

The ICGEM-format

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28. February 2006

The ICGEM-format accommodates

- Earth Gravity Field models in terms of spherical harmonic coefficients and
- Ocean and Atmosphere Tides.

Each individual data file consists of two sections:

1. The **header** containing parameters which do not depend on degree l and order m . The end of the header is marked by the keyword "end_of_head" (as a separator between header and data section)
2. The **data section** with the list of degree- and order-dependent parameters

The records have the following basic structure:

- The basic structure of the record lines is unformatted, i.e. separators are blanks and/or tabs
- Each record consists of one keyword followed by one or more parameters (numbers or characters), which are separated by one or an arbitrary number of blanks and/or tabs,
- The number of parameters depends on the corresponding keyword as defined below,
- There are mandatory and optional records,
- All lines led by non-defined keywords are comments,
- In any line, additional characters and/or numbers beyond the last parameter are allowed as comments.
- Leading and trailing blanks are ignored.

Earth Gravity Field Models

Header section:

keyword (mandatory records)	number of parameters	meaning of parameters
product_type	1	"gravity_field"
modelname	1	name of the model
earth_gravity_constant	1	gravitational constant times mass of the earth
radius	1	reference radius of the spherical harmonic development
max_degree	1	maximum degree of the spherical harmonic development
errors	1	either "no", "calibrated", "formal" or both "calibrated and formal" errors are included
norm	1	either "fully normalized" (=default) or "unnormalized"
tide_system	1	either "zero_tide", "tide_free" or "unknown" (default)
end_of_head	0	The position of this keyword defines the end of the header

Data section:

keyword (optional records)	number of parameters	meaning of the parameters
gfc	6(*)	degree, order, Clm, Slm, sigmaC sigmaS
gfc	8(**)	degree, order, Clm, Slm, sigmaC_cal, sigmaS_cal, sigmaC_formal, sigmaS_formal
gfc	4(***)	degree, order, Clm, Slm
gfct	7(*)	degree, order, Clm, Slm, sigmaC, sigmaS, time (yyyymmdd)
gfct	9(**)	degree, order, Clm, Slm, sigmaC_cal, sigmaS_cal, sigmaC_formal, sigmaS_formal, time (yyyymmdd)
gfct	5(***)	degree, order, Clm, Slm, time (yyyymmdd)
dot	6(*)	degree, order, dClm/dt, dSlm/dt, sigmaCdot, sigmaSdot
dot	8(**)	degree, order, dClm/dt, dSlm/dt, sigmaCdot_cal, sigmaSdot_cal, sigmaCdot_formal, sigmaSdot_formal,
dot	4(***)	degree, order, dClm/dt, dSlm/dt

(*) = in the case of errors = "calibrated" or "formal" in the header

(**) = in the case of errors = "calibrated_and_formal" in the header

(***)= in the case of errors = "no" in the header

Example:

```

product_type          gravity_field
modelname             EXAMPLE-MODEL
earth_gravity_constant 0.3986004415E+15 [m3/s2]
radius                0.6378136460E+07 [m]
max_degree            99
errors                 formal
  
```

```

key   L   M   C   S   sigma C   sigma S   time
end_of_head =====
gfc   0   0  0.999999999874D+00 0.000000000000D+00 0.3162D-10 0.0000D+00
gfc   1   0  0.000000000000D+00 0.000000000000D+00 0.0000D+00 0.0000D+00
gfct  2   0  -.484165115509D-03 0.000000000000D+00 0.4096D-11 0.0000D+00 19970101
dot   2   0  0.136375909757D-10 0.000000000000D+00 0.2878D-12 0.0000D+00
gfct  3   0  0.958574917402D-06 0.000000000000D+00 0.2595D-10 0.0000D+00 19970101
dot   3   0  0.281757002657D-11 0.000000000000D+00 0.9929D-13 0.0000D+00
gfct  4   0  0.539787841808D-06 0.000000000000D+00 0.1529D-10 0.0000D+00 19970101
dot   4   0  0.122491499575D-10 0.000000000000D+00 0.2598D-12 0.0000D+00
gfct  5   0  0.656243329790D-07 0.000000000000D+00 0.4442D-09 0.0000D+00 20000101
gfct  5   0  0.681084383151D-07 0.000000000000D+00 0.3950D-09 0.0000D+00 20000131
gfct  5   0  0.680886351414D-07 0.000000000000D+00 0.3774D-09 0.0000D+00 20000301
gfct  5   0  0.674522327854D-07 0.000000000000D+00 0.3201D-09 0.0000D+00 20000331
gfct  6   0  -.151387863517D-06 0.000000000000D+00 0.4826D-09 0.0000D+00 20000101
gfct  6   0  -.151047338230D-06 0.000000000000D+00 0.3676D-09 0.0000D+00 20000131
gfct  6   0  -.150062466972D-06 0.000000000000D+00 0.5020D-09 0.0000D+00 20000301
gfct  6   0  -.150450345396D-06 0.000000000000D+00 0.2850D-09 0.0000D+00 20000331
gfct  7   0  0.932891368668D-07 0.000000000000D+00 0.4761D-09 0.0000D+00 20000101
gfct  7   0  0.909622149314D-07 0.000000000000D+00 0.4059D-09 0.0000D+00 20000131
gfct  7   0  0.913272281584D-07 0.000000000000D+00 0.4183D-09 0.0000D+00 20000301
.
.
.
.
gfc   97  95 0.189944302212D-15 -.329637980180D-15 0.9821D-10 0.9821D-10
gfc   98  95 0.380508739299D-15 0.704946172153D-15 0.9621D-10 0.9621D-10
gfc   99  95 0.888165168730D-15 -.115549525123D-14 0.9428D-10 0.9428D-10
  
```

Ocean/Atmosphere Tides

Header section:

keyword (mandatory records)	number of parameters	meaning of parameters
product_type	1	"ocean_tides"
modelname	1	name of the model
earth_gravity_constant	1	gravitational constant times mass of the earth
radius	1	reference radius of the spherical harmonic development
max_degree	1	maximum degree of the spherical harmonic development
errors	1	either "no", "calibrated" or "formal" errors given

keyword (optional records)	number of parameters	meaning of parameters
norm	1	either "fully normalized" (=default) or "unnormalized"
water_density	1	density of sea water [kg/m3] (default = 1025.0)

keyword (mandatory records)	number of parameters	meaning
end_of_head	0	Position of keyword defines the end of the header

Data section:

keyword (optional records)	number of parameters	meaning of parameters
lovrn	2	degree, load love number
ocs	8(*)	degree, order, "pro" or "retro", Doodson number, Clm-coefficient, Slm-coefficient, sigmaC, sigmaS
ocs	6(**)	degree, order, "pro" or "retro", Doodson number, Clm-coefficient, Slm-coefficient
acs	8(*) / 6(**)	(dto. for atmosphere tide coefficients)
ccs	8(*) / 6(**)	(dto. for combined ocean/atmosphere tide coefficients)
oap	8(*)	degree, order, "pro" or "retro", Doodson number, Alm (amplitude), Plm (phase), sigmaA, sigmaP
oap	6(**)	degree, order, "pro" or "retro", Doodson number, Alm (amplitude), Plm (phase)
aap	8(*) / 6(**)	(dto. for atmosphere tide amplitude/phase)
cap	8(*) / 6(**)	(dto. for combined ocean/atmosphere tide amplitude/phase)

(*) = in the case of errors = "calibrated" or "formal" in the header

(**) = in the case of errors = "no" in the header

Example:

```
product_type      ocean_tides
modelname         EXAMPLE-MODEL
earth_gravity_constant  0.3986030000E+15
radius           0.6378160000E+07
water_density    1025.0
max_degree       6
errors           formal
norm             fully_normalized
```

end_of_head

=====

```
lovrn 0      0.0000
```

```
lovr 1 -0.3075
lovr 2 -0.1950
lovr 3 -0.1320
lovr 4 -0.1032
lovr 5 -0.0892
lovr 6 -0.0820
ocs 2 1 pro +135.655 -.699279379E+00 0.616931102E+00 0.1048E+00 0.1035E+00
oap 2 1 pro +135.655 .933000000E+00 0.311400000E+03 0.0210E+00 0.1200E+01
.
.
.
.
ocs 6 2 pro +275.555 -.102235651E+00 0.489852820E-02 0.3575E-02 0.3308E-02
oap 6 2 pro +275.5552 .102240000E+00 0.272700000E+03 0.1000E-03 0.4000E+00
```