# Practical handling sea surface height data from tide gauge

#### Jang-Geun Choi

Center for Ocean Engineering, University of New Hampshire, NH, USA

#### **Table of Contents**

1.	Quality control	1
2.	Tide analysis	3
	Inverted barometer component	
	eferences	

"busan\_tide.mat" incldue 10 years sea surface height (sea level) observations at the Busan tide guage station off the coast of south Korea.

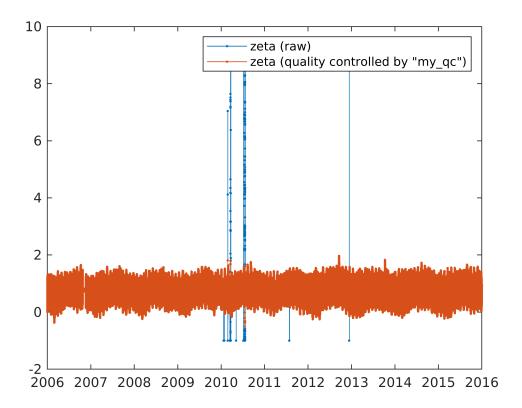
```
clc;clear;
load busan_tide.mat
% t (days): time in MATLAB date-format
% zeta (cm): raw sea level data from tide gauge
% zeta_qc (m): quality-controlled sea level data
plot(t,zeta,'.-')
datetick
```

# 1. Quality control

Unfortunately, many real time tide gauge dataset is not quality controlled. It is usually reauired for the users to do quality control. Useful guidance for quality control is provided by Integrated Ocean Observing System (IOOS; https://ioos.noaa.gov/project/qartod/). I recommend to do gross-range test, spike test, and flat line test to use tide gauge datasets off the coast of the Korea. The "my\_qc.m" is an example code for quality control programming

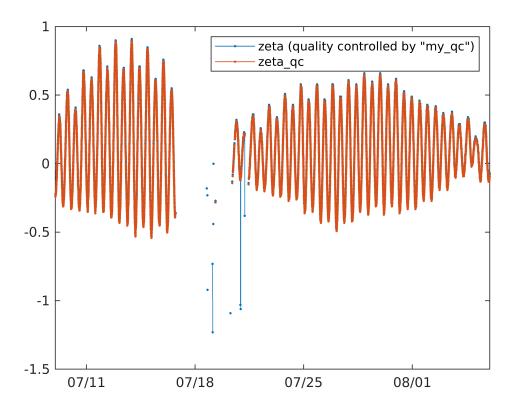
```
% Quality control
% Note that three-standard devidation is frequnetly considered as
% reasonable choice of threshold.
dat_min=nanmean(zeta)-3*nanstd(zeta);
dat_max=nanmean(zeta)+3*nanstd(zeta);
spk_trsd=3*nanstd(conv(zeta,[0.5 0 0.5],'valid'));
flt_n=5;
flt_eps=0.001;
flag=my_qc(zeta,dat_min,dat_max,spk_trsd,flt_n,flt_eps);
% suspect data will be flagged by '4'
hold on

zeta(flag==4)=nan;
plot(t,zeta,'.-')
legend('zeta (raw)','zeta (quality controlled by "my\_qc")')
```



Note that most quality control programs, including "my\_qc.m", is imperfect so it may be required to check the data manually. Variable "zeta\_qc" is manually quality controlled data where apparently suspect data (e.g., undected spike and abnormal discontinuity) are subjectively removed.

```
figure
plot(t,zeta-nanmean(zeta),'.-')
hold on
plot(t,zeta_qc,'.-')
xlim([734328 734356])
datetick('x','keeplimits')
legend('zeta (quality controlled by "my\_qc")','zeta\_qc')
```



## 2. Tide analysis

Frequently, predominant component in the sea level observations off the shallow coastal region is tides. The tidal component can be obtained by finding mode having modes having specific frequence which corresonds with tides. There are toolboxes for the tidal analysis:

T\_Tide: https://www.eoas.ubc.ca/~rich/

UTide: http://www.po.gso.uri.edu/~codiga/utide/utide.htm

Here, T\_Ttide will be used. It is worth noting that demo problem is provided by T\_Tide ("t\_demo.m").

number of standard constituents used: 68
Points used: 3739300 of 5258880
percent of var residual after lsqfit/var original: 7.08 %
Greenwich phase computed with nodal corrections applied to amplitude
and phase relative to center time
Using linearized error estimates
Generating prediction with nodal corrections, SNR is 1.000000
percent of var residual after synthesis/var original: 7.11 %

-----

date: 13-Jan-2023

nobs = 5258880, ngood = 3739300, record length (days) = 3652.00

start time: 01-Jan-2006
rayleigh criterion = 1.0

Greenwich phase computed with nodal corrections applied to amplitude \n and phase relative to center time

x0 = -0.00474, x trend= 0

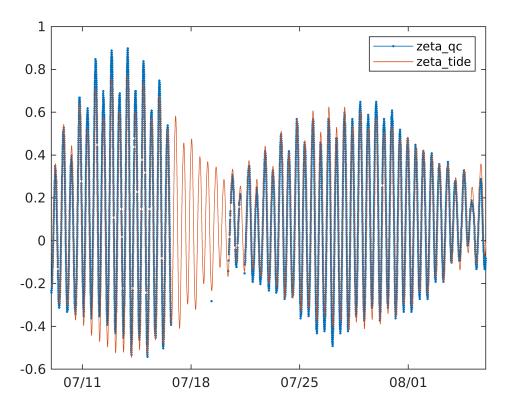
var(x) = 0.10119 var(xp) = 0.093995 var(xres) = 0.0071934 percent var predicted/var original= 92.9 %

tidal amplitude and phase with 95% CI estimates

*SSA 0.0001141 0.1045 0.006 221.40 3.17 3.3e+02 *SSA 0.0002282 0.0075 0.006 337.69 44.11 1.7  MSM 0.0013098 0.0048 0.006 12.58 68.61 0.7  MM 0.0015122 0.0028 0.006 75.51 118.45 0.23  MSF 0.0028219 0.0038 0.006 75.51 118.45 0.23  MSF 0.0038511 0.0106 0.006 214.32 31.33 3.33  *ALP1 0.0343966 0.0006 0.000 169.52 34.67 2.6  201 0.0357064 0.0004 0.000 254.38 59.10 0.88  *SIG1 0.0359087 0.0012 0.000 172.62 18.80 8.9  *01 0.0374209 0.0003 0.000 172.62 18.80 8.9  *TOI 0.0387307 0.0164 0.000 172.62 18.80 8.9  *TOI 0.0387307 0.0164 0.000 109.81 1.37 1.7e+03  *TAUI 0.0389588 0.0010 0.000 224.76 22.62 5.8  BET1 0.0400404 0.0002 0.000 179.14 12.27 11  CHII 0.0404710 0.0001 0.000 179.14 12.27 11  CHII 0.0404710 0.0001 0.000 179.14 12.27 11  CHII 0.0404710 0.0001 0.000 13.29 229.22 0.058  *PII 0.0415326 0.0136 0.000 189.90 1.70 1.1e+03  *SSI 0.0416667 0.0066 0.000 284.87 22.88  *PHII 0.0416898 0.0011 0.000 224.68 5.05 1.1e+04  *PSSI 0.0416807 0.0029 0.000 189.90 1.70 1.1e+03  *STHEL 0.0430905 0.0009 0.000 246.87 22.88  *PHII 0.042089 0.0016 0.000 283.04 8.57 43  *OOI 0.0448308 0.0015 0.000 283.04 8.57 43  *OOI 0.046830 0.0005 0.000 283.04 8.57 5.8  *MUS 0.0776895 0.0189 0.002 221.68 311.38 25  *MUZ 0.0776895 0.0189 0.002 221.68 311.38 25  *MUZ 0.0776895 0.0189 0.002 231.99 9.53  *MZ 0.00792016 0.0121 0.002 231.99 9.53  *MZ 0.0085114 0.002 241.08 31.91 4.2  *MKS2 0.080515 0.0131 0.002 242.70 0.31 3.5e-04  *MS2 0.080516 0.0121 0.002 241.08 31.91 4.2  *MKS2 0.0805193 0.016 0.002 284.70 1.050 7.7e-03  *Z2 0.0759749 0.0009 0.002 241.08 31.91 4.2  *MKS2 0.080515 0.0189 0.002 231.99 9.53  *MZ 0.076895 0.0189 0.002 241.08 31.91 4.2  *MS2 0.080516 0.0032 0.002 289.42 34.78 2.6  *MS2 0.0805174 0.0008 0.002 279.07 0.65 7.7e-03  *Z2 0.083333 0.1768 0.002 279.07 0.65 7.7e-03  *Z2 0.083333 0.1768 0.002 279.07 0.65 7.7e-03  *MS2 0.083333 0.1768 0.000 344.41 2.23 6.6e-02  *MS3 0.1220640 0.0039 0.000 83.99 40.003 60	tide	freq	amp	amp_err	pha	pha_err	snr
MSM         0.0015122         0.0028         0.006         12.58         68.61         0.7           MM         0.0015122         0.0028         0.006         75.51         118.45         0.23           MSF         0.0028219         0.0038         0.006         8.18         87.95         0.42           *MF         0.0030501         0.0106         0.000         169.52         34.67         2.6           201         0.0357064         0.0004         0.000         254.38         59.10         0.88           *SIGI         0.0357087         0.0012         0.000         254.38         59.10         0.88           *Q1         0.0372185         0.0019         0.000         86.57         11.71         23           *TAUI         0.0387307         0.0164         0.000         109.81         1.37         1.7e+03           *TAUI         0.0389588         0.0010         0.000         165.2         138.49         0.16           RETI         0.0402686         0.0013         0.000         179.14         12.27         11           CHII         0.040710         0.0001         0.000         129.81         1.37         1.7e+03           *P1	*SA	0.0001141	0.1045	0.006	221.40	3.17	3.3e+02
MSM         0.0015122         0.0028         0.006         12.58         68.61         0.7           MM         0.0015122         0.0028         0.006         75.51         118.45         0.23           MSF         0.0028219         0.0038         0.006         8.18         87.95         0.42           *MF         0.0030501         0.0106         0.000         169.52         34.67         2.6           201         0.0357064         0.0004         0.000         254.38         59.10         0.88           *SIGI         0.0357087         0.0012         0.000         254.38         59.10         0.88           *Q1         0.0372185         0.0019         0.000         86.57         11.71         23           *TAUI         0.0387307         0.0164         0.000         109.81         1.37         1.7e+03           *TAUI         0.0389588         0.0010         0.000         165.2         138.49         0.16           RETI         0.0402686         0.0013         0.000         179.14         12.27         11           CHII         0.040710         0.0001         0.000         129.81         1.37         1.7e+03           *P1	*SSA	0.0002282	0.0075	0.006	337.69	44.11	1.7
MSF         0.0028219         0.0038         0.006         214.32         31.33         3.3           *ALPI         0.0343966         0.0006         0.000         169.52         34.67         2.6           2Q1         0.0343966         0.0004         0.000         254.38         59.10         0.88           *SIGI         0.0359087         0.0012         0.000         172.62         18.80         8.9           *Q1         0.0372185         0.0019         0.000         172.62         18.80         8.9           *Q1         0.0372185         0.0019         0.000         172.62         18.80         8.9           *Q1         0.0372185         0.0010         0.000         172.61         78.83         0.55           *Q1         0.0387307         0.0164         0.000         109.81         1.37         1.7e+03           *TAU1         0.0402686         0.0013         0.000         149.91         1.37         1.7e+03           *BET1         0.0404710         0.0001         0.000         179.14         12.27         11           CH1         0.0414385         0.0009         0.000         20.14         24.59         5.4           *P11 <td></td> <td>0.0013098</td> <td>0.0048</td> <td></td> <td>12.58</td> <td>68.61</td> <td>0.7</td>		0.0013098	0.0048		12.58	68.61	0.7
*MFF 0.0030501 0.0106 0.006 214.32 31.33 3.3   *ALPI 0.0343966 0.0006 0.000 169.52 34.67 2.6   2Q1 0.0357064 0.0004 0.000 254.38 59.10 0.88   *SIG1 0.0359087 0.0012 0.000 172.62 18.80 8.9   *Q1 0.0372185 0.0019 0.000 86.57 11.71 23   RH01 0.0372185 0.0019 0.000 86.57 11.71 23   RH01 0.0372185 0.0019 0.000 177.01 78.83 0.55   ****O1 0.0387307 0.0164 0.000 109.81 1.37 1.7e+03   ****TAU1 0.0389588 0.0010 0.000 224.76 22.62 5.8   BET1 0.0400404 0.0002 0.000 16.52 138.49 0.16   **N01 0.0402686 0.0013 0.000 179.14 12.27 11   CH11 0.0404710 0.0001 0.000 32.9 229.22 0.058   **PFI 0.0415526 0.0136 0.000 149.90 1.70 1.1e+03   **S1 0.0416667 0.0066 0.000 240.14 24.59 5.4   **PFI 0.0417807 0.0429 0.000 152.80 0.53 1.1e+04   **PSI1 0.0419898 0.0011 0.000 246.87 20.28 8   **PHTI 0.0420089 0.0016 0.000 246.87 20.28 8   **PHTI 0.0420089 0.0016 0.000 246.87 20.28 8   **PHTI 0.0430905 0.0009 0.000 246.87 20.28 8   **S01 0.0446027 0.0026 0.000 280.38 5.07 2.7e+02   **S01 0.0446027 0.0026 0.000 283.04 8.57 43   **O01 0.0448308 0.0015 0.000 246.87 7.77 52   **S01 0.04663430 0.0004 0.000 255.47 50.94 0.93   002 0.0759749 0.0009 0.000 246.86 7.77 52   **S01 0.0463430 0.0004 0.000 229.95 6.15 87   **N20 0.076895 0.0189 0.002 229.95 6.15 87   **N20 0.076895 0.0189 0.002 229.95 6.15 87   **N20 0.076895 0.0189 0.002 229.95 6.15 87   **N21 0.04803090 0.0041 0.002 241.08 31.13 8 25   **M22 0.080514 0.3787 0.002 231.99 9.53 36   **GAM2 0.080390 0.0041 0.002 241.08 31.13 8 25   **M22 0.0805255 0.0131 0.002 241.08 31.13 8 2.6   **M22 0.0805255 0.0131 0.002 241.08 31.13 8 2.6   **M22 0.0805214 0.3787 0.002 242.70 0.31 3.5e+04   **M22 0.0805214 0.3787 0.002 241.08 31.13 8 2.6   **M22 0.0805214 0.3787 0.002 242.70 0.31 3.5e+04   **M22 0.0805215 0.0131 0.002 241.08 31.13   **M22 0.0805214 0.3787 0.002 242.70 0.31 3.5e+04   **M22 0.0805214 0.0328 0.002 279.07 0.65 7.7e+03   **M22 0.083333 0.1768 0.002 279.07 0.65 7.7e+03   **M22 0.083333 0.1768 0.002 279.07 0.65 7.7e+03   **M30 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02   **M33 0.1207671 0.0110 0.0	MM	0.0015122	0.0028	0.006	75.51	118.45	0.23
*ALP1 0.0343966 0.0006 0.000 169.52 34.67 2.6 201 0.0357064 0.0004 0.000 254.38 59.10 0.88 *XIGI 0.0359087 0.0019 0.000 172.62 18.80 8.9 *Q1 0.0372185 0.0019 0.000 86.57 11.71 23 RHO1 0.0374209 0.0003 0.000 117.01 78.83 0.55 *O1 0.0387307 0.0164 0.000 109.81 1.37 1.7e+03 TATU1 0.0389588 0.0010 0.000 124.76 22.62 5.8 BETI 0.0400404 0.0002 0.000 16.52 138.49 0.16 *NO1 0.0402686 0.0013 0.000 179.14 12.27 11 CHII 0.0404710 0.0001 0.000 3.29 229.22 0.058 *PII 0.0414385 0.0009 0.000 20.14 24.59 5.4 *PII 0.0415526 0.0136 0.000 149.90 1.70 1.le+03 *XII 0.041667 0.0066 0.000 280.38 50.7 2.7e-02 *XII 0.0418948 0.0011 0.000 246.87 20.28 8 *PHII 0.0417807 0.0429 0.000 152.80 0.53 1.le+04 *PSII 0.0418948 0.0011 0.000 246.87 20.28 8 *PHII 0.0430905 0.0009 0.000 143.60 25.44 4.7 *JI 0.0433905 0.0009 0.000 246.87 20.28 8 *PHII 0.0433929 0.0016 0.000 189.94 14.11 15 *THEL 0.0433929 0.0029 0.000 245.66 7.77 52 *SO1 0.0446027 0.0026 0.000 283.04 8.57 43 *O01 0.0448308 0.0015 0.000 245.66 7.77 52 *SO1 0.0446027 0.0026 0.000 283.04 8.57 43 *O01 0.0448308 0.0015 0.000 223.34 8.57 43 *O01 0.0448308 0.0015 0.000 2216.81 12.51 13 *UPSI 0.0463430 0.0004 0.000 255.47 50.94 0.93 0.002 0.0759749 0.0009 0.000 245.66 7.77 52 *EPSZ 0.0761773 0.0049 0.002 233.19 9.53 36 *GMNU2 0.0776895 0.0189 0.002 233.19 9.53 36 *GMNU2 0.0776895 0.0189 0.002 233.19 9.53 36 *GMNU2 0.0776895 0.0189 0.002 233.19 9.53 36 *GMNU2 0.0789992 0.0735 0.002 233.19 9.53 36 *GMNU2 0.0789992 0.0735 0.002 233.19 9.53 36 *GMNU2 0.0803973 0.0131 0.002 241.08 31.91 4.2 *MSZ 0.080514 0.3787 0.002 242.70 0.31 3.5e+04 *MZ 0.080514 0.3787 0.002 241.08 31.91 4.2 *MSZ 0.080514 0.3787 0.002 241.08 31.91 4.2 *MSZ 0.080514 0.3787 0.002 241.08 31.91 5.7 *O04 *MZ 0.0803973 0.0131 0.002 241.08 31.91 5.7 *O04 *MZ 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 *MZ 0.083333 0.1768 0.002 241.08 31.91 5.7 *O04 *MZ 0.083515 0.0076 0.002 241.08 66.77 5.5e+02 *MSZ 0.083333 0.1768 0.002 241.08 66.77 5.5e+02 *MSZ 0.083545 0.0017 0.000 344.41 2.23 6.6e+02 *MSZ 0.085515 0.0017 0.000 344.41 2.23 6.6e+02 *	MSF	0.0028219		0.006		87.95	0.42
*ALP1 0.0343966 0.0006 0.000 169.52 34.67 2.6 201 0.0357064 0.0004 0.000 254.38 59.10 0.88 *XIGI 0.0359087 0.0019 0.000 172.62 18.80 8.9 *Q1 0.0372185 0.0019 0.000 86.57 11.71 23 RHO1 0.0374209 0.0003 0.000 117.01 78.83 0.55 *O1 0.0387307 0.0164 0.000 109.81 1.37 1.7e+03 TATU1 0.0389588 0.0010 0.000 124.76 22.62 5.8 BETI 0.0400404 0.0002 0.000 16.52 138.49 0.16 *NO1 0.0402686 0.0013 0.000 179.14 12.27 11 CHII 0.0404710 0.0001 0.000 3.29 229.22 0.058 *PII 0.0414385 0.0009 0.000 20.14 24.59 5.4 *PII 0.0415526 0.0136 0.000 149.90 1.70 1.le+03 *XII 0.041667 0.0066 0.000 280.38 50.7 2.7e-02 *XII 0.0418948 0.0011 0.000 246.87 20.28 8 *PHII 0.0417807 0.0429 0.000 152.80 0.53 1.le+04 *PSII 0.0418948 0.0011 0.000 246.87 20.28 8 *PHII 0.0430905 0.0009 0.000 143.60 25.44 4.7 *JI 0.0433905 0.0009 0.000 246.87 20.28 8 *PHII 0.0433929 0.0016 0.000 189.94 14.11 15 *THEL 0.0433929 0.0029 0.000 245.66 7.77 52 *SO1 0.0446027 0.0026 0.000 283.04 8.57 43 *O01 0.0448308 0.0015 0.000 245.66 7.77 52 *SO1 0.0446027 0.0026 0.000 283.04 8.57 43 *O01 0.0448308 0.0015 0.000 223.34 8.57 43 *O01 0.0448308 0.0015 0.000 2216.81 12.51 13 *UPSI 0.0463430 0.0004 0.000 255.47 50.94 0.93 0.002 0.0759749 0.0009 0.000 245.66 7.77 52 *EPSZ 0.0761773 0.0049 0.002 233.19 9.53 36 *GMNU2 0.0776895 0.0189 0.002 233.19 9.53 36 *GMNU2 0.0776895 0.0189 0.002 233.19 9.53 36 *GMNU2 0.0776895 0.0189 0.002 233.19 9.53 36 *GMNU2 0.0789992 0.0735 0.002 233.19 9.53 36 *GMNU2 0.0789992 0.0735 0.002 233.19 9.53 36 *GMNU2 0.0803973 0.0131 0.002 241.08 31.91 4.2 *MSZ 0.080514 0.3787 0.002 242.70 0.31 3.5e+04 *MZ 0.080514 0.3787 0.002 241.08 31.91 4.2 *MSZ 0.080514 0.3787 0.002 241.08 31.91 4.2 *MSZ 0.080514 0.3787 0.002 241.08 31.91 5.7 *O04 *MZ 0.0803973 0.0131 0.002 241.08 31.91 5.7 *O04 *MZ 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 *MZ 0.083333 0.1768 0.002 241.08 31.91 5.7 *O04 *MZ 0.083515 0.0076 0.002 241.08 66.77 5.5e+02 *MSZ 0.083333 0.1768 0.002 241.08 66.77 5.5e+02 *MSZ 0.083545 0.0017 0.000 344.41 2.23 6.6e+02 *MSZ 0.085515 0.0017 0.000 344.41 2.23 6.6e+02 *	*MF	0.0030501	0.0106	0.006	214.32	31.33	3.3
2Q1	*ALP1	0.0343966	0.0006	0.000		34.67	
*SIGI 0.0359087	201	0.0357064	0.0004	0.000	254.38	59.10	0.88
*Q1 0.0372185 0.0019 0.000 86.57 11.71 23 RHOI 0.0374209 0.0003 0.000 117.01 78.83 0.55 ** **\text{*01} 0.0387307 0.0164 0.000 109.81 1.37 1.7e+03 ** *\text{*TAUI} 0.0389588 0.0010 0.000 224.76 22.62 5.8 ** BETI 0.0400404 0.0002 0.000 16.52 138.49 0.16 ** *\text{*NOI} 0.0402686 0.0013 0.000 179.14 12.27 11 CHII 0.0404710 0.0001 0.000 3.29 229.22 0.058 ** *\text{*PII} 0.0414385 0.0009 0.000 200.14 24.59 5.4 ** *\text{*PI} 0.0415526 0.0136 0.000 149.90 1.70 1.1e+03 ** *\text{*SI} 0.0416667 0.0066 0.000 280.38 5.07 2.7e+02 ** *\text{*K1} 0.0415807 0.0429 0.000 152.80 0.53 1.1e+04 ** *\text{*PSII} 0.0418948 0.0011 0.000 246.87 20.28 8 ** *\text{*PHII} 0.042089 0.0016 0.000 189.94 14.11 15 ** *\text{*THEI} 0.0430905 0.0009 0.000 244.56 7.77 52 ** *\text{*SOI} 0.0446027 0.0026 0.000 283.04 8.57 43 ** *\text{*OOI} 0.0448308 0.0015 0.000 224.56 7.77 52 ** *\text{*SOI} 0.0448308 0.0015 0.000 225.47 50.94 0.93 0.02 0.00446027 0.0026 0.000 225.47 50.94 0.93 0.02 0.00448308 0.0015 0.000 225.47 50.94 0.93 0.02 0.0759749 0.0009 0.002 2176.64 125.64 0.2 ** *\text{*EPSI2} 0.0761773 0.0049 0.002 229.95 6.15 87 ** *\text{*NU2} 0.0778871 0.0101 0.002 233.05 23.77 5.8 ** *\text{*MU2} 0.0778875 0.0189 0.002 229.95 6.15 87 ** *\text{*MU2} 0.0778895 0.0189 0.002 233.19 9.53 36 ** *\text{*MU2} 0.0778895 0.0189 0.002 241.08 31.13 4.2 ** *\text{*MM2} 0.0803973 0.0131 0.002 241.08 31.91 4.2 ** *\text{*MM2} 0.0803973 0.0131 0.002 241.08 31.91 4.2 ** *\text{*MM2} 0.0803973 0.0131 0.002 242.70 0.31 3.5e+04 ** *\text{*MM2} 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04 ** *\text{*MM2} 0.080525 0.0131 0.002 248.70 0.31 3.5e+04 ** *\text{*MM2} 0.08053193 0.0176 0.002 248.70 10.50 7.7e+03 ** *\text{*MS2} 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 ** *\text{*MS2} 0.0834474 0.0089 0.002 244.70 0.05 2.37 5.5e+02 0.833333 0.1768 0.002 279.07 0.65 7.7e+03 ** *\text{*MS2} 0.0834474 0.0089 0.002 244.70 0.05 2.37 5.5e+02 0.83333 0.1768 0.002 279.26 2.37 5.5e+02 0.83333 0.120640 0.0033 0.002 388.35 32.68 2.7 ** *\text{*MS3} 0.1220640 0.0033 0.002 388.35 32.6	*SIG1	0.0359087	0.0012		172.62		
**O1 0.0387307 0.0164 0.000 109.81 1.37 1.7e+03 **TAUI 0.0389588 0.0010 0.000 224.76 22.62 5.8 BET1 0.0400404 0.0002 0.000 16.52 138.49 0.16 **NO1 0.0402686 0.0013 0.000 179.14 12.27 11 CHII 0.0404710 0.0001 0.000 3.29 229.22 0.058 **PII 0.0414385 0.0009 0.000 200.14 24.59 5.4 **PI 0.0415526 0.0136 0.000 149.90 1.70 1.1e+03 **S1 0.0416667 0.0066 0.000 280.38 5.07 2.7e+02 **K1 0.0417807 0.0429 0.000 152.80 0.53 1.1e+04 **PSII 0.0418948 0.0011 0.000 246.87 20.28 8 **PHII 0.042089 0.0016 0.000 189.94 14.11 1.5 **THEI 0.0430905 0.0009 0.000 143.60 25.44 4.7 **J1 0.0430929 0.0009 0.000 246.56 7.77 52 **S01 0.0446027 0.0026 0.000 283.04 8.57 43 **O01 0.0448308 0.0015 0.000 224.56 7.77 52 **S01 0.0446037 0.0026 0.000 225.47 50.94 0.93 **OQ2 0.0759749 0.0009 0.002 2176.64 125.64 0.2 **EPS2 0.0761773 0.0049 0.002 255.47 50.94 0.93 **OQ2 0.0759749 0.0009 0.002 216.83 11.38 25 **MU2 0.0776875 0.0189 0.002 229.95 6.15 87 **N2 0.0778871 0.0101 0.002 216.83 11.38 25 **MU2 0.0776895 0.0189 0.002 229.95 6.15 87 **N2 0.0778992 0.0735 0.002 233.19 1.57 1.3e+03 **N2 0.080514 0.0121 0.002 233.19 1.57 1.3e+03 **MA2 0.080514 0.3787 0.002 241.08 31.91 4.2 **MKS 0.080515 0.0131 0.002 241.08 31.91 4.2 **MKS 0.080515 0.0131 0.002 227.15 12.30 40 **T2 0.0806255 0.0131 0.002 227.15 12.30 40 **T2 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 **R2 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 **R2 0.083319 0.0176 0.002 288.05 6.57 76 **S2 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 **R2 0.0848455 0.0017 0.002 241.46 66.17 0.75 **ETA2 0.0850736 0.0033 0.002 288.05 6.57 76 **S2 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 **R2 0.0848455 0.0017 0.002 241.46 66.17 0.75 **ETA2 0.0850736 0.0033 0.002 288.05 6.57 76 **S3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 **M33 0.11220640 0.0039 0.000 344.41 2.23 6.6e+02 **M33 0.11220640 0.0039 0.000 344.41 2.23 6.6e+02 **M33 0.1220640 0.0039 0.000 344.41 2.23 6.6e+02 **M33 0.1220640 0.0039 0.000 344.41 2.23 6.6e+02 **M33 0.1220640 0.0039 0.000 344.41 2.23 6.6e+02	*Q1	0.0372185		0.000	86.57	11.71	23
**O1 0.0387307 0.0164 0.000 109.81 1.37 1.7e+03 **TAUI 0.0389588 0.0010 0.000 224.76 22.62 5.8 BET1 0.0400404 0.0002 0.000 16.52 138.49 0.16 **NO1 0.0402686 0.0013 0.000 179.14 12.27 11 CHII 0.0404710 0.0001 0.000 3.29 229.22 0.058 **PII 0.0414385 0.0009 0.000 200.14 24.59 5.4 **PI 0.0415526 0.0136 0.000 149.90 1.70 1.1e+03 **S1 0.0416667 0.0066 0.000 280.38 5.07 2.7e+02 **K1 0.0417807 0.0429 0.000 152.80 0.53 1.1e+04 **PSII 0.0418948 0.0011 0.000 246.87 20.28 8 **PHII 0.042089 0.0016 0.000 189.94 14.11 1.5 **THEI 0.0430905 0.0009 0.000 143.60 25.44 4.7 **J1 0.0430929 0.0009 0.000 246.56 7.77 52 **S01 0.0446027 0.0026 0.000 283.04 8.57 43 **O01 0.0448308 0.0015 0.000 224.56 7.77 52 **S01 0.0446037 0.0026 0.000 225.47 50.94 0.93 **OQ2 0.0759749 0.0009 0.002 2176.64 125.64 0.2 **EPS2 0.0761773 0.0049 0.002 255.47 50.94 0.93 **OQ2 0.0759749 0.0009 0.002 216.83 11.38 25 **MU2 0.0776875 0.0189 0.002 229.95 6.15 87 **N2 0.0778871 0.0101 0.002 216.83 11.38 25 **MU2 0.0776895 0.0189 0.002 229.95 6.15 87 **N2 0.0778992 0.0735 0.002 233.19 1.57 1.3e+03 **N2 0.080514 0.0121 0.002 233.19 1.57 1.3e+03 **MA2 0.080514 0.3787 0.002 241.08 31.91 4.2 **MKS 0.080515 0.0131 0.002 241.08 31.91 4.2 **MKS 0.080515 0.0131 0.002 227.15 12.30 40 **T2 0.0806255 0.0131 0.002 227.15 12.30 40 **T2 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 **R2 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 **R2 0.083319 0.0176 0.002 288.05 6.57 76 **S2 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 **R2 0.0848455 0.0017 0.002 241.46 66.17 0.75 **ETA2 0.0850736 0.0033 0.002 288.05 6.57 76 **S2 0.083333 0.1768 0.002 279.07 0.65 7.7e+03 **R2 0.0848455 0.0017 0.002 241.46 66.17 0.75 **ETA2 0.0850736 0.0033 0.002 288.05 6.57 76 **S3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 **M33 0.11220640 0.0039 0.000 344.41 2.23 6.6e+02 **M33 0.11220640 0.0039 0.000 344.41 2.23 6.6e+02 **M33 0.1220640 0.0039 0.000 344.41 2.23 6.6e+02 **M33 0.1220640 0.0039 0.000 344.41 2.23 6.6e+02 **M33 0.1220640 0.0039 0.000 344.41 2.23 6.6e+02	RHO1	0.0374209	0.0003	0.000	117.01	78.83	0.55
BET1   0.0400404   0.0002   0.000   16.52   138.49   0.16	*01	0.0387307	0.0164			1.37	1.7e+03
BET1   0.0400404   0.0002   0.000   16.52   138.49   0.16	*TAU1						
*NO1 0.0402686 0.0013 0.000 179.14 12.27 11 CHII 0.0404710 0.0001 0.000 3.29 229.22 0.058 *PII 0.0414385 0.0009 0.000 200.14 24.59 5.4 *PI 0.0415526 0.0136 0.000 149.90 1.70 1.1e+03 *S1 0.0416667 0.0066 0.000 280.38 5.07 2.7e+02 *KI 0.0417807 0.0429 0.000 152.80 0.53 1.1e+04 *PSI 0.0418948 0.0011 0.000 246.87 20.28 8 *PHII 0.0420089 0.0016 0.000 189.94 14.11 15 *THEI 0.0430905 0.0009 0.000 143.60 25.44 4.7 *JI 0.0432929 0.0029 0.000 204.56 7.77 52 *S01 0.0448027 0.0026 0.000 283.04 8.57 43 *OO1 0.0448308 0.0015 0.000 210.81 12.51 133 UPSI 0.0463430 0.0004 0.000 255.47 50.94 0.93 OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2 *EPS2 0.0761773 0.0049 0.002 203.05 23.77 5.8 *2N2 0.0774871 0.0101 0.002 216.83 11.38 25 *NNU2 0.0776895 0.0189 0.002 233.19 1.57 1.3e+03 *NU2 0.0792016 0.0121 0.002 233.19 1.57 1.3e+03 *NU2 0.0792016 0.0121 0.002 231.99 9.53 36 *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2 *HI 0.0803973 0.0131 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 242.70 0.31 3.5e+04 *MXS 0.0803133 0.0176 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 279.07 0.65 7.7e+03 *R2 0.0832193 0.0176 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 279.07 0.65 7.7e+03 *R2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03 *R2 0.0834845 0.0017 0.002 241.14 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 279.07 0.65 7.7e+03 *R2 0.085615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0850736 0.0033 0.002 308.35 32.68 2.7 *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *MSN3 0.1202640 0.0039 0.000 344.41 2.23 6.6e+02 *M3 0.1202640 0.0039 0.000 344.41 2.23 6.6e+02			0.0002				
CHI1         0.0404710         0.0001         0.000         3.29         229.22         0.058           *PI1         0.0414385         0.0009         0.000         200.14         24.59         5.4           *P1         0.0416667         0.0066         0.000         280.38         1.70         1.1e+03           *S1         0.0416667         0.0066         0.000         280.38         5.07         2.7e+02           *KI         0.0418948         0.0011         0.000         246.87         20.28         8           *PHI1         0.0420089         0.0016         0.000         143.60         25.44         4.7           *JI         0.0430905         0.0009         0.000         246.56         7.77         52           *S01         0.0446027         0.0026         0.000         283.04         8.57         43           *O01         0.0448308         0.0015         0.000         210.81         12.51         13           UPS1         0.0463430         0.0004         0.000         255.47         50.94         0.93           *EPS2         0.076173         0.0049         0.002         203.05         23.77         5.8           *Mu2							
*PII 0.0414385 0.0009 0.000 200.14 24.59 5.4 *PII 0.0415526 0.0136 0.000 149.90 1.70 1.1e+03 *SI 0.0416667 0.0066 0.000 280.38 5.07 2.7e+02 *KI 0.0417807 0.0429 0.000 152.80 0.53 1.1e+04 *PSII 0.0418948 0.0011 0.000 246.87 20.28 *PHII 0.0420089 0.0016 0.000 189.94 14.11 15 *THEI 0.0430905 0.0009 0.000 143.60 25.44 4.7 *JI 0.0432929 0.0029 0.000 244.56 7.77 52 *SOI 0.0446027 0.0026 0.000 283.04 8.57 43 *OOI 0.0448308 0.0015 0.000 210.81 12.51 13 UPSI 0.0433430 0.0004 0.000 255.47 50.94 0.93 *QQ 0.0759749 0.0009 0.002 176.64 125.64 0.2 *EPS2 0.0761773 0.0049 0.002 203.05 23.77 5.8 *2N2 0.0774871 0.0101 0.002 216.83 11.38 25 *MU2 0.0776895 0.0189 0.002 229.95 6.15 87 *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+04 *HI 0.0803973 0.0131 0.002 231.99 9.53 36 *GAM2 0.0803090 0.0041 0.002 231.99 9.53 36 *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2 *HI 0.0803973 0.0131 0.002 95.05 8.67 42 *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6 *LDA2 0.083333 0.1768 0.002 289.42 34.78 2.6 *LDA2 0.083313 0.1768 0.002 279.07 0.65 7.7e+03 *R2 0.0833133 0.1768 0.002 279.07 0.65 7.7e+03 *R2 0.0834474 0.0089 0.002 241.14 66.17 0.75 *ETA2 0.083615 0.0476 0.002 241.14 66.17 0.75 *ETA2 0.0836736 0.0033 0.002 242.70 0.31 3.5e+04 *MS2 0.0848455 0.0017 0.002 241.14 66.17 0.75 *ETA2 0.0836736 0.0033 0.002 279.07 0.65 7.7e+03 *MS2 0.0848455 0.0017 0.002 241.14 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 241.14 66.17 0.75 *ETA3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *MSN3 0.120640 0.0039 0.000 83.19 6.23 81 *MK3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *MSN3 0.1220921 0.0047 0.000 100.36 5.18 1.2e+02	CHI1						0.058
*P1 0.0415526 0.0136 0.000 149.90 1.70 1.1e+03 *S1 0.0416667 0.0066 0.000 280.38 5.07 2.7e+02 *KI 0.0417807 0.0429 0.000 152.80 0.53 1.1e+04 *PSII 0.0418948 0.0011 0.000 246.87 20.28 8 *PHII 0.0420089 0.0016 0.000 189.94 14.11 15 *THE1 0.0430905 0.0009 0.000 143.60 25.44 4.7 *JI 0.0432929 0.0029 0.000 204.56 7.77 52 *S01 0.0446027 0.0026 0.000 283.04 8.57 43 *O01 0.0448308 0.0015 0.000 210.81 12.51 13 UPSI 0.0463430 0.0004 0.000 255.47 50.94 0.93 OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2 *EPS2 0.0761773 0.0049 0.002 276.83 11.38 25 *MU2 0.0774871 0.0101 0.002 216.83 11.38 25 *MU2 0.0776895 0.0189 0.002 229.95 6.15 87 *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03 *N2 0.0792016 0.0121 0.002 231.99 9.53 3646 *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2 *HI 0.0803973 0.0131 0.002 241.08 31.91 4.2 *HI 0.0803973 0.0131 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 242.70 0.31 3.5e+04 *H2 0.080455 0.0131 0.002 249.94 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6 *LDA2 0.0833193 0.0176 0.002 289.42 34.78 2.6 *LDA2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 *MSN2 0.0848455 0.0017 0.002 241.4 66.17 0.75 *ETA2 0.0836736 0.0033 0.002 388.35 32.68 2.7 *MSN3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *MSN3 0.120640 0.0039 0.000 83.19 6.23 81 *MS 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *MSN3 0.1202640 0.0039 0.000 83.19 6.23 81 *MS3 0.120640 0.0039 0.000 83.19 6.23 81							
*S1 0.0416667 0.0066 0.000 280.38 5.07 2.7e+02 *K1 0.0417807 0.0429 0.000 152.80 0.53 1.1e+04 *PSII 0.0418948 0.0011 0.000 246.87 20.28 8 *PHII 0.0420089 0.0016 0.000 189.94 14.11 15 *THEI 0.0430905 0.0009 0.000 143.60 25.44 4.7 *J1 0.0432929 0.0029 0.000 204.56 7.77 52 *S01 0.0446027 0.0026 0.000 283.04 8.57 43 *O01 0.0448308 0.0015 0.000 210.81 12.51 13 UPSI 0.0463430 0.0004 0.000 255.47 50.94 0.93 OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2 *EPS2 0.0761773 0.0049 0.002 203.05 23.77 5.8 *XN2 0.0774871 0.0101 0.002 216.83 11.38 25 *MU2 0.0776895 0.0189 0.002 229.95 6.15 87 *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03 *N12 0.0792016 0.0121 0.002 231.99 9.53 36 *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2 *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04 *M2 0.080512 0.033 0.002 242.70 0.31 3.5e+04 *M2 0.080525 0.0131 0.002 242.70 0.31 3.5e+04 *M2 0.080525 0.0131 0.002 242.70 0.31 3.5e+04 *M2 0.080526 0.0128 0.002 242.70 0.31 3.5e+04 *M2 0.080329 0.0032 0.002 242.70 0.31 3.5e+04 *M2 0.080525 0.0131 0.002 242.70 0.31 3.5e+04 *M3 0.120767 0.002 248.70 10.50 19 *K2 0.0832193 0.0176 0.002 249.70 0.65 7.7e+03 *M3 0.192421 0.0068 0.000 72.27 3.56 2.5e+02 *M30 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M30 0.1220640 0.0039 0.000 83.19 6.23 81 *M33 0.1220640 0.0039 0.000 83.19 6.23 81 *M33 0.1220640 0.0039 0.000 83.19 6.23 81 *M33 0.1220640 0.0039 0.000 83.19 6.23 81							
*K1 0.0417807 0.0429 0.000 152.80 0.53 1.1e+04 *PSI1 0.0418948 0.0011 0.000 246.87 20.28 8 *PHII 0.0420089 0.0016 0.000 189.94 14.11 15 *THEI 0.0430905 0.0009 0.000 143.60 25.44 4.7 *J1 0.0432929 0.0029 0.000 204.56 7.77 52 *SO1 0.0446027 0.0026 0.000 283.04 8.57 43 *OO1 0.0448308 0.0015 0.000 210.81 12.51 13 UPSI 0.0463430 0.0004 0.000 255.47 50.94 0.93 OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2 *EPSZ 0.0761773 0.0049 0.002 203.05 23.77 5.8 *MU2 0.0776895 0.0189 0.002 223.05 23.77 5.8 *NU2 0.0776895 0.0189 0.002 229.95 6.15 87 *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03 *NU2 0.0792016 0.0121 0.002 231.99 9.53 36 *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2 *H1 0.0803973 0.0131 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 227.15 12.30 40 *MX2 0.0807396 0.0032 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 227.15 12.30 40 *TZ 0.0832193 0.0176 0.002 248.07 42.04 1.9 *K2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03 *S2 0.0833133 0.1768 0.002 279.07 0.65 7.7e+03 *S2 0.0835615 0.0476 0.002 241.4 66.17 0.75 *ETA2 0.0848455 0.0017 0.002 241.4 66.17 0.75 *ETA2 0.0848455 0.0017 0.002 241.4 66.17 0.75 *ETA2 0.0848455 0.0017 0.002 241.4 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 242.70 3.56 2.5e+02 *MSN2 0.0848455 0.0017 0.002 241.4 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 383.5 32.68 2.7 *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *MSN2 0.192421 0.0068 0.000 72.27 3.56 2.5e+02 *MSN3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1220640 0.0039 0.000 5000 5000 5000 5000 5000 5000 50	*S1						
*PSI1 0.0418948 0.0011 0.000 246.87 20.28 8 *PHI1 0.0420089 0.0016 0.000 189.94 14.11 15 *THE1 0.0430905 0.0009 0.000 143.60 25.44 4.7 *J1 0.0432929 0.0029 0.000 204.56 7.77 52 *SO1 0.0446027 0.0026 0.000 210.81 12.51 13 UPS1 0.0463430 0.0015 0.000 210.81 12.51 13 UPS1 0.0463430 0.0004 0.000 255.47 50.94 0.93 OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2 *EPS2 0.0761773 0.0049 0.002 233.05 23.77 5.8 *2N2 0.0774871 0.0101 0.002 216.83 11.38 25 *MU2 0.0776895 0.0189 0.002 229.95 6.15 87 *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03 *SN12 0.0792016 0.0121 0.002 231.99 9.53 36 *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2 *H1 0.0803973 0.0131 0.002 242.70 0.31 3.5e+04 *H2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9 *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6 *LDA2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03 *R2 0.08334474 0.0089 0.002 248.70 10.50 19 *K2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 248.70 10.50 19 *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 241.4 66.17 0.75 *ETA2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.083573 0.0170 0.002 241.4 66.17 0.75 *ETA2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 248.70 10.50 19 *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 248.70 10.50 19 *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 38.35 32.68 2.7 *M3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1220640 0.0039 0.000 83.19 6.23 81							
*PHII 0.0420089 0.0016 0.000 189.94 14.11 15  *THE1 0.0430905 0.0009 0.000 143.60 25.44 4.7  *J1 0.0432929 0.0029 0.000 204.56 7.77 52  *SO1 0.0446027 0.0026 0.000 283.04 8.57 43  *OO1 0.0448308 0.0015 0.000 210.81 12.51 13  UPS1 0.0463430 0.0004 0.000 255.47 50.94 0.93  OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2  *EPS2 0.0761773 0.0049 0.002 203.05 23.77 5.8  *2N2 0.0774871 0.0101 0.002 216.83 11.38 25  *MU2 0.0776895 0.0189 0.002 229.95 66.15 87  *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03  *NU2 0.0792016 0.0121 0.002 231.99 9.53 36  *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2  *H1 0.0803973 0.0131 0.002 241.08 31.91 4.2  *H2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6  *LDA2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.07 0.65 7.7e+03  *R2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  *MSN2 0.0848455 0.0017 0.002 248.70 10.50 19  *KETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*THE1 0.0430905 0.0009 0.000 143.60 25.44 4.7  *J1 0.0432929 0.0029 0.000 204.56 7.77 52  *SO1 0.0446027 0.0026 0.000 283.04 8.57 43  *OO1 0.0448308 0.0015 0.000 210.81 12.51 13  UPS1 0.0463430 0.0004 0.000 255.47 50.94 0.93  OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2  *EPS2 0.0761773 0.0049 0.002 203.05 23.77 5.8  *2N2 0.0774871 0.0101 0.002 216.83 11.38 25  *MU2 0.0776895 0.0189 0.002 229.95 6.15 87  *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03  *NU2 0.0792016 0.0121 0.002 231.99 9.53 36  *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2  *H1 0.0803973 0.0131 0.002 95.05 8.67 42  *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 242.70 0.31 3.5e+04  *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9  *L2 0.082036 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6  *LDA2 0.0833333 0.1768 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 241.14 66.17 0.75  *ETA2 0.0836776 0.0033 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 241.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 241.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 241.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 241.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 344.41 2.23 6.6e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1220640 0.0039 0.000 83.19 6.23 81							
*J1 0.0432929 0.0029 0.000 204.56 7.77 52  *SO1 0.0446027 0.0026 0.000 283.04 8.57 43  *OO1 0.0448308 0.0015 0.000 210.81 12.51 13  UPS1 0.0463430 0.0004 0.000 255.47 50.94 0.93  OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2  *EPS2 0.0761773 0.0049 0.002 203.05 23.77 5.8  *2N2 0.0774871 0.0101 0.002 216.83 11.38 25  *MU2 0.0776895 0.0189 0.002 229.95 6.15 87  *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03  *NU2 0.0792016 0.0121 0.002 231.99 9.53 36  *GAM2 0.0803090 0.0041 0.002 231.99 9.53 36  *GAM2 0.0803993 0.0131 0.002 241.08 31.91 4.2  *H1 0.0803973 0.0131 0.002 241.08 31.91 4.2  *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 95.05 8.67 42  *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9  *L2 0.082036 0.0128 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 241.44 66.17 0.75  *ETA2 0.0848455 0.0017 0.002 241.4 66.17 0.75  *ETA2 0.0848455 0.0017 0.002 241.4 66.17 0.75  *ETA2 0.0848455 0.0017 0.002 241.4 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *MM3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *M3 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1220921 0.0047 0.000 100.36 5.18 1.2e+02							
*SO1 0.0446027 0.0026 0.000 283.04 8.57 43 *OO1 0.0448308 0.0015 0.000 210.81 12.51 13 UPS1 0.0463430 0.0004 0.000 255.47 50.94 0.93 OQ2 0.0759749 0.0009 0.002 176.64 125.64 0.2 *EPS2 0.0761773 0.0049 0.002 203.05 23.77 5.8 *2N2 0.0774871 0.0101 0.002 216.83 11.38 25 *MU2 0.0776895 0.0189 0.002 229.95 6.15 87 *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03 *NU2 0.0792016 0.0121 0.002 231.99 9.53 36 *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2 *H1 0.0803973 0.0131 0.002 241.08 31.91 4.2 *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 242.70 0.31 3.5e+04 *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 279.07 42.04 1.9 *L2 0.0820236 0.0128 0.002 279.07 42.04 1.9 *L2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03 *R2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.0834474 0.0089 0.002 279.07 0.65 7.7e+03 *R2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.08348455 0.0017 0.002 24.14 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 279.26 2.37 5.5e+02 *M3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *SO3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1220640 0.0039 0.000 100.36 5.18 1.2e+02							
*OO1       0.0448308       0.0015       0.000       210.81       12.51       13         UPS1       0.0463430       0.0004       0.000       255.47       50.94       0.93         OQ2       0.0759749       0.0009       0.002       176.64       125.64       0.2         *EPS2       0.0761773       0.0049       0.002       203.05       23.77       5.8         *2N2       0.0774871       0.0101       0.002       216.83       11.38       25         *MU2       0.0778995       0.0189       0.002       229.95       6.15       87         *N2       0.0789992       0.0735       0.002       231.99       9.53       36         *GAM2       0.0803090       0.0041       0.002       241.08       31.91       4.2         *H1       0.0803973       0.0131       0.002       242.70       0.31       3.5e+04         *H2       0.0806255       0.0131       0.002       242.70       0.31       3.5e+04         *MKS2       0.0807396       0.0032       0.002       289.42       34.78       2.6         *LDA2       0.0818212       0.0028       0.002       288.05       6.57       76 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>							
UPS1         0.0463430         0.0004         0.000         255.47         50.94         0.93           OQ2         0.0759749         0.0009         0.002         176.64         125.64         0.2           *EPS2         0.0761773         0.0049         0.002         203.05         23.77         5.8           *2N2         0.0774871         0.0101         0.002         216.83         11.38         25           *MU2         0.0776895         0.0189         0.002         229.95         6.15         87           *N2         0.0789992         0.0735         0.002         233.19         1.57         1.3e+03           *NU2         0.0792016         0.0121         0.002         231.99         9.53         36           *GAM2         0.0803090         0.0041         0.002         241.08         31.91         4.2           *H1         0.0803973         0.0131         0.002         95.05         8.67         42           *M2         0.0806255         0.0131         0.002         242.70         0.31         3.5e+04           *LDA2         0.0818212         0.0028         0.002         289.42         34.78         2.6           *LDA2							
OQ2         0.0759749         0.0009         0.002         176.64         125.64         0.2           *EPS2         0.0761773         0.0049         0.002         203.05         23.77         5.8           *2N2         0.0774871         0.0101         0.002         216.83         11.38         25           *MU2         0.0776895         0.0189         0.002         229.95         6.15         87           *N2         0.0789992         0.0735         0.002         233.19         1.57         1.3e+03           *NU2         0.0792016         0.0121         0.002         231.99         9.53         36           *GAM2         0.0803090         0.0041         0.002         241.08         31.91         4.2           *H1         0.0803973         0.0131         0.002         95.05         8.67         42           *M2         0.0806255         0.0131         0.002         242.70         0.31         3.5e+04           *H2         0.0806255         0.0131         0.002         289.42         34.78         2.6           *LDA2         0.0818212         0.0028         0.002         289.42         34.78         2.6           *LDA2							
*EPS2 0.0761773 0.0049 0.002 203.05 23.77 5.8  *2N2 0.0774871 0.0101 0.002 216.83 11.38 25  *MU2 0.0776895 0.0189 0.002 229.95 6.15 87  *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03  *NU2 0.0792016 0.0121 0.002 231.99 9.53 36  *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2  *H1 0.0803973 0.0131 0.002 95.05 8.67 42  *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 0.20 8.82 42  *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6  *LDA2 0.0820236 0.0128 0.002 289.42 34.78 2.6  *LDA2 0.0832193 0.0176 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*2N2 0.0774871 0.0101 0.002 216.83 11.38 25  *MU2 0.0776895 0.0189 0.002 229.95 6.15 87  *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03  *NU2 0.0792016 0.0121 0.002 231.99 9.53 36  *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2  *H1 0.0803973 0.0131 0.002 95.05 8.67 42  *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 0.20 8.82 42  *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 289.42 34.78 2.6  *LDA2 0.0820236 0.0128 0.002 287.15 12.30 40  *T2 0.0832193 0.0176 0.002 227.15 12.30 40  *T2 0.0833133 0.1768 0.002 227.15 12.30 40  *T2 0.08334474 0.0089 0.002 288.05 6.57 76  *S2 0.08334474 0.0089 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 279.07 0.65 7.7e+03  *R2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 241.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02	~						
*MU2 0.0776895 0.0189 0.002 229.95 6.15 87  *N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03  *NU2 0.0792016 0.0121 0.002 231.99 9.53 36  *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2  *H1 0.0803973 0.0131 0.002 95.05 8.67 42  *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 0.20 8.82 42  *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9  *L2 0.0820236 0.0128 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 2288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 241.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*N2 0.0789992 0.0735 0.002 233.19 1.57 1.3e+03  *NU2 0.0792016 0.0121 0.002 231.99 9.53 36  *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2  *H1 0.0803973 0.0131 0.002 95.05 8.67 42  *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 0.20 8.82 42  *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9  *L2 0.0820236 0.0128 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 2288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*NU2 0.0792016 0.0121 0.002 231.99 9.53 36 *GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2 *H1 0.0803973 0.0131 0.002 95.05 8.67 42 *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 0.20 8.82 42 *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9 *L2 0.0820236 0.0128 0.002 227.15 12.30 40 *T2 0.0832193 0.0176 0.002 288.05 6.57 76 *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03 *R2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 248.70 10.50 19 *KETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7 *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *S03 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*GAM2 0.0803090 0.0041 0.002 241.08 31.91 4.2  *H1 0.0803973 0.0131 0.002 95.05 8.67 42  *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 0.20 8.82 42  *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9  *L2 0.0820236 0.0128 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*H1 0.0803973 0.0131 0.002 95.05 8.67 42  *M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04  *H2 0.0806255 0.0131 0.002 0.20 8.82 42  *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9  *L2 0.0820236 0.0128 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*M2 0.0805114 0.3787 0.002 242.70 0.31 3.5e+04 *H2 0.0806255 0.0131 0.002 0.20 8.82 42 *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9 *L2 0.0820236 0.0128 0.002 227.15 12.30 40 *T2 0.0832193 0.0176 0.002 288.05 6.57 76 *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03 *R2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7 *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *S03 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*H2 0.0806255 0.0131 0.002 0.20 8.82 42  *MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6  *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9  *L2 0.0820236 0.0128 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*MKS2 0.0807396 0.0032 0.002 289.42 34.78 2.6 *LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9 *L2 0.0820236 0.0128 0.002 227.15 12.30 40 *T2 0.0832193 0.0176 0.002 288.05 6.57 76 *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03 *R2 0.0834474 0.0089 0.002 248.70 10.50 19 *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7 *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *S03 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*LDA2 0.0818212 0.0028 0.002 185.07 42.04 1.9  *L2 0.0820236 0.0128 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*L2 0.0820236 0.0128 0.002 227.15 12.30 40  *T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*T2 0.0832193 0.0176 0.002 288.05 6.57 76  *S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*S2 0.0833333 0.1768 0.002 279.07 0.65 7.7e+03  *R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *S03 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*R2 0.0834474 0.0089 0.002 248.70 10.50 19  *K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02  MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75  *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7  *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02  *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02  *SO3 0.1220640 0.0039 0.000 83.19 6.23 81  *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*K2 0.0835615 0.0476 0.002 279.26 2.37 5.5e+02 MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7 *M03 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *SO3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
MSN2 0.0848455 0.0017 0.002 24.14 66.17 0.75 *ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7 *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *SO3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*ETA2 0.0850736 0.0033 0.002 308.35 32.68 2.7 *MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *SO3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*MO3 0.1192421 0.0068 0.000 72.27 3.56 2.5e+02 *M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *SO3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*M3 0.1207671 0.0110 0.000 344.41 2.23 6.6e+02 *SO3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*SO3 0.1220640 0.0039 0.000 83.19 6.23 81 *MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							
*MK3 0.1222921 0.0047 0.000 100.36 5.18 1.2e+02							

```
*MN4 0.1595106 0.0042 0.001 220.39 8.20
                                           49
*M4 0.1610228 0.0089 0.001 246.97
                                   3.90 2.2e+02
*SN4 0.1623326 0.0011 0.001 221.12 32.35 3.1
*MS4 0.1638447 0.0031 0.001 313.90 11.23
                                            26
*MK4 0.1640729 0.0016 0.001 259.71 20.53
                                           7.4
S4 0.1666667 0.0006 0.001 335.88 57.55 0.99
*SK4 0.1668948 0.0010 0.001 327.50 32.07
*2MK5 0.2028035 0.0002 0.000 230.04 28.48
                                           3.9
*2SK5 0.2084474 0.0003 0.000 110.41 22.02
                                           6.5
*2MN6 0.2400221 0.0010 0.000 348.73
                                   6.91
                                            69
*M6 0.2415342 0.0015 0.000 352.03
                                   4.59 1.6e+02
                                   2.92 3.9e+02
*2MS6 0.2443561 0.0024 0.000
                           41.49
                    0.000
*2MK6 0.2445843 0.0004
                           82.24 17.19
                                           11
                    0.000 117.20
*2SM6 0.2471781 0.0008
                                   8.88
                                             42
                                  12.53
            0.0005
                    0.000
                           214.18
*MSK6 0.2474062
                                            20
*3MK7 0.2833149 0.0005
                    0.000
                           63.56
                                   8.40
                                            45
*M8 0.3220456 0.0004
                    0.000
                           95.91
                                   11.60
                                             25
```

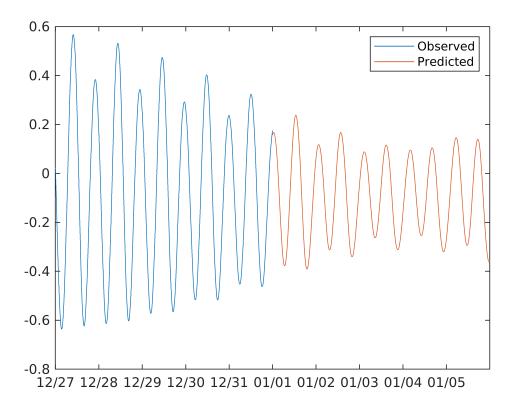
```
% tidestruc.name: name of tidal harmonic constituents
% tidestruc.freq: frequency of tidal harmonic constituents
% tidestruc.tidecon(:,1): amplitude of the harmonic constituents
% tidestruc.tidecon(:,2): amplitude error (95% confident interval)
% tidestruc.tidecon(:,3): phase (degrees) of the harmonic constituents
% tidestruc.tidecon(:,4): phase error (95% confident interval)
figure
plot(t,zeta_qc,'.-')
hold on
plot(t,zeta_tide,'-')
legend('zeta\qc','zeta\_tide')
xlim([734328 734356])
datetick('x','keeplimits')
```



The squared correlation between the original sea level time and tidal component is 0.93, that means tides explain 93% of variance of sea level.

```
R2_tide=nancorr(zeta_qc,zeta_tide)^2
R2_tide = 0.9289
```

Using the analyzed tidal constituents, tidal component can be easily predicted by "t\_predic".



## 3. Inverted barometer component

The inverted barometer component indicate sea level fluctuation component caused by atmospheric pressure. It is well known that 1 cm sea level decrease as 1 hPa atmospheric pressure increase (0.0001 m decrease as 1 Pa), governed by

$$\eta_I = -\frac{P_{atm} - P_0}{\rho_0 g}$$

where  $P_{atm}$  is atmospheric pressure,  $P_0$  is reference pressure,  $\rho_0$  is constant density, and g is gravitational acceleration. The reference pressure usually indicates spatially avaeraged global atmospheric pressure over the entire ocean but ocassionally assumed as constant. This equation is obtained by hydrostatic equation with constant density and continuity equation given by

$$0 = -\frac{1}{\rho_0} \frac{\partial P}{\partial z} - g \quad (1)$$

$$\frac{\partial \eta}{\partial t} + \frac{\partial (hu)}{\partial x} = 0 \quad (2).$$

For simplicity, let's consider one-dimensional ocean (in x) where both west (x = 0) and east boundaries (x = L) are closed. The former equation (1) can be solved for P by the vertical integration:

$$P(\eta) - P(z) = -\rho_0 g(\eta - z)$$

where  $P(\eta) = P_{atm}$  can be used as surface boundary condition and z = 0 can be induced to discuss values at the surface.

$$P_{atm} - P(0) = -\rho_0 g \eta$$
 (3)

The P(0) can be determined by the vertical integrated continuity equation (2). Note that the continuity equation can be rewritten as mass (volume) conservation equation by the closed boundary condition. To be specific, sptial averaging (2) for the domain yields

$$\frac{\partial}{\partial t} \left( \int_0^L \eta \, dx \right) - (hu|_{x=L} - hu|_{x=0}) = 0$$

Apply the closed boundary conditions  $(hu|_{x=L}=0 \text{ and } hu|_{x=0}=0)$  removes second terms of left hand side, that yields spatially integrated (summed) sea level is constant in the time. Applying initial condition  $\eta|_{t=0}=0$  determines the constant is zero, so the equation is given by

$$\int_0^L \eta \, dx = 0$$

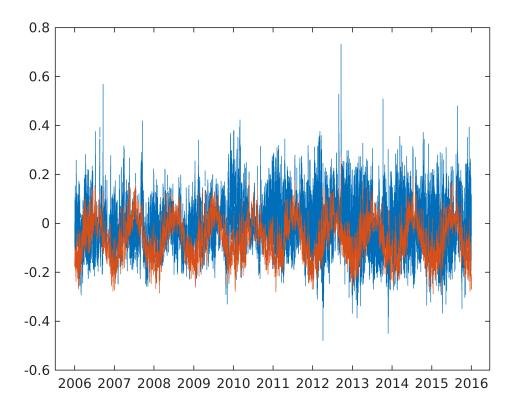
Substituting (3) to the above equation with assuming P(0) is constant in space and the rearranging for P(0) yields

$$P(0) = \frac{1}{L} \int_0^L P_{atm} dx$$

The left hand side indicates spatially averaged atmospheric pressure over entire domain. If observation is located at the closed basin, the reference pressure need to be spatial-averaged over the basin (Le Traon and Gauzelin, 1997). If it is semi-closed, a bit complex approach may be required (Le Traon and Gauzelin, 1997; Inazu et al., 2006; Lee et al., 2022).

"pair\_ref" includes time series for atmospheric pressure from ECMWF ERA5 reanalyiss dataset.

```
load('pair_ref.mat')
% tpair (days): time of atmospheric pressure data
% pair_global (Pa): global averaged atmospheric pressure over entire ocean
% pair (Pa): mean local atmospheric pressure over south coast of the Korea
g=9.8;
rho0=1025;
zeta_ib=-(pair-pair_global)/rho0/g;
zeta_detide=zeta_qc-zeta_tide;
figure
plot(t,zeta_detide)
hold on
plot(tpair,zeta_ib)
datetick('x','keeplimits')
```

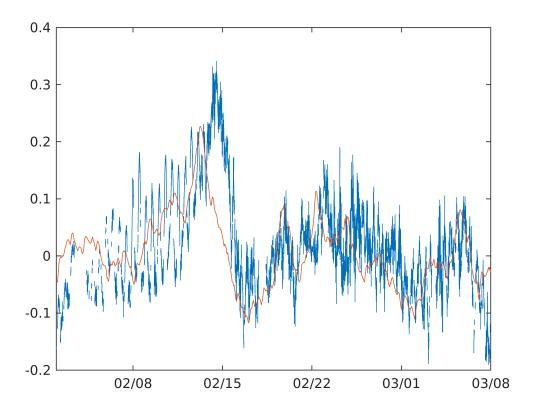


```
zeta_ibi=interp1(tpair,zeta_ib,t);
nancorr(zeta_detide,zeta_ibi)^2
ans = 0.0423
```

Calculated inverted barometer component shows predominant seasonality, that is not clearly shown in the observations where tidal signals are removed. The barometer effect is dominant in the intraseasonal so the seasonality need to be removed (Le Traon and Gauzelin, 1997).

```
% SineP=sineFit(tpair,zeta_ib,0); % get seasonal signal via sine fitting
% zeta_ib_seasonal=SineP(1)+SineP(2)*sin(2*pi*SineP(3)*tpair+SineP(4));
zeta_ib_seasonal=smoothdata(zeta_ib,'gaussian',round(90/nanmean(diff(tpair))));
zeta_ib=zeta_ib-zeta_ib_seasonal;

figure
plot(t,zeta_detide)
hold on
plot(tpair,zeta_ib)
xlim([733806 733840])
datetick('x','keeplimits')
```



```
zeta_ibi=interp1(tpair,zeta_ib,t);
nancorr(zeta_detide,zeta_ibi)^2
```

ans = 0.1152

The squared correlation shows that the inverted barometer components explains about 12% of variation for sea level of which tidal component is removed.

```
zeta_res=zeta_detide-zeta_ibi;
```

The residual component where tidal and inverted barometer components are removed (zeta\_res) includes signals which are interested by many geophysical scales (e.g., response to coastal trapped wave and up/downwelling) but it must be noted that the residual inclues not only other signals from unresolved processes (e.g., high frequnecy waves) but also error signals.

### References

Le Traon, P. Y., & Gauzelin, P. (1997). Response of the Mediterranean mean sea level to atmospheric pressure forcing. *Journal of Geophysical Research: Oceans*, *102*(C1), 973-984.

Inazu, D., Hirose, N., Kizu, S., & Hanawa, K. (2006). Zonally asymmetric response of the Japan Sea to synoptic pressure forcing. *Journal of oceanography*, *62*(6), 909-916.

Lee, K., Nam, S., & Park, J. H. (2022). Alongshore Propagation of Subtidal Sea Level Fluctuations Around the Korean Peninsula Over Varying Stratification and Shelf Topography. *Frontiers in Marine Science*, *8*, 2037.