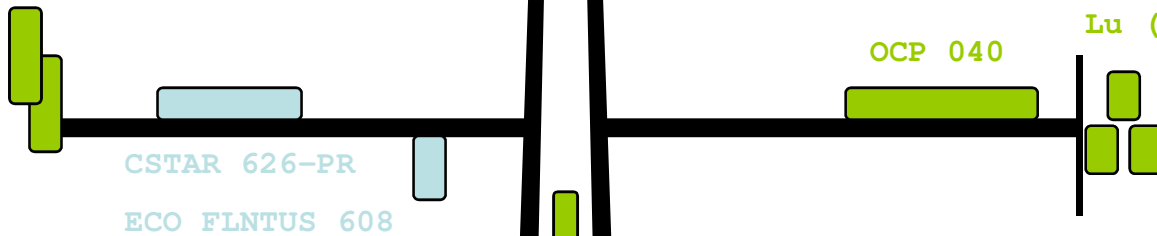


- SATLANTIC
- HOBILABS
- WETLABS
- SEABIRD
- GARROS

MVD (OCI) 030
 ARGOS 003
 Es (HOCl) 327
 Junction Box SJB 002
 MVDS 0062
 PAR 0061
 Feux: ?
 Solar Panels:

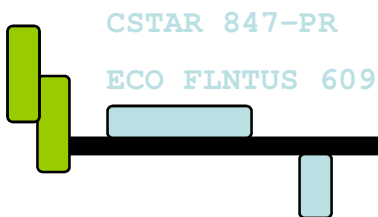
Lu (HOcR) 276
 Ed (HOcRI) 421

Ed (OCI) 050
 Eu (OCI) 048
 Lu (OcR) 036



Lu (HOcR) 277
 Ed (HOcRI) 422

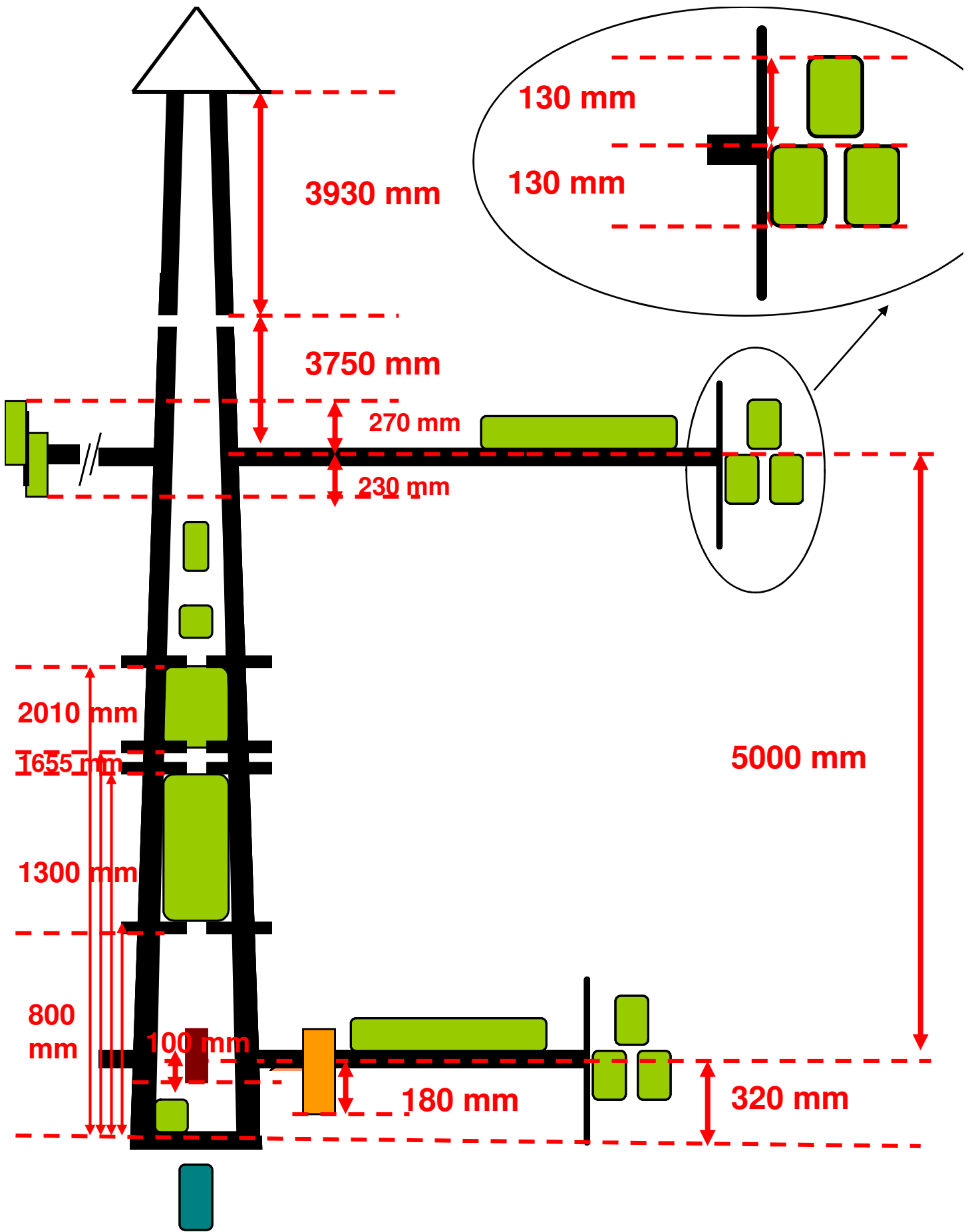
STOR-X 068
 CLC 004
 DACNet (mSM) 011
 Battery 002
 Strain-100 001

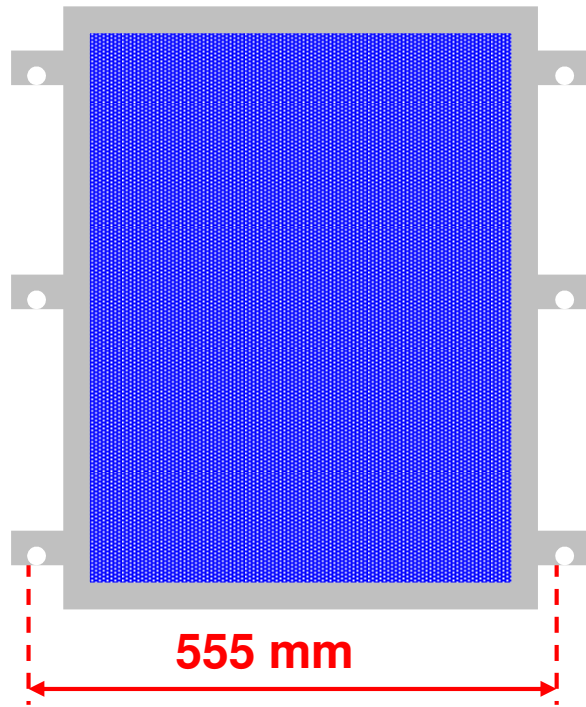
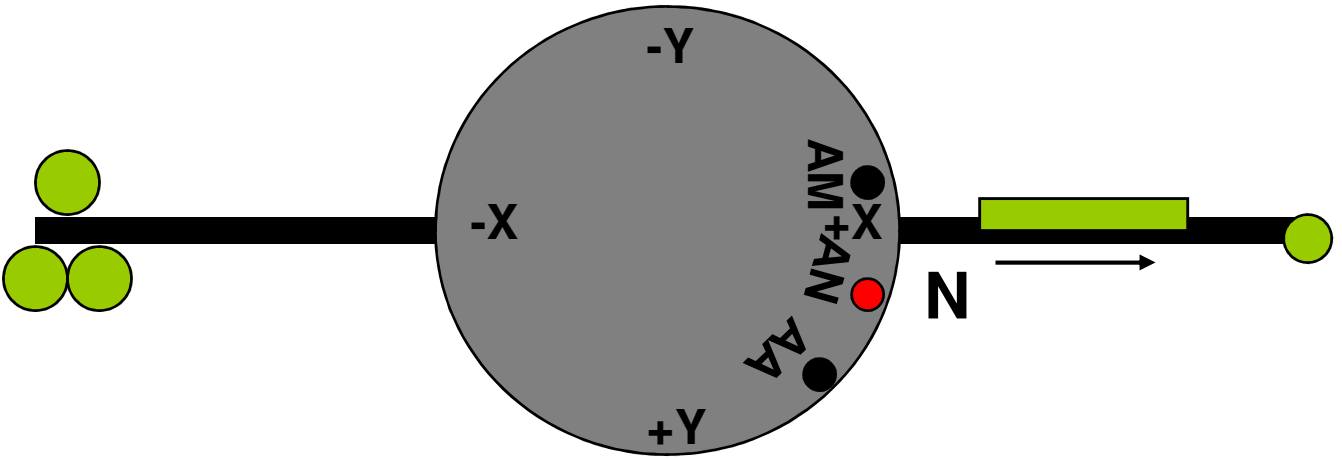


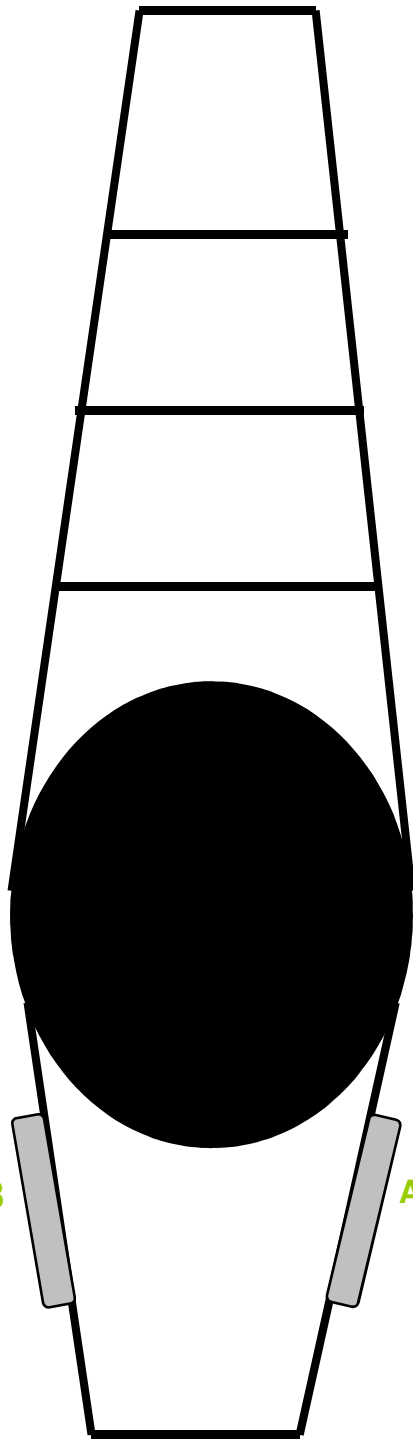
CTD 37SI30260-2404
 OCP 037
 Ed (OCI) 164
 Eu (OCI) 163
 Lu (OcR) 037

HS4 H4080705
 GAROS OML CSSPE00356









ARGOS 5433

ARGOS 74605

2012

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

11-Jan 17-Feb 15-Mar 5-Apr 15-May 2-Jun 18-Jun 16-Jul 13-Aug 22-Sep 5-Oct 27-Oct 20-Nov 20-Dec

(only rads cleaning)

4 m

ocp036n.cal
CST-1057PR
726_2011-08-05 HPL241h & PLD241h.cal
HPE399B & PED399B

ocp040l.cal
CST-626PR
608_2012-01-10 HPL276H.cal & PLD276H.cal
HPE421A.cal & PED421A.cal

9 m

ocp041j.cal
CST-1058PR
727_2011-08-05 HPL242i & PLD242i.cal
HPE405B & PED405B

ocp037m.cal
CST-847PR
609_2012-01-10 HPL277F.cal & PLD277F.cal
HPE422A.cal & PED422A.cal

MVD

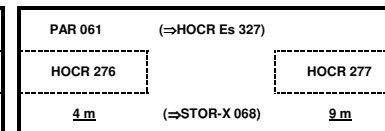
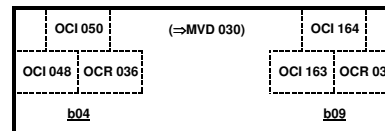
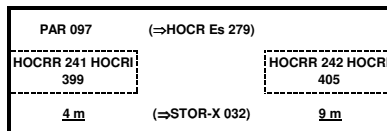
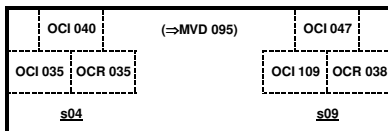
mvd053l.cal
HED279l.cal & Hse279l.cal

mvd062l.cal
HED327J.cal & HSE327J.cal

H4070403 2011-5-21.cal
Strain100_001b.cal
SATSTX0032d.cal

H4080705 2011-11-13.cal
Strain100_001b.cal
SATSTX0068d.cal

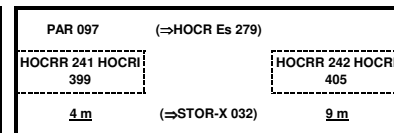
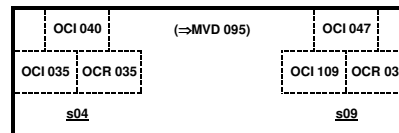
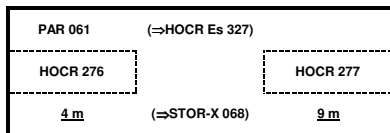
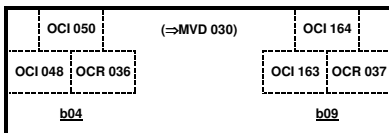
buoy XIV deployment (2012-09-07, vf2)

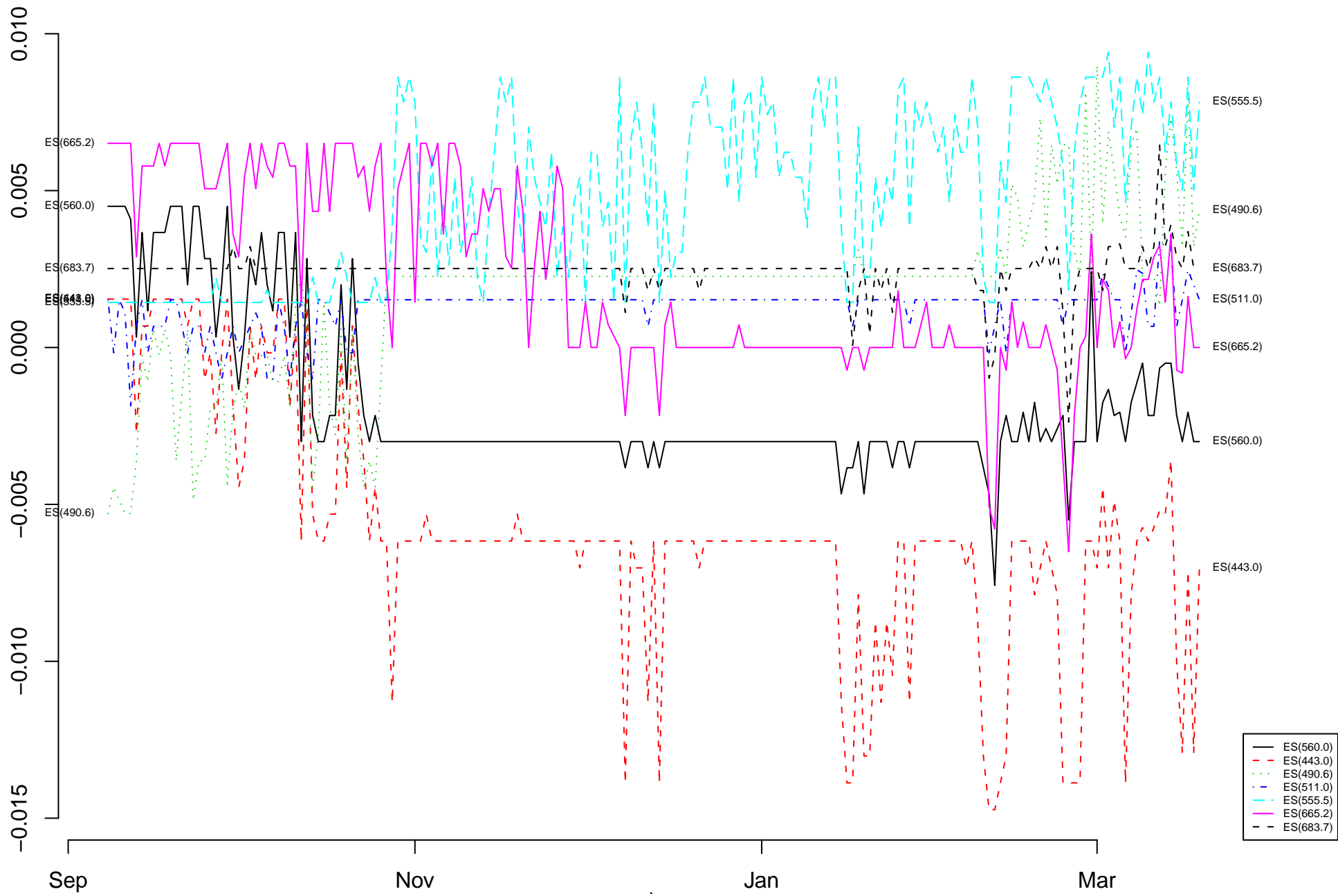


same configuration of buoy X

2013																							
JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
04-Jan	26-Jan	14-Feb	22-Mar	14-Apr	02-May	22-May	08-Jun					15-Jul	26-Jul	23-Aug	13-Sep	9-Oct	15-Oct	2-Nov	14-Nov	29-Nov	12-Dec		
		(only rads cleaning)																					
		ocp040l.cal								ocp036p_ocp040_temp.cal		26-July		ocp036p.cal									
CST-626PR 608_2012-01-10		HPL276H.cal & PLD276H.cal HPE421A.cal & PED421A.cal										CST-1057PR 726_2013-01-15		HPL241j.cal/PLD241j.cal HPE399E.cal/PED399E.cal									
		ocp037m.cal												ocp041L.cal									
CST-847PR 609_2012-01-10		HPL277F.cal & PLD277F.cal HPE422A.cal & PED422A.cal										CST-1058PR 727_2013-01-15		HPL242j.cal & PLD242j.cal HPE399E.cal & PED399E.cal									
		mvd062l.cal												mvd053n.cal									
HED327J.cal & HSE327J.cal														HED279k.cal & HSE279k.cal									
H4080705 2011-11-13.cal														H4070403 2012-10-6.cal									
Strain100_001b.cal														Strain100_002b.cal									
SATSTX0068d.cal														SATSTX0032f.cal									

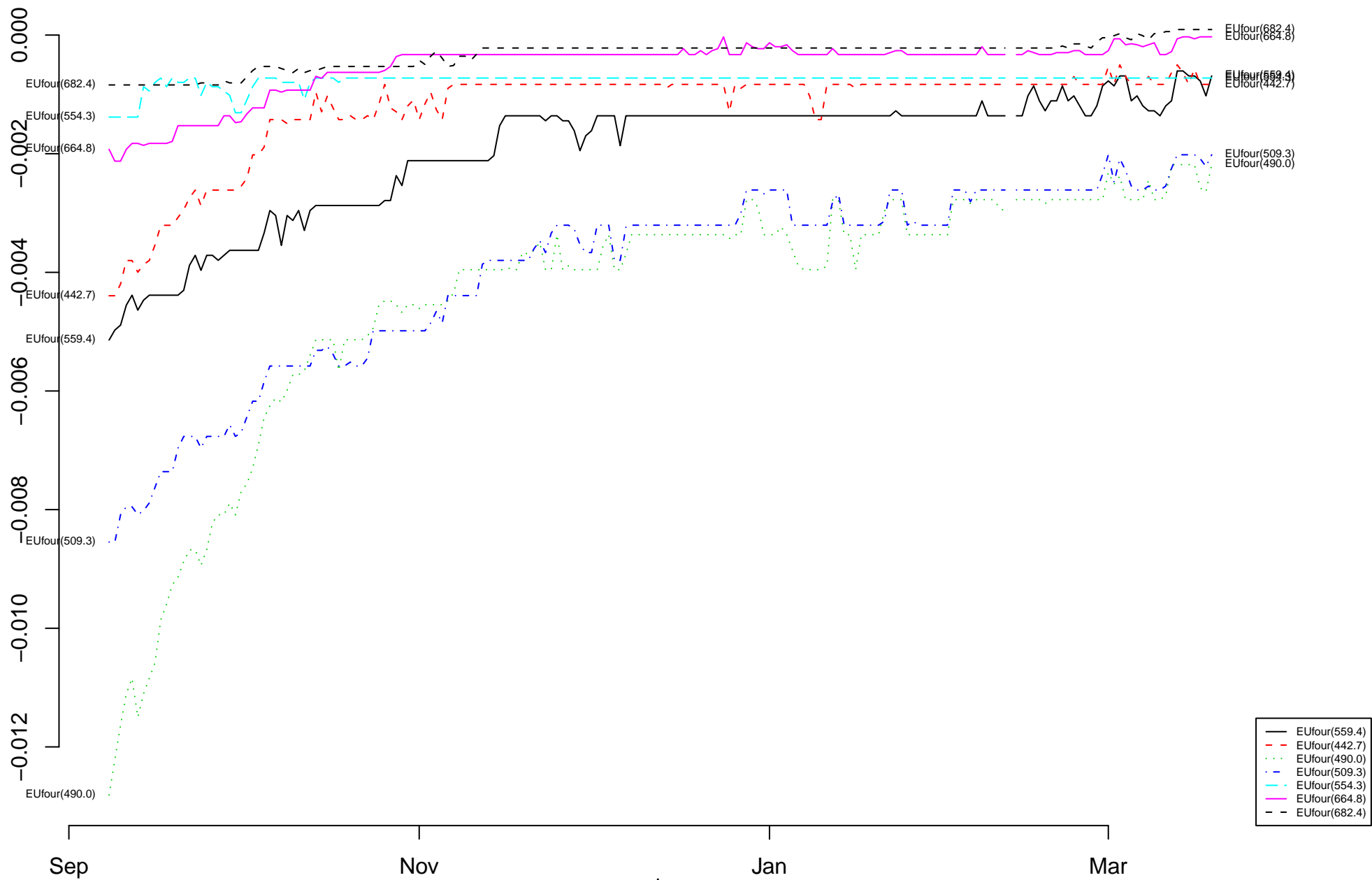
buoy XV deployment (2013-06-14, vf1)



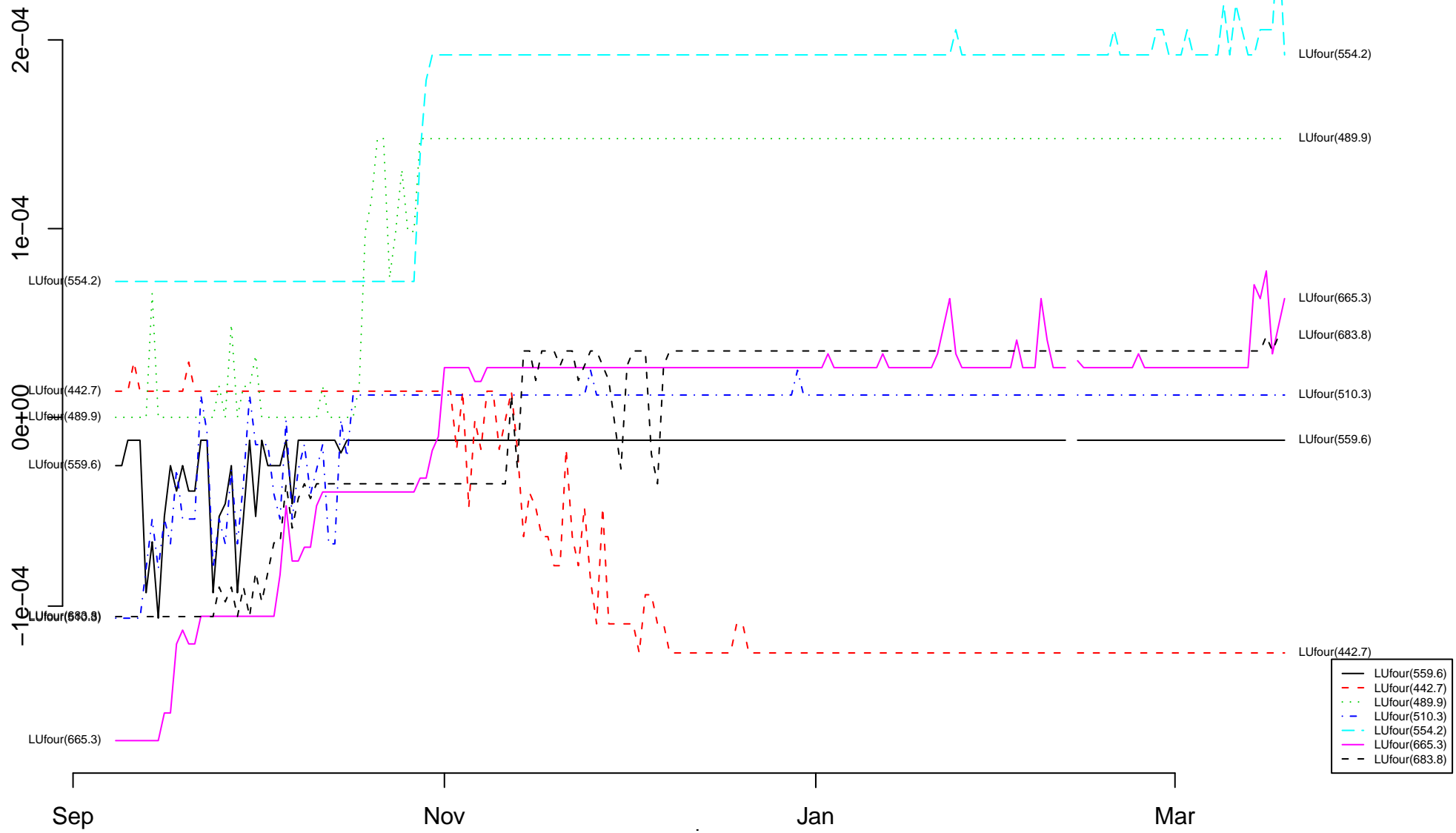


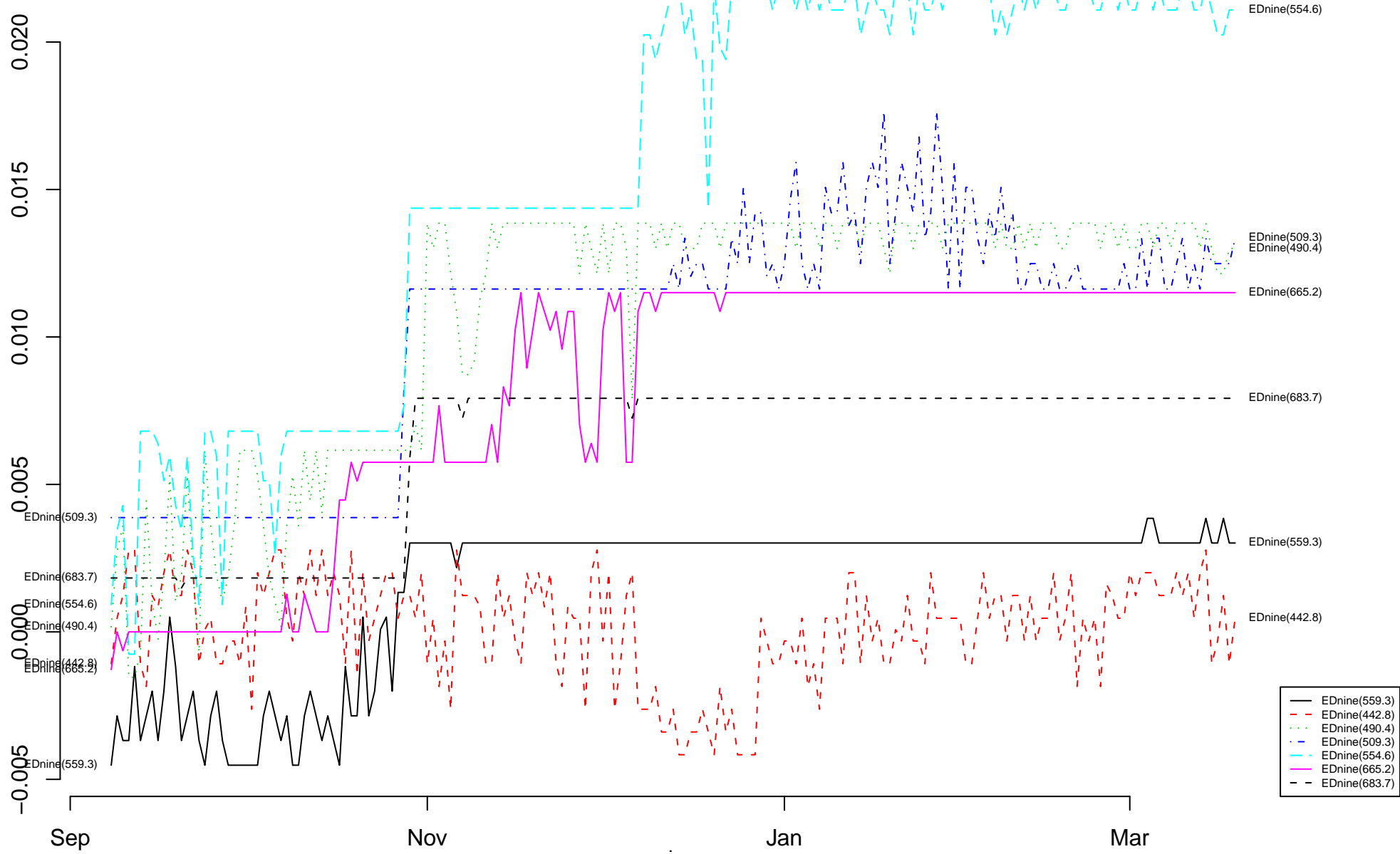
2012



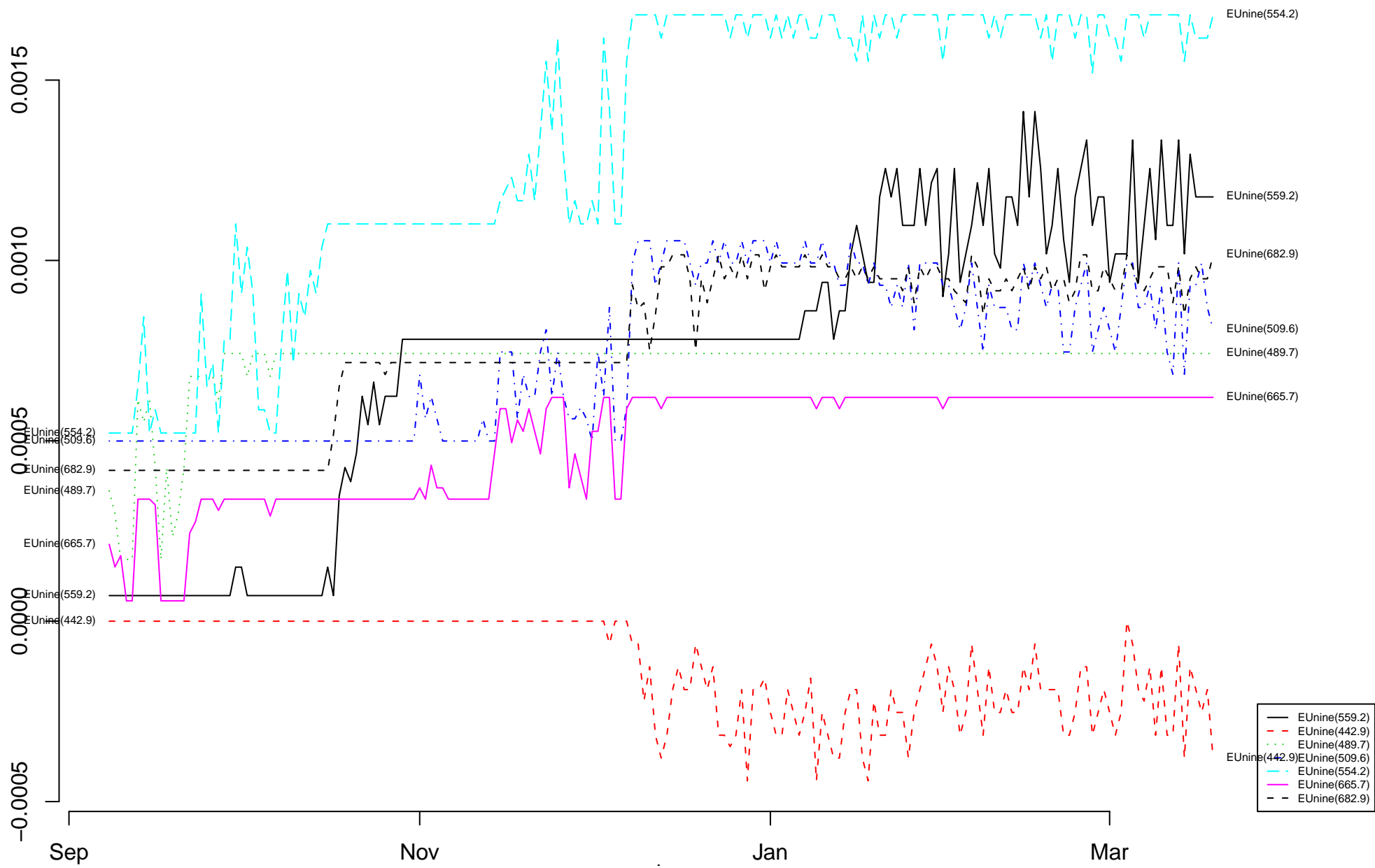


2012

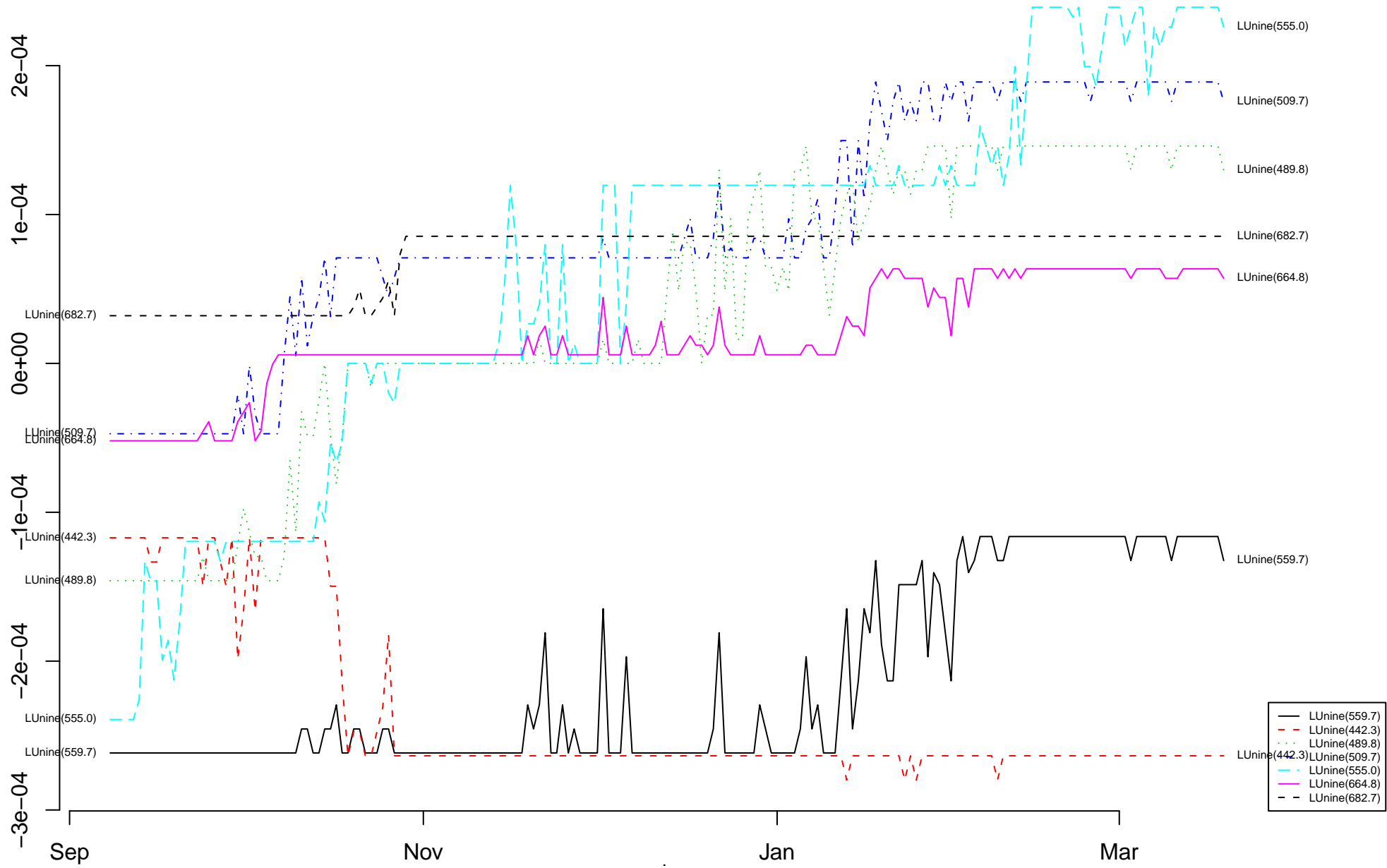




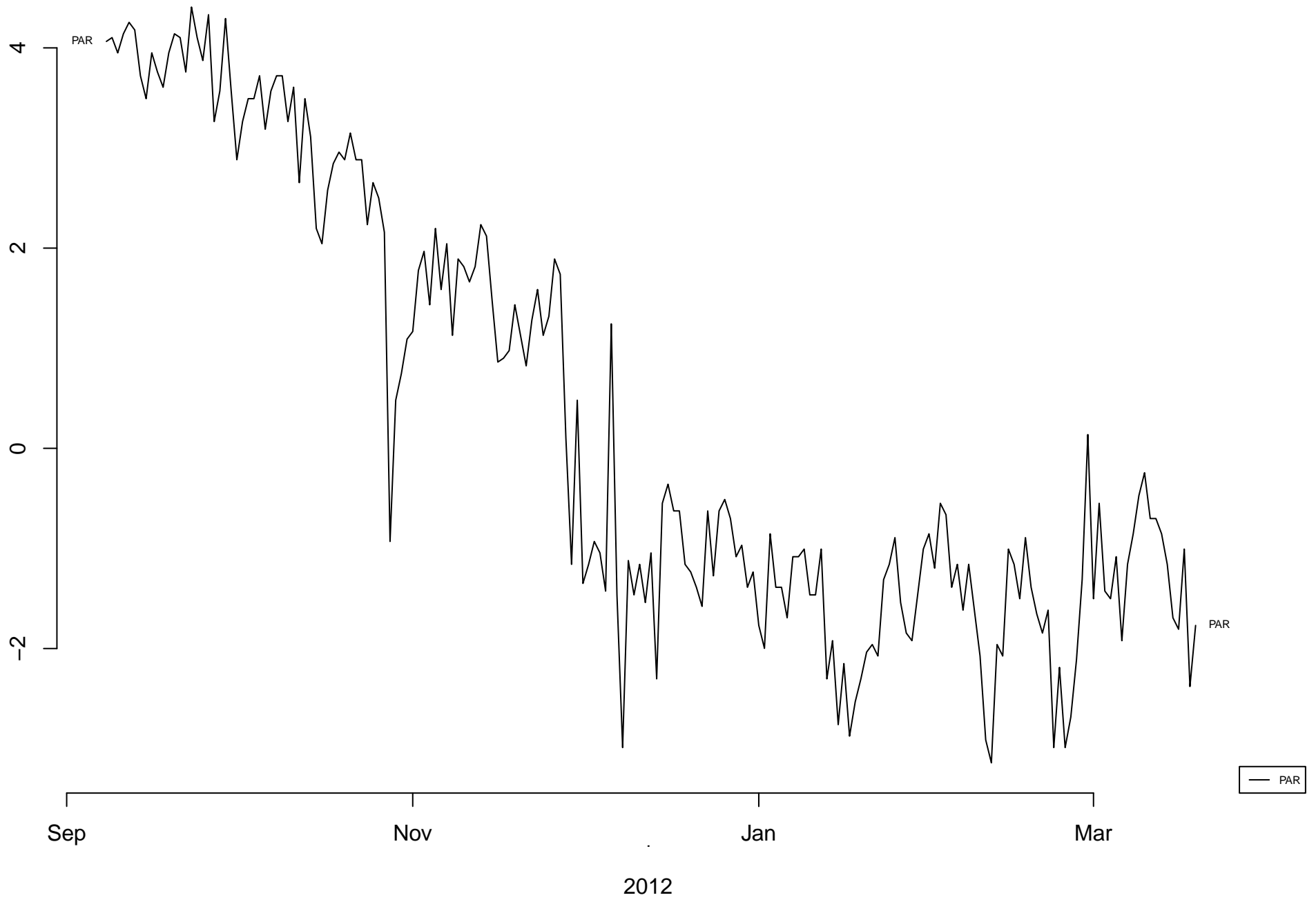
2012

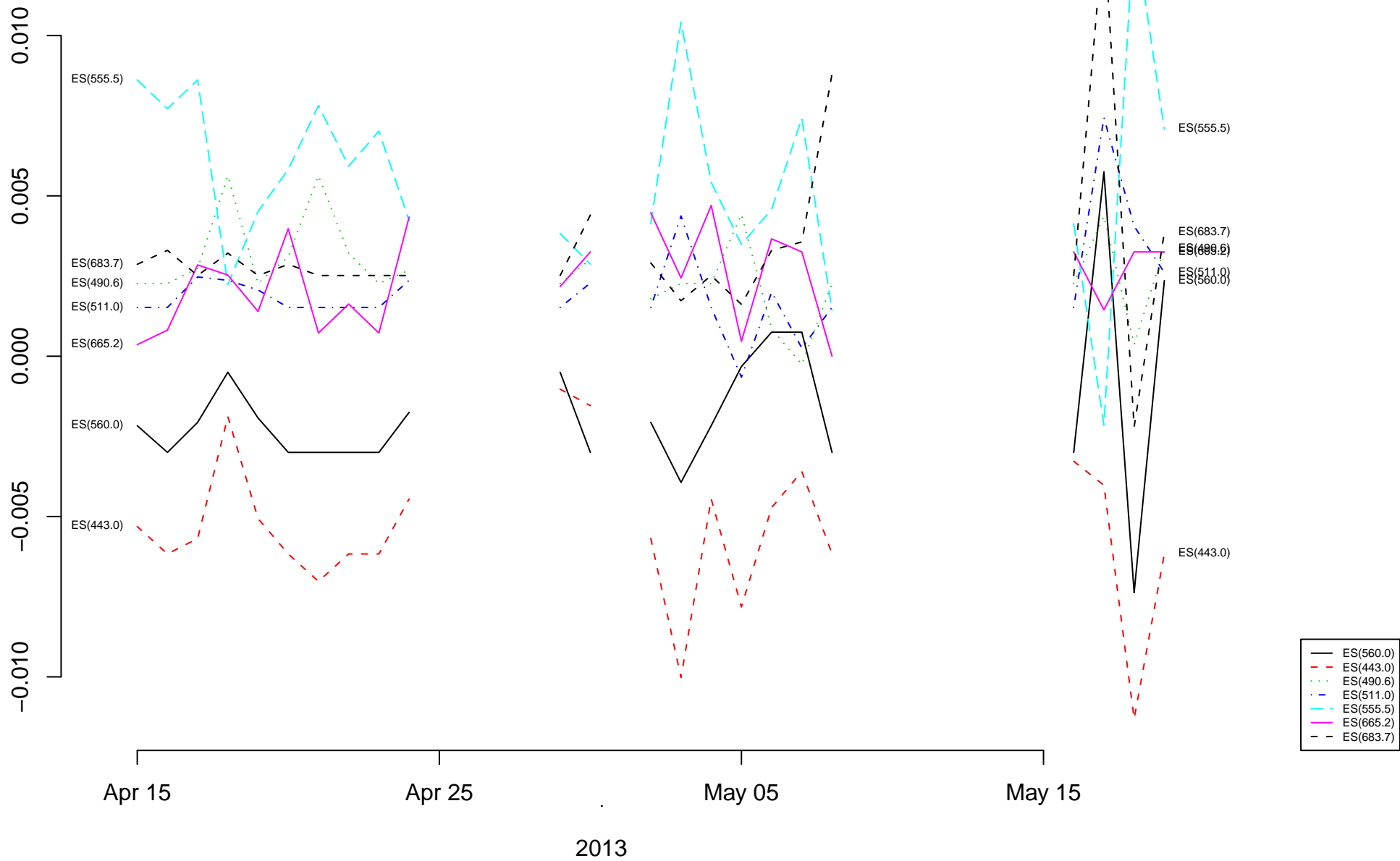


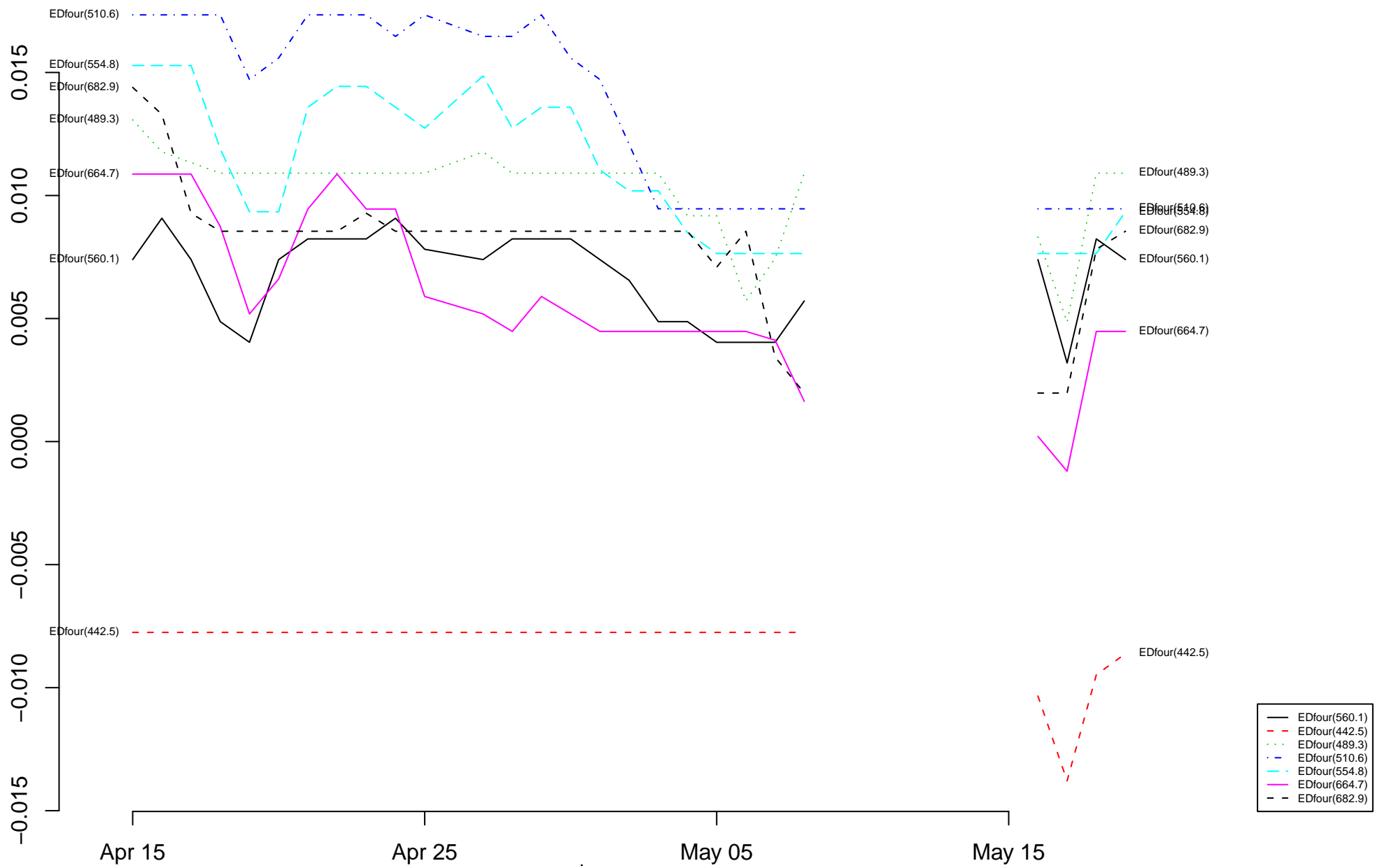
2012



2012

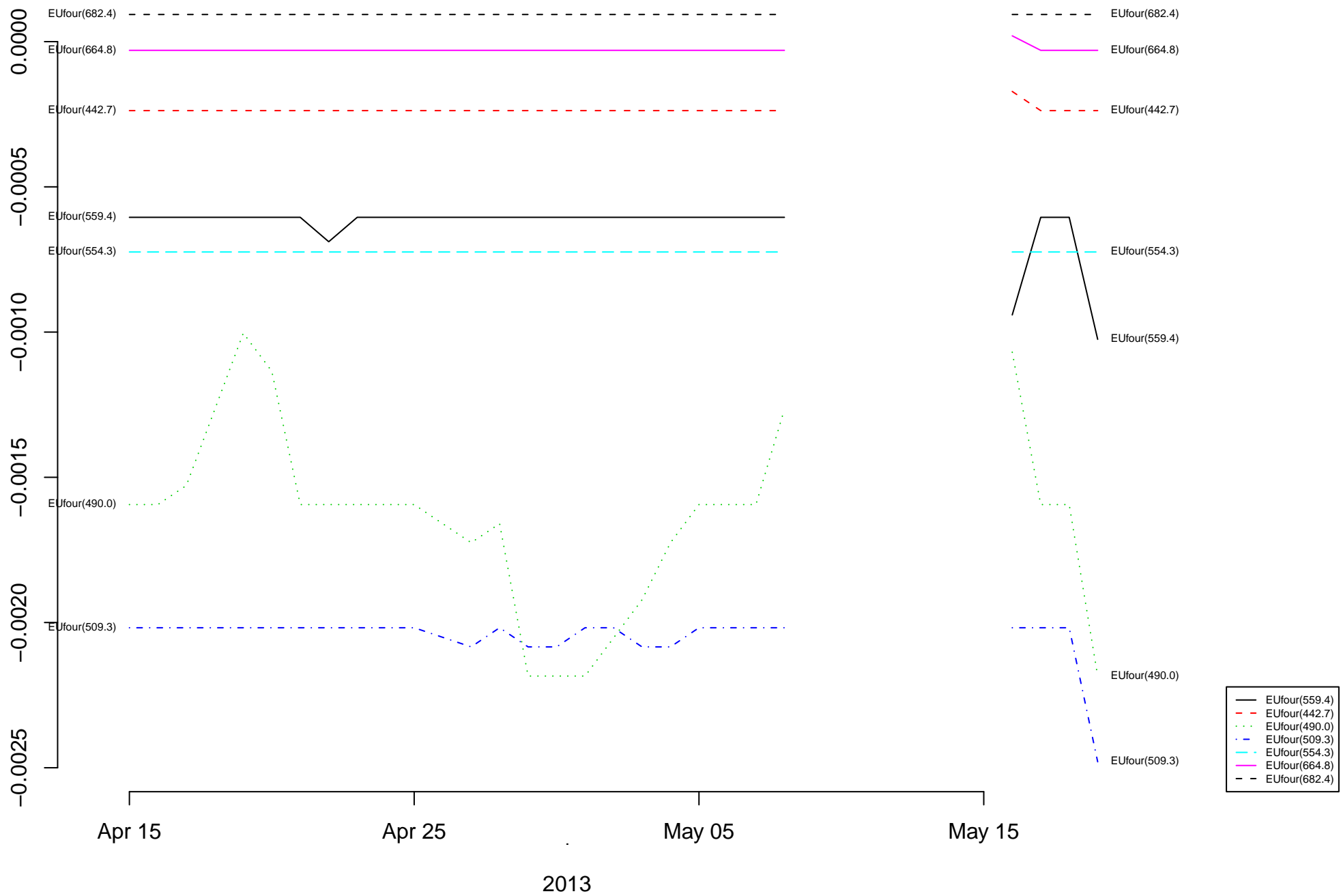


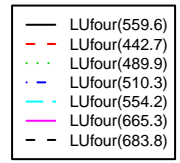
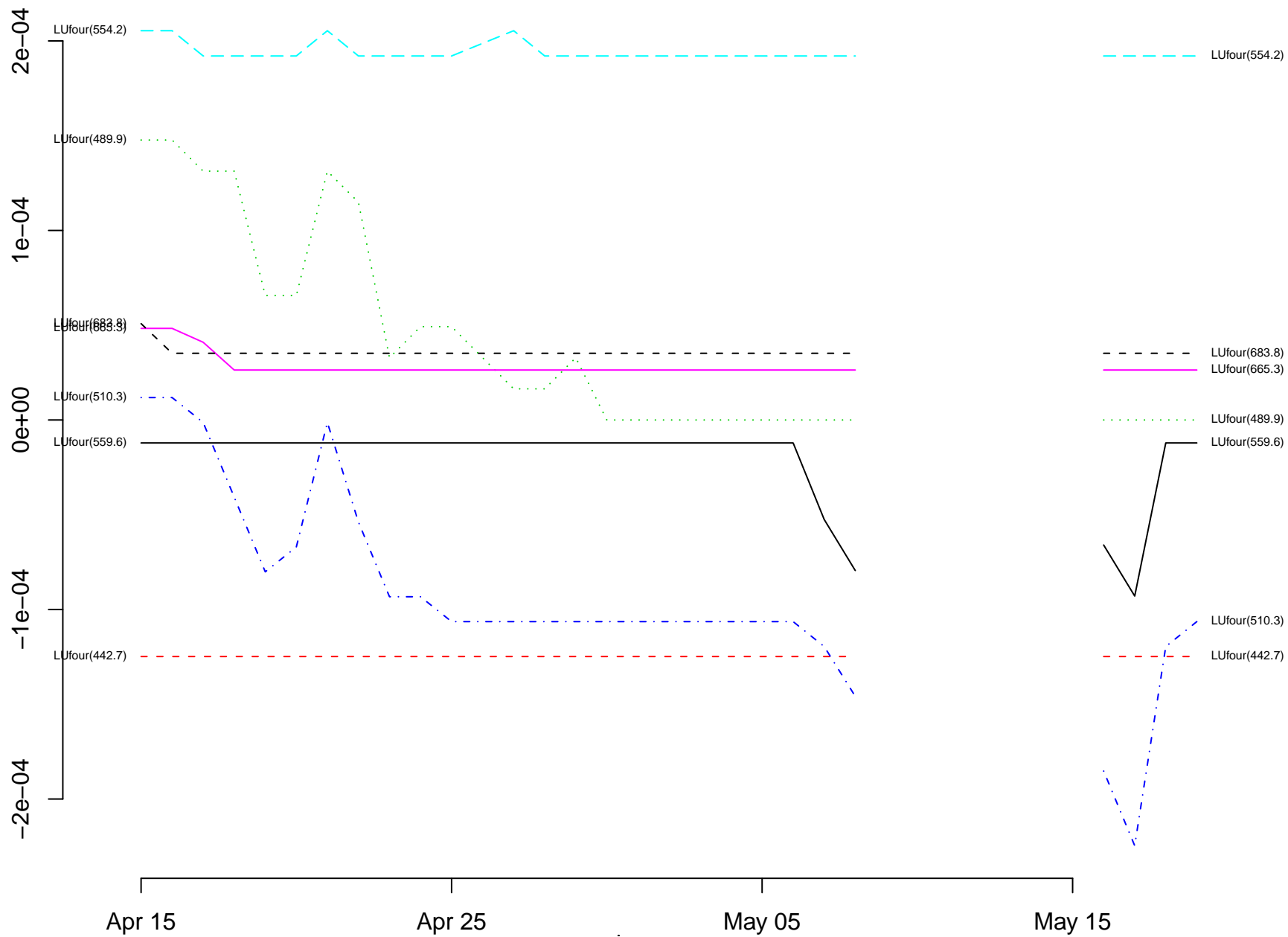




2013

- EDfour(560.1)
- - EDfour(442.5)
- ... EDfour(489.3)
- . - EDfour(510.6)
- - - EDfour(554.8)
- EDfour(664.7)
- - EDfour(682.9)





2013

