

We summarize in the following pages the different remarks we have received on the version of FES2014b that was originally delivered on our web site https://grace.obs-mip.fr/dealiasing_and_tides/ocean-tides/ (from Torsten Mayer-Gürr, Martin Lasser, Heike Peter and Kaifa Kuang in particular), and our answers to these questions.

A new delivery of the FES2014b ocean tide model for geodesic applications has been done on the same web site on December 7, 2019, under the name "FES2014b.v1". It takes into account all the remarks listed below.

1) Oceanic margins

Yes, there was a big mistake in the first release of the FES2014b in spherical harmonics: we had taken a version of the FES2014b grids extrapolated over the continents. This error has been corrected on November 12, 2019 and the correct files uploaded to the server.

2) Long period tides Om1 and Om2

As stated in the Conventions, the Om1 and Om2 waves are not provided in the original FES grid files, since there is no hydrodynamical solution for these very long period waves (18.6 and 9.8 years). They should not depart much, anyway, from equilibrium waves. We therefore provide the equilibrium solution for these waves, based on their astronomical amplitude.

a) Why is the sign of the C20 coefficients of Om1 and Om2 opposite to the one that appears in the IERS2010 Conventions (FES2004)?

There has been a debate in the Conventions on the sign of these long period tides:

23 September 2011:

In the Section 6.3.2 "Ocean tide models", part "FES2004", the phase of the C20 term of the very long period waves has been corrected to $\pi/2$. The corresponding changes are introduced in the first two data lines of the files fes2004.dat and fes2004_Cnm-Snm.dat.

14 October 2011:

In Section 6.3.2 "Ocean tide models", part "FES2004", there is an ongoing discussion on the phase of the C20 term of the very long period waves ($\pi/2$ as per the update of 23 September 2011 or $-\pi/2$). A warning sentence has been inserted in the text. The same warning applies to the values in the first two data lines of the files fes2004.dat and fes2004_Cnm-Snm.dat, which remain as in the update of 23 September 2011.

In our case, we have chosen to stick to the original Conventions, the one valid before the September 23, 2011 change. This is why the C20 values from Om1 and Om2 appear with a negative sign in the files we have distributed, i.e. with a phase = $-\pi/2$. Another reason for choosing this convention is that Florent Lyard has computed for us (private communication) a map of Om1 which enables the computation of this wave up to dg and order 100. The sign of the C20 coefficient in this decomposition is also negative, meaning that we are using the same conventions as the one used by the tide modelers.

b) Why do we provide only the C20 coefficient and not all the spherical harmonics up to dg/order 100?

As indicated just above, we have the decomposition of Om1 up to dg and order 100. We didn't provide it, in order to be consistent with what had been done for FES2004, but there is no reason not to distribute it. So, Om1 is provided up to degree and order 100 in "FES2014b.v1". Concerning Om2, its amplitude is so weak (1 % of Om1), that probably just C20 is sufficient.

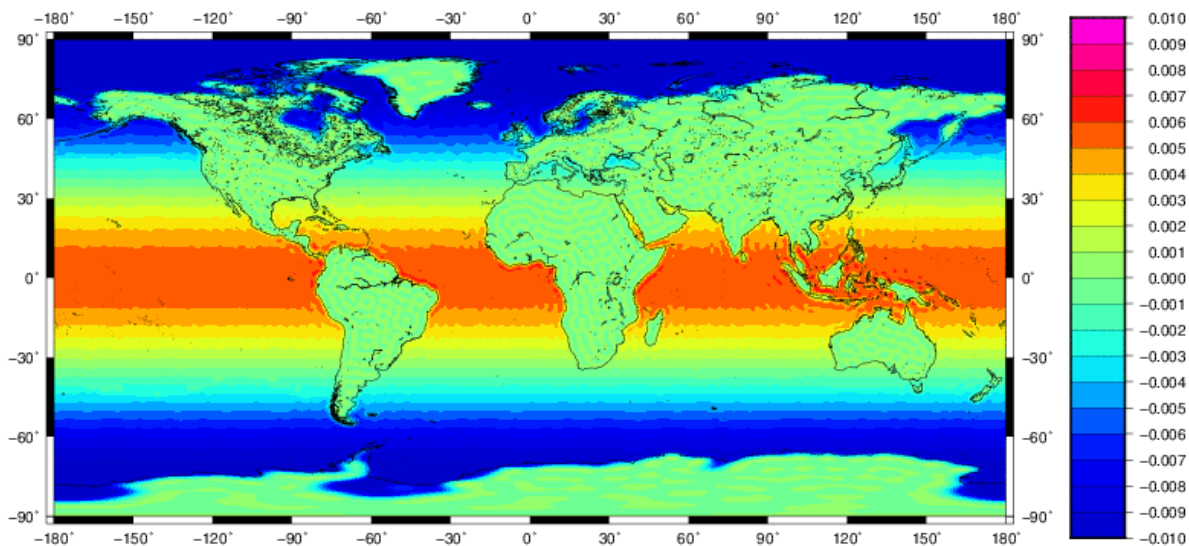
Tidal Heights of fes2014-100-100-ell+Om1+Om2C20+Msq+Sa-S1

Wave Om1 – Harmonic : C

degree 1 to 100

(unit : m of water)

(mean: 0.0001 / st.dev: 0.0043 / min: -0.0132 / max: 0.0068)



Amplitude, in m of water, of the Om1 wave developed in SH up to dg/order 100

3) Sa wave: there is no equilibrium component

Well, this is normal for the purely radiational wave Sa (056.555) which has no astronomical potential (see Table below). It is this wave which is provided in the Fes2014b atlas. We acknowledge it was wrongly named in the SH files that we originally computed, since the Doodson number we gave for it was 056.554 (same as the one which was present in the IERS2010 Conventions). On the contrary, Sa_ (056.554) has an astronomical potential (see Table below and Table 6.7 of the Conventions). Sa and Sa_ have almost the same frequency. The Doodson number of Sa has been changed to 056.555 in "FES2014b.v1".

Listing 2: output of showarg

```
# nbre d'ondes: 150
-----astronomic potential amplitude in cm, pulsation in degrees/h and in /h, period in hours and in days
, critical latitude in degrees, Doodson number
```

wave	Ap	deg/h	/h	h	days	deg	Doodson
Z0	0.0000	0.000000000	0.000000000	inf	inf	0.0000	0555555
Sa_	0.3147	0.041066678	0.000114074	8766.231393200	365.259641383	0.0782	0565545
Sa	0.0000	0.041068639	0.000114080	8765.812771979	365.242198832	0.0782	0565555
Ssa	1.9416	0.082137278	0.000228159	4382.906385989	182.621099416	0.1564	0575555
Sta	0.1146	0.123203956	0.000342233	2921.984102648	121.749337610	0.2347	0585545
MSm	0.3094	0.471521089	0.001309781	763.486530333	31.811938764	0.8981	0636555

From ftp://ftp.legos.obs-mip.fr/pub/ecola/tools/ttb.pdf

4) S1 wave: there are two different definitions of S1 (164.555 vs. 164.556)

S1: There are two different definitions of S1 (164.555 vs. 164.556). They have almost the same frequency, but have a significant phase shift. I have looked into the provided FES tidal prediction software and it seems FES2014b is using 164.555 (you provided S1 as 164.556). Could you please clarify which one has to be used?

Right:

```
S1 0.0000 15.000000000 0.041666667 24.000000000 1.000000000 29.9097 164555
```

Same problem as with Sa and Sa_: unfortunately, the AVISO site does not give the Doodson number of each wave, so we have to make our own equivalence and sometimes we make mistakes. So, YES, the Doodson number of the purely radiational S1 wave is 164.555. We have corrected it in "FES2014b.v1".

5) Files in potential units: sign errors for some waves (MSq, MSf)

Below is the list of phase conventions (" χ " parameter) used in our conversion software to transform the "Water Heights" SH to the "POT values" SH:

```

wave = Om1 ( 55.565) Hf<0? : F chi= 180.
wave = Om2 ( 55.575) Hf<0? : T chi= 0.
wave = Sa ( 56.555) Hf<0? : T chi= 0.
wave = Ssa ( 57.555) Hf<0? : T chi= 0.
wave = Mm ( 65.455) Hf<0? : T chi= 0.
wave = MSf ( 73.555) Hf<0? : T chi= 0.
wave = Mf ( 75.555) Hf<0? : T chi= 0.
wave = Mtm ( 85.455) Hf<0? : T chi= 0.
wave = MSq ( 93.555) Hf<0? : T chi= 0.
wave = Q1 (135.655) Hf<0? : T chi= -90.
wave = O1 (145.555) Hf<0? : T chi= -90.
wave = P1 (163.555) Hf<0? : T chi= -90.
wave = S1 (164.555) Hf<0? : F chi= 180.
wave = K1 (165.555) Hf<0? : F chi= 90.
wave = J1 (175.455) Hf<0? : F chi= 90.
wave = E2 (227.655) Hf<0? : F chi= 0.
wave = 2N2 (235.755) Hf<0? : F chi= 0.
wave = Mu2 (237.555) Hf<0? : F chi= 0.
wave = N2 (245.655) Hf<0? : F chi= 0.
wave = Nu2 (247.455) Hf<0? : F chi= 0.
wave = M2 (255.555) Hf<0? : F chi= 0.
wave = MKS (257.555) Hf<0? : F chi= 0.
wave = La2 (263.655) Hf<0? : T chi= 180.
wave = L2 (265.455) Hf<0? : T chi= 180.
wave = T2 (272.556) Hf<0? : F chi= 0.
wave = S2 (273.555) Hf<0? : F chi= 0.
wave = R2 (274.554) Hf<0? : T chi= 180.
wave = K2 (275.555) Hf<0? : F chi= 0.
wave = M3 (355.555) Hf<0? : T chi= 0.
wave = N4 (435.755) Hf<0? : F chi= 0.
wave = MN4 (445.655) Hf<0? : F chi= 0.
wave = M4 (455.555) Hf<0? : F chi= 0.
wave = MS4 (473.555) Hf<0? : F chi= 0.
wave = S4 (491.555) Hf<0? : F chi= 0.
wave = M6 (655.555) Hf<0? : F chi= 0.
wave = M8 (855.555) Hf<0? : F chi= 0.

```

For MSf, MSq, we have corrected a bug in our software which was giving a wrong value of 180° for χ for these waves. This has been corrected in "FES2014b.v1".

Below are the official χ values used by the FES2014 team. The only discrepancy between our software and the values given below is for S1, where we follow the Schureman convention in accordance with the paper of Ray & Egbert ("The Global S1 Tide", 2004, Journal of Physical Oceanography, vol. 34) because of the radiational nature of the S1 tide. It is also the convention followed by the FES team, so we think the value of 0 for S1 given in the table below is an error.

```

# astronomic potential amplitude in cm, pulsation in degrees/h and in /h, period in hours and in days, critical
latitude in degrees, Doodson number, Xf_phase_bias
# wave Ap deg/h /h h days deg Doodson Xf_phase_bias
Z0 0.0000 0.000000000 0.000000000 0.000000000 inf inf 0.0000 055555 0
M0 13.4523 0.000000000 0.000000000 0.000000000 inf inf 0.0000 055555 0
Sa_1 0.3147 0.041066678 0.000114074 8766.231393200 365.259641383 0.0782 056554 0
Sa 0.0000 0.041068639 0.000114080 8765.812771979 365.242198832 0.0782 056555 0
Ssa_1 0.0195 0.072853609 0.000202371 4941.416165718 205.892340238 0.1388 057355 0
Ssa 1.9416 0.082137278 0.000228159 4382.906385989 182.621099416 0.1564 057555 0
Sta 0.1146 0.123203956 0.000342233 2921.984102648 121.749337610 0.2347 058554 0
MSm 0.3094 0.471521089 0.001309781 763.486530333 31.811938764 0.8981 063655 0
Mm 2.2056 0.544374697 0.001512152 661.309207939 27.554550331 1.0369 065455 0
Mm_2 0.7094 0.549016532 0.001525046 655.717959261 27.321581636 1.0457 065555 90
Mm_1 0.1147 0.553658367 0.001537940 650.220463890 27.092519329 1.0546 065655 180
MSf 0.2240 1.015895786 0.002821933 354.367057034 14.765294043 1.9353 073555 0
Mf_1 0.1814 1.088749395 0.003024304 330.654603969 13.777275165 2.0741 075355 0
Mf_2 0.1156 1.093391230 0.003037198 329.250857590 13.718785733 2.0830 075455 90
Mf 4.1765 1.098033064 0.003050092 327.858979630 13.660790818 2.0918 075555 0
MStm_1 0.0579 1.560270484 0.004334085 230.729225334 9.613717722 2.9731 083455 0
MStm 0.1147 1.569554153 0.004359873 229.364497779 9.556854074 2.9908 083655 0
Mtm 0.8081 1.642407762 0.004562244 219.190391341 9.132932973 3.1298 085455 0
MSqm 0.0667 2.113928850 0.005872025 170.299014535 7.095792272 4.0296 093555 0
Mqm 0.1067 2.186782459 0.006074396 164.625428795 6.859392866 4.1687 095355 0
30K1 0.0000 11.746969447 0.032630471 30.646202123 1.276925088 22.9854 105555 0
2Q1 0.2587 12.854286180 0.035706350 28.006222591 1.166925941 25.2967 125755 -90
Sig1 0.1627 12.927139789 0.035908722 27.848387647 1.160349485 25.4503 127555 -90
Q1 1.9469 13.398660877 0.037218502 26.868356718 1.119514863 26.4491 135655 -90
Ro1 0.3787 13.471514486 0.037420874 26.723053326 1.113460555 26.6042 137455 -90
O1 10.0573 13.943035575 0.038730654 25.819341711 1.075805905 27.6131 145555 -90
MS1 0.0000 13.984104214 0.038844734 25.743515244 1.072646468 27.7014 146555 0
MP1 0.0800 14.025172853 0.038958813 25.668132848 1.069505535 27.7898 147555 90

```

MI_3	0.6528	14.492052107	0.040255700	24.841202429	1.035050101	28.7997	155555	0
M1	0.8454	14.496693942	0.040268594	24.833248288	1.034718679	28.8098	155655	90
Ki1	0.1120	14.569547550	0.040470965	24.709072039	1.029544668	28.9683	157455	90
Pi1	0.2747	14.917864683	0.041438513	24.132140065	1.005505836	29.7294	162556	-90
P1	4.6806	14.958931361	0.041552587	24.065890224	1.002745426	29.8195	163555	-90
S1	0.0000	15.000000000	0.041666667	24.000000000	1.000000000	29.9097	164555	0
K1	14.1484	15.041068639	0.041780746	23.934469594	0.997269566	30.0000	165555	90
Psi1	0.1120	15.082135317	0.041894820	23.869299170	0.994554132	30.0904	166554	90
Phi1	0.2027	15.123205917	0.042008905	23.804476510	0.991853188	30.1808	167555	90
Tta1	0.1120	15.512589728	0.043090527	23.206956822	0.966956534	31.0426	173655	90
J1	0.7921	15.585443336	0.043292898	23.098476715	0.962436530	31.2046	175455	90
S01	0.0000	16.056964425	0.044602679	22.420177966	0.934174082	32.2606	183555	90
001	0.4347	16.139101703	0.044830838	22.306074193	0.929419758	32.4458	185555	90
KQ1	0.0085	16.683476401	0.046342990	21.578236535	0.899093189	33.6830	195455	90
2MN2S2	0.0000	26.407937944	0.073355383	13.632646911	0.568011029	61.3854	209655	0
2NS2	0.0000	26.879459033	0.074665164	13.393126683	0.558046945	63.3210	217755	0
3M2S2	0.0000	26.952312641	0.074867535	13.356924313	0.556538513	63.6317	219555	0
ST1	0.0000	26.961596311	0.074893323	13.352325131	0.556346880	63.6715	219755	0
OQ2	0.0000	27.341696452	0.075949157	13.166703121	0.548612630	65.3540	225655	180
E2	0.1789	27.423833730	0.076177316	13.127267454	0.546969477	65.7319	227655	0
MNS2	0.0000	27.423833730	0.076177316	13.127267454	0.546969477	65.7319	227655	0
MNuS2	0.0000	27.496687339	0.076379687	13.092486217	0.545520259	66.0717	229455	0
ST2	0.0000	27.505971008	0.076405475	13.088067311	0.545336138	66.1153	229655	0
ST3	0.0000	27.803933872	0.077233150	12.947808093	0.539492004	67.5581	233555	0
2MK2	0.0000	27.886071150	0.077461309	12.909670856	0.537902952	67.9716	235555	0
2N2	0.6267	27.895354819	0.077487097	12.905374473	0.537723936	68.0187	235755	0
Mu2	0.5841	27.968208428	0.077689468	12.871757622	0.536323234	68.3925	237555	0
SNK2	0.0000	28.357592238	0.078771090	12.695012925	0.528958872	70.5053	243655	0
N2	4.6313	28.439729516	0.078999249	12.658348238	0.527431177	70.9796	245655	0
Nu2	0.9094	28.512583125	0.079201620	12.626004400	0.526083517	71.4101	247455	0
MSK2	0.0000	28.901966936	0.080283241	12.455899655	0.518995819	73.8978	253555	0
OP2	0.0000	28.901966936	0.080283241	12.455899655	0.518995819	73.8978	253555	180
M(SK)2	0.0000	28.943035575	0.080397321	12.438225392	0.518259391	74.1823	254555	-90
M2	24.2297	28.984104214	0.080511401	12.420601215	0.517525051	74.4718	255555	0
M(KS)2	0.0000	29.025172853	0.080625480	12.403026911	0.516792788	74.7667	256555	90
MKS2	0.0000	29.066241492	0.080739560	12.385502271	0.516062595	75.0673	257555	0
La2	0.1760	29.455625303	0.081821181	12.221774154	0.509240590	78.2860	263655	180
L2	0.6694	29.528478911	0.082023553	12.191620201	0.507984175	78.9904	265455	180
NKM2	0.0000	29.537762580	0.082049341	12.187788395	0.507824516	79.0834	265655	0
T2	0.6614	29.958933322	0.083219259	12.016449188	0.500685383	84.8127	272556	0
S2	11.2734	30.000000000	0.083333333	12.000000000	0.500000000	85.7651	273555	0
R2	0.0933	30.041066678	0.083447407	11.983595784	0.499316491	87.0058	274554	180
K2	3.0697	30.082137278	0.083561492	11.967234797	0.498634783	nan	275555	0
MSN2	0.0000	30.544374697	0.084845485	11.786130951	0.491088790	nan	283455	0
KJ2	0.1707	30.626511975	0.085073644	11.754521713	0.489771738	nan	285455	0
2SM2	0.0000	31.015895786	0.086155266	11.606951561	0.483622982	nan	291555	0
SKM2	0.0000	31.098033064	0.086383425	11.576294850	0.482345619	nan	293555	0
2SN2	0.0000	31.560270484	0.087667418	11.406746345	0.475281098	nan	301455	0
2SMu2	0.0000	32.031791572	0.088977199	11.238834368	0.468284765	nan	309555	0
MQ3	0.0000	42.382765091	0.117729903	8.494018718	0.353917447	nan	335655	-90
2MK3	0.0000	42.927139789	0.119242055	8.386302972	0.349429291	nan	345555	-90
MO3	0.0000	42.927139789	0.119242055	8.386302972	0.349429291	nan	345555	-90
M3	0.0000	43.476156321	0.120767101	8.280400810	0.345016700	nan	355555	0
S03	0.0000	43.943035575	0.122063988	8.192424472	0.341351020	nan	363555	-90
MS3	0.0000	43.984104214	0.122178067	8.184775078	0.341032295	nan	364555	0
MK3	0.0000	44.025172853	0.122292147	8.177139956	0.340714165	nan	365555	90
SP3	0.0000	44.958931361	0.124885920	8.007307761	0.333637823	nan	381555	-90
S3	0.0000	45.000000000	0.125000000	8.000000000	0.333333333	nan	382555	0
SK3	0.0000	45.041068639	0.125114080	7.992705566	0.333029399	nan	383555	90
K3	0.0000	45.123205917	0.125342239	7.978156531	0.332423189	nan	385555	???
2MNS4	0.0000	56.407937944	0.156688717	6.382080486	0.265920020	nan	427655	0
N4	0.0000	56.879459033	0.157998497	6.329174119	0.263715588	nan	437555	0
3MS4	0.0000	56.952312641	0.158200868	6.321077816	0.263378242	nan	437555	0
MN4	0.0000	57.423833730	0.159510649	6.269173906	0.261215579	nan	445655	0
MNu4	0.0000	57.496687339	0.159713020	6.261230284	0.260884595	nan	447455	0
MA4	0.0000	57.927139789	0.160908722	6.214703528	0.258945980	nan	454555	0
M4	0.0000	57.968208428	0.161022801	6.210300607	0.258762525	nan	455555	0
2MKS4	0.0000	58.050345706	0.161250960	6.201513456	0.258396394	nan	457555	0
SN4	0.0000	58.439729516	0.162332582	6.160192783	0.256674699	nan	463655	0
ML4	0.0000	58.512583125	0.162534953	6.152522770	0.256355115	nan	465455	180
NK4	0.0000	58.521866794	0.162560741	6.151546759	0.256314448	nan	465655	0
MS4	0.0000	58.984104214	0.163844734	6.103339278	0.254305803	nan	473555	0
MK4	0.0000	59.066241492	0.164072893	6.094851999	0.253952167	nan	475555	0
2MSN4	0.0000	59.528478911	0.165356886	6.047525598	0.251980233	nan	483455	0
S4	0.0000	60.000000000	0.166666667	6.000000000	0.250000000	nan	491555	0
SK4	0.0000	60.082137278	0.166894826	5.991797501	0.249658229	nan	493555	0
2MQ5	0.0000	71.366869305	0.198241304	5.044357466	0.210181561	nan	535655	-90
2M05	0.0000	71.911244003	0.199753456	5.006171218	0.208590467	nan	545555	-90
2NK5	0.0000	71.920527672	0.199779244	5.005525010	0.208563542	nan	545755	90
3MS5	0.0000	71.952312641	0.199867535	5.003313817	0.208471409	nan	546555	0
3MP5	0.0000	71.993381280	0.199981615	5.000459676	0.208352486	nan	547555	90
M5	0.0000	72.483469708	0.201342971	4.966649658	0.206943736	nan	556056	0
2MP5	0.0000	72.927139789	0.202575388	4.936433830	0.205684743	nan	563555	-90
2MS5	0.0000	72.968208428	0.202689468	4.933655461	0.205568978	nan	564555	0
2MK5	0.0000	73.009277067	0.202803547	4.930880218	0.205453342	nan	565555	90
NSK5	0.0000	73.480798155	0.204113328	4.899239108	0.204134963	nan	573655	90
3MQ5	0.0000	73.553651764	0.204315699	4.894386497	0.203932771	nan	575455	90
MSP5	0.0000	73.943035575	0.205397321	4.868612672	0.202858861	nan	581555	-90

MSK5	0.0000	74.025172853	0.205625480	4.863210529	0.202633772	nan	583555	90
S5	0.0000	75.000000000	0.208333333	4.800000000	0.200000000	nan	600555	0
3MNK6	0.0000	85.309904880	0.236971958	4.219908585	0.175829524	nan	625655	0
3MNS6	0.0000	85.392042158	0.237200117	4.215849521	0.175660397	nan	627655	0
4MK6	0.0000	85.854279577	0.238484110	4.193151486	0.174714645	nan	635555	0
3MNL6	0.0000	85.863563247	0.238509898	4.192698118	0.174695755	nan	635755	???
4MS6	0.0000	85.936416855	0.238712269	4.189143708	0.174547655	nan	637555	0
2MN6	0.0000	86.407937944	0.240022050	4.166283892	0.173595162	nan	645655	0
2MNU6	0.0000	86.480791553	0.240224421	4.162774109	0.173448921	nan	647455	0
3MSK6	0.0000	86.870175364	0.241306043	4.144115037	0.172671460	nan	653555	0
M6	0.0000	86.952312641	0.241534202	4.140200405	0.172508350	nan	655555	0
3MKS6	0.0000	87.034449919	0.241762361	4.136293161	0.172345548	nan	657555	0
MSN6	0.0000	87.423833730	0.242843983	4.117870204	0.171577925	nan	663655	0
2ML6	0.0000	87.496687339	0.243046354	4.114441483	0.171435062	nan	665455	180
MSNU6	0.0000	87.496687339	0.243046354	4.114441483	0.171435062	nan	665455	0
MNK6	0.0000	87.505971008	0.243072142	4.114004974	0.171416874	nan	665655	0
2MS6	0.0000	87.968208428	0.244356135	4.092387539	0.170516147	nan	673555	0
3MLN6	0.0000	88.041062036	0.244558506	4.089001106	0.170375046	nan	675355	180
2MK6	0.0000	88.050345706	0.244584294	4.088569978	0.170357082	nan	675555	0
MSL6	0.0000	88.512583125	0.245868286	4.067218324	0.169467430	nan	683455	180
3MSN6	0.0000	88.512583125	0.245868286	4.067218324	0.169467430	nan	683455	0
3MKN6	0.0000	88.594720403	0.246096446	4.063447555	0.169310315	nan	685455	0
2SM6	0.0000	88.984104214	0.247178067	4.045666394	0.168569433	nan	691555	0
MSK6	0.0000	89.066241492	0.247406226	4.041935463	0.168413978	nan	693555	0
S6	0.0000	90.000000000	0.250000000	4.000000000	0.166666667	nan	709555	0
S7	0.0000	105.000000000	0.291666667	3.428571429	0.142857143	nan	818555	0
N8	0.0000	113.758918065	0.315996995	3.164587059	0.131857794	nan	815955	0
4MNS8	0.0000	114.376146372	0.317711518	3.147509436	0.131146227	nan	827655	0
2M2N8	0.0000	114.847667460	0.319021299	3.134586953	0.130607790	nan	835755	0
3MN8	0.0000	115.392042158	0.320533450	3.119799193	0.129991633	nan	845655	0
3MNU8	0.0000	115.464895767	0.320735822	3.117830728	0.129909614	nan	847455	0
M8	0.0000	115.936416855	0.322045602	3.105150304	0.129381263	nan	855555	0
2MSN8	0.0000	116.407937944	0.323355383	3.092572606	0.128857192	nan	863655	0
3ML8	0.0000	116.480791553	0.323557754	3.090638338	0.128776597	nan	865455	180
3MS8	0.0000	116.952312641	0.324867535	3.078177694	0.128257404	nan	873555	0
3MS8	0.0000	116.952312641	0.324867535	3.078177694	0.128257404	nan	873555	0
3MK8	0.0000	117.034449919	0.325095694	3.076017363	0.128167390	nan	875555	0
MSNK8	0.0000	117.505971008	0.326405475	3.063674100	0.127653088	nan	883655	0
2M2S8	0.0000	117.968208428	0.327689468	3.051669639	0.127152902	nan	891555	0
2M2S8	0.0000	117.968208428	0.327689468	3.051669639	0.127152902	nan	891555	0
2MSK8	0.0000	118.050345706	0.327917627	3.049546343	0.127064431	nan	893555	0
2M2K8	0.0000	118.132482984	0.328145786	3.047425999	0.126976083	nan	895555	0
2SKN8	0.0000	118.521866794	0.329227408	3.037414190	0.126558925	nan	901655	0
S8	0.0000	120.000000000	0.333333333	3.000000000	0.125000000	nan	927555	0
S9	0.0000	135.000000000	0.375000000	2.666666667	0.111111111	nan	1036555	0
S10	0.0000	150.000000000	0.416666667	2.400000000	0.100000000	nan	1145555	0
S11	0.0000	165.000000000	0.458333333	2.181818182	0.090909091	nan	1254555	0