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CNIG
Conseil national de l'information géolocalisée

Commission Géopositionnement
Groupe de travail Réglementation et information géodésique

Normalisation des numéros d'identification des stations géodésiques au sol

Demande d'avis des membres des commissions concernées au CNIG

version du 22/01/2025

Objet de la présente note

En vue du vote français à l'ISO, le GT RIG sollicite l'avis des membres des commissions du CNIG sur les propositions examinées par l'ISO relatives à la future norme d'identification des stations géodésiques au sol.

Contexte

L'une des activités actuelles du groupe de travail Réglementation et information géodésique (GT RIG) de la commission GéoPos est de contribuer à l'établissement d'une numérotation standardisée des stations géodésiques avec une identification unique et internationale partagée par la communauté scientifique et les utilisateurs de données géodésiques.

Les stations géodésiques au sol sont des instruments implantés à la surface de la Terre dont les données contribuent à l'amélioration de la connaissance des formes et dimensions de la Terre et de son champ de pesanteur et au suivi de l'évolution temporelle de ces grandeurs.

La numérotation à l'aide de la convention DOMES[1], administrée par l'IGN depuis plusieurs décennies au service de la communauté géodésique internationale, a atteint ses limites. Des extensions de ces limites existent actuellement dans l'attente d'une nouvelle norme de numérotation, mais ne permettent pas d'assurer la viabilité à long terme de ce système.

Un projet de norme a été soumis fin 2023 dans le cadre des travaux de normalisation ISO, relayé le 23 avril 2024 par le GT RIG auprès de la commission GéoPos et des présidents de commissions Florent Cholat, Christine Archias, Henri Verdier, appelant à manifestation d'intérêt et contributions à la définition de cette nouvelle norme.

Etat d'avancement des travaux de l'ISO

Le projet de nouvelle norme s'appuie sur le rapport technique ISO 19161 de 2015. Il se concrétise par un « *New Work Item Proposal* » (NWIP) pris en charge par le groupe de travail

1 https://itrf.ign.fr/en/network/domes/description

WG9 du Comité Technique TC211[2] de l'ISO, en charge de la normalisation dans le domaine de l'information géographique numérique. Thierry GATTACCECA (IGN) est chef de projet de ce WG9 et Brice VIRLY (IGN) en est le secrétaire.

Au cours de l'année 2024, huit réunions de travail se sont tenues rassemblant des experts ISO d'une quinzaine de pays ainsi que des représentants d'organismes internationaux tels que l'IERS, l'UN-GGCE ou l'IGS permettant de dégager plusieurs propositions de numérotations.

Une de ces propositions doit être choisie par un vote d'ici le 28 Février 2025 pour rédaction d'une proposition de norme. Celle-ci sera amendée et commentée par les experts ISO du TC-211 pendant six mois, puis retravaillée pendant trois à six mois à l'issue de cette phase et enfin présentée comme proposition finale de norme pendant à nouveau six mois. Ainsi, la publication de la norme pourrait intervenir au printemps 2026.

Les six propositions actuelles de numérotations pour les stations géodésiques

Les propositions de numérotation soumises au vote sont les six suivantes :

Trois propositions similaires à la numérotation DOMES actuelle :

1. Proposition 1: CCC TTT SSSS NN (12 caractères)
2. Proposition 2: CCC *SSSSS T NNN* GG (14 caractères contenant les actuels DOMES)
3. Proposition 3: CCC SSS T NN (9 caractères comme les actuels DOMES)

Trois propositions substantiellement différentes de la numérotation DOMES actuelle :

4. Proposition 4: OOOO SS T NN (9 caractères comme les actuels DOMES)
5. Proposition 5: DOIs (Digital Object Identifier)
6. Proposition 6: UUIDs (Unique Universal Identifier)

(C pour le pays, T pour la technique géodésique, S pour le site, N pour le numéro du point dans le site, O pour une localisation géographique basée sur les coordonnées)

Avantages et inconvénients identifiés à ce stade sur ces numérotations

Les propositions 1 et 2 étendent la logique DOMES en ajoutant des caractères. La chaîne plus longue a un impact sur les formats SINEX, RINEX et les chaînes de calcul relatives.

La proposition 2 intègre la chaîne DOMES et facilite la compatibilité avec la numérotation actuelle.

Les proposition 1 à 4 augmentent la possibilité de caractères alphanumériques ce qui accroît considérablement les possibles numérotations des sites.

Les propositions 3 et 4 conservent neuf caractères ce qui réduit l'impact sur les formats RINEX, SINEX et les chaînes de calcul. La lettre « T » réservée à la technique géodésique y est

2 ISO/TC 211 - Information géographique/Géomatique

déplacée, permettant facilement la distinction entre les numéros DOMES actuels et future numérotation : un caractère de plus pour le site, un de moins pour le point dans le site.

La numérotation 4 identifie la zone géographique non pas par le code pays (CCC) mais par une localisation géographique par zone sur quatre caractères, laissant deux caractères (soit 1296 possibilités alphanumériques) pour l'identification du site dans la zone. Ceci permet de s'affranchir de considération diplomatiques ou géopolitiques sur l'attribution des DOMES.

Les propositions 5 et 6 semblent présenter d'importantes difficultés de mise en œuvre, mais ayant été proposées par des membres ISO, elles sont proposées au vote.

Les six propositions ainsi que les enjeux associés à chacune d'elles sont détaillées dans un document en anglais en annexe de la présente note.

ANNEXE : ISO 19161-2 Committee Internal Ballot

REFERENCE: Call for liaison input, subject matter expert perspectives, and national body positions as guidance on the new unique numbering scheme for ground geodetic stations.

Justification for this project

Historically, the Directory of Monitoring of Earth Rotation and Intercomparison of Techniques (MERIT) Sites (DOMES) numbering system was designed in the early 1980s in order to give an unambiguous identifier to all instrument reference points and markers.

Since the official start of the International Earth Rotation Service (IERS) in 1988, the Terrestrial Reference Frame (TRF) section of the IERS/Central Bureau (CB) continued this task for all International Terrestrial Reference Frame (ITRF) contributing stations.

A DOMES number is currently 9 characters long, and is made up of a site number followed by a point number within the site, see below.

Reminder on current DOMES numbering scheme

First 5 characters = site number.

A site is a restricted (few hundreds of meters to 10 km) geographical area, where marks and instruments are collocated, even temporarily. A site number (according to DOMES) is 5 characters long:

- First 3 characters = National Institute of Statistics and Economic Studies (INSEE) (French statistics agency) country code
- Next 2 characters = site number within that particular country

As a result, from the moment a country has more than 99 DOMES numbers (17 countries today), “fake” country codes were used to build up the additional DOMES number requested as a temporary option.

Next character = 1 character to describe the nature of the point.

A point is a basic concept of geometric geodesy to which one can provide coordinates in order to identify its location in space-time. DOMES consider two major types:

- points connected to tracking instruments (called S-points for the reference point of the station instrument).

- permanent mark points, usually established by geodetic survey teams (called M-points for « materialized reference point »)

Last 3 characters = increment within the site (with no respect of the chronological order…)

As a result, the DOMES code is a 9-character code

Examples:

10001M001 = Paris meridian pillar 10001S002 = Paris astrolabe

DOMES numbers are not long enough to accommodate current needs, and a new system is under development via ISO TC 211 project 19161-2 to overcome these limitations.

Reminder on the scope of the numbering scheme

This request is a description of the options under consideration for the revised numbering system replacing the current DOMES numbering scheme.

The final 19161-2 document will provide to the geodetic data producers and users a proper and unique identification of the permanently instrumented stations, (e.g. those used in the production of the ITRF and other similar stations), with special emphasis on the backward compatibility with existing DOMES numbers, which will have a positive impact on interoperability issues when merging several data from different communities.

Types of ground geodetic stations

Ground geodetic stations to take into consideration are (but not limited to) the following:

- Global Navigation Satellite Systems (GNSS) permanent stations
- Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) (transponders or beacons)
- Very Long Baseline Interferometry (VLBI) radio telescopes
- Satellite and Lunar Laser Stations (SLR & LLR)
- Synthetic Aperture Radar (SAR) passive reflectors and active transponders
- Precise Range And Range-Rate Equipment (PRARE) ground stations

Six proposals under consideration (the six proposals are further detailed later in the document):

Three proposals are similar to the current DOMES scheme:

- **Proposal 1**: CCC TTT SSSS NN
- **Proposal 2**: CCC ***SSSSS T NNN*** GG
- **Proposal 3:** CCC SSS T NN

Three proposals are substantially different from the current DOMES scheme:

- **Proposal 4:** OOOOSS T NN
- **Proposal 5:** DOIs
- **Proposal 6:** UUIDs

In order to ensure that the outcome optimally aligns with the user community preferences, for today and into the future, please encourage affected stakeholders to submit comments in response to this Committee Internal Ballot (CIB).

Please consider the following

"Our most preferred solution is:" *(select between the different proposals; comments are allowed)* **"Our second preferred solution is:"** *(select between the different proposals; comments are allowed)* **"Our third preferred solution is:"** *(select between the different proposals; comments are allowed)* **"We do not think this proposal is a good solution:"** *(select between the different proposals; comments are allowed)*

First proposal: CCC TT SSSS NN

CCC = ISO country code

TT = type of geodetic station/ technique (3-characters code)

SSSSNN = site number (within the country) followed with sequential number (within the site)

Remarks

- 12 digits long numbering
- probably 2 digits can be enough for technique (with 1296 alphanumeric possibilities)
- does not distinguish marker from station

Advantages

Longer id with respect to current numbering (DOMES) allows to accommodate technology evolutions in the future and extension of the use of this numbering.

Drawbacks

Based on country boundaries: geopolitical issues may affect the numbering

Longer scheme than existing one:

- more difficult to generate; for software developers, the difficulty is that many existing software share the existing DOMES format, and a change in length would complicate things (this is also true for database managers)
- implies revision of some data formats such as RINEX and SINEX

Second proposal: CCC ***SSSSS T NNN*** GG

Alternative proposal including current DOMES numbers within the new numbering (bold italic):

- CCC: iso country code (A-3 or numeric?)
- SSSSS: site code
- T: nature: M for Marker, S for instrument
- NNN: number in the site
- GG: Geodetic technique (example: GN for GNSS, DO for DORIS…)

Remarks

- 14 alpha-numeric digits code
- current DOMES number are preserved inside new numbering; SSSSS T NNN = current DOMES number
    - unchanged for former DOMES
    - many more possibilities (up to 46 000 points per site)
- SSSSS for site code allows 60 million sites per country
- Geodetic technique allows 1296 alphanumeric possibilities.

Advantages

Former DOMES number Easy to extract: easier retro-compatibility

Longer id with respect to current numbering (DOMES) allows to accommodate technology evolutions in the future and extension of the use of this numbering.

Drawbacks

Based on country boundaries: geopolitical issues may affect the numbering

Longer scheme than existing one:

- more difficult to generate; for software developers, the difficulty is that many existing software share the existing DOMES format, and a change in length would complicate things (this is also true for database managers)
- implies revision of some data formats such as RINEX and SINEX

Third proposal: CCC SSS T NN

CCC: iso country code (A-3 or numeric?)

SSS: first uses numbers (up to 999) and then uses alphanumeric digits

T: M (Marker) or S (Station)

NN: sequential number for points within the site

Remarks

- either INSEE code (the 3 first digits of DOMES for actual current ground stations) or ISO 3166 can be used for new ones.
- extension of numbering by using alphanumeric digits instead of numeric only
    - up to 46,656 sites per country and up to 1296 points per site.
- SSS numbers already exist in the DOMES database (but not visible for DOMES users). These numbers can be derived very quickly from existing numbers.
- Marker/Station digit is moved of 1 digit, allowing distinction between former DOMES and new numbering.

Advantages

9 characters, fully consistent with current format. Only software that needs to read the first 5 digits of current DOMES numbers will have to be modified to read the first 6 digits of the new scheme, in order to identify co-located sites; software that use DOMES as metadata need not be modified.

Drawbacks

Based on country boundaries: geopolitical issues may affect the numbering

Large extension of use of the numbering may imply a revision (and extension of number of digits) in the future decades

Fourth proposal: OOOO SS T NN

OOOO: 4 digits location code

OOOO is either Open Location Code or ISO standard on Discrete Global Grid System (DGGS)

SS: 2 digits for site within the OLC box (alphanumeric)

T: M (Marker) or S (Station)

NN: sequential number for points within the site

Remarks:

- 4 digits location code implies a 110x110 km box based on OpenLocationCode (OLC: OOOO ≈110 km box, see https://plus.codes/map). Location standard developed by Google, free for use but not ISO standard.
- Alternative proposal: 4 digits location code based on standard ISO 19170 for DGGS (Discrete Global Grid Systems)
- Move digit on Marker / Station within the code
- Problem if site extends across several polygons.

Advantages

Not related to any country => avoid geopolitical concerns

Keep 9 digits code to avoid change on formats and/or calculation processes.

Drawbacks

No immediate (human readable) identification of the country

Retro-compatibility with current DOMES might be affected, although open source code exists to convert from OLC to geographic coordinates

5th proposal: DOI's (Digital Object Identifier)

Identifier that is linked directly to the metadata (through an url for instance)

See more on : https://ggos.org/about/org/co/dois-geodetic-data-sets/

Remarks

More related to the information/data received than the station itself.

Advantages

Practically unlimited possibility of numbering

Implemented to fullfil geodetic data sets needs: linked to metadata through an url

ISO 26324 standard: https://www.iso.org/obp/ui/#iso:std:iso:26324:ed-1:v1:en

Machine readable

Drawbacks

DOI's have a cost to be generated, although this cost is not so significant when compared to the cost for a geodetic station. They also imply a delay that could be significantly longer than the present delay for DOMES.

They are not "human-readable"

Imply deep revision of database management

Imply deep revision of formats like RINEX and SINEX

Imply deep revision of software using DOMES number

Longer scheme than existing one; more difficult to generate; for software developers, the difficulty is that many existing software share the existing DOMES format, and a change in length would complicate things (this is also true for database managers)

6th proposal: UUID (Unique Universal IDentifier)

UUID's are 32 digits alphanumeric codes that are randomly generated, it means about 6.10^{49} different codes. This very large range of possibility guarantee statistical unicity of codes. UUID's can be generated by independent generators.

Advantages

UUID can be generated independently by the users.

Remarks: more related to the information/data received than the station itself.

Drawbacks

UUIDs are not "human-readable"

Need to be linked to metadata (site, geodetic technique, etc.)

Imply deep revision of database management

Imply deep revision of formats like RINEX and SINEX

Imply deep revision of software using DOMES number

Longer scheme than existing one: for software developers, the difficulty is that many existing software share the existing DOMES format, and a change in length would complicate things (this is also true for database managers)