

# Résolutions et recommandations des unions internationales en matière de référentiels astrogéodésiques

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# Résolutions de l'UAI (1/3)

## Historique:

- Résolution C1 (1988) sur le repère céleste utilisant des objets extragalactiques
- Résolution A4 (1991) sur l'utilisation d'un modèle relativiste pour le système céleste et la définition de l'ICRS
- Résolution B5 (1994) sur une liste de sources réalisant l'ICRS
- **Résolution (1997) sur l'ICRF adopté au 1er janvier 1998 en remplacement du FK5**
- Résolution B1.3 (Manchester 2000) Définition de Système de référence céleste barycentrique et du Système de référence céleste géocentrique
- Résolution 2 (Prague 2006) Supplément aux résolutions 2000 de l'UAI sur les systèmes de référence

## Résolutions de l'UAI (2/3)

### IAU GA 2018:

#### RESOLUTION B2: on The **Third** Realization of the International Celestial Reference Frame:

« that, as from 1 January 2019, the fundamental realization of the International Celestial Reference System (ICRS) shall be the **Third** Realization of the International Celestial Reference Frame (ICRF3), as constructed by the IAU Working Group on the Third Realization of the International Celestial Reference Frame;

#### RESOLUTION B3: On the **Gaia** Celestial Reference Frame:

« that as from 1 January 2022, the fundamental realization of the International Celestial Reference System (ICRS) shall comprise the **Third** Realization of the International Celestial Reference Frame (ICRF3) for the radio domain and the **Gaia-CRF3 for the optical domain.**”

## Résolutions de l'UAI (3/3)

### IAU GA 2018:

#### RESOLUTION B1: on Geocentric and International Terrestrial Reference Systems and Frames:

“That the **ITRS** be adopted as the preferred GTRS for scientific and technical applications; and

That the IAU engage, together with other concerned organizations such as the IUGG and the IAG, with the United Nations (UN) Global Geospatial Information Management (GGIM) Subcommittee on Geodesy in order to promote the implementation of the UN-GGIM Road Map for the Global Geodetic Reference Frame.”

# International Terrestrial Reference System (ITRS)

Realized and maintained by the IERS, **since 1988**

Description/definition: Chapter 4 of the IERS Conventions

## International Terrestrial Reference System (ITRS): Definition (IERS Conventions, Chapter 4)

- **Origin:** Center of mass of the whole Earth, including oceans and atmosphere
- **Unit of length:** meter SI, consistent with TCG (Geocentric Coordinate Time)
- **Orientation:** consistent with BIH (Bureau International de l'Heure) orientation at 1984.0.
- **Orientation time evolution:** ensured by using a No-Net-Rotation-Condition w.r.t. horizontal tectonic motions over the whole Earth

$$h = \int_C X \times V dm = 0$$

# Transformation between ITRS and GCRS

## Following the IERS Conventions, Chapter 5:

The transformation to be used to relate the International Terrestrial Reference System (ITRS) to the Geocentric Celestial Reference System (GCRS) at the date  $t$  of the observation can be written as:

$$[\text{GCRS}] = Q(t)R(t)W(t) [\text{ITRS}]$$

where  $Q(t)$ ,  $R(t)$  and  $W(t)$  are the transformation matrices arising from the motion of the celestial pole in the celestial reference system, from the rotation of the Earth around the axis associated with the pole, and from polar motion, respectively.



# “First” IUGG/IAG resolutions on ITRS

- Vienna 1991: IUGG Resolution n° 2:

“Considering the need to define a Conventional Terrestrial Reference System (CTRS)...”

- Vienna 1991: IAG Resolution n° 1:

“Considering the IUGG Resolution on CTRS...and noting that the IERS is implementing such a system **under the name of ITRS** from VLBI, SLR, LLR and now GPS data, ..., recommends: that groups making highly accurate ... analysis should either use the ITRS directly or carefully tie their own systems to it...and that for high accuracy in continental areas, a system moving with a rigid plate may be used to eliminate unnecessary velocities provided it coincides exactly with the ITRS at a specific epoch (e.g. the ETRS 89 system selected by the EUREF sub-commission).

# Resolutions/recommendations on ITRS & ITRF

- **IUGG2007**: adopted the **ITRS** as the preferred Geocentric Terrestrial Reference System (GTRS) for scientific and technical applications
- **CGPM2011**: recommends that the **ITRS**, as defined by the IUGG and realized by IERS, be adopted as the unique international reference system for terrestrial reference frames for all metrological applications
- **ICG**: recommendation to align GNSS-specific reference frames (WGS84, PZ90, GTRF, CGCS2000, JGS) to the ITRF
- **IUGG2019**: recommend to the user community that the **ITRF** be the standard for positioning, satellite navigation and Earth Science applications, ...
- **UN-GGIM-2019**: adoption of the **ITRS** and the **ITRF** as the standard for scientific, geospatial and operational geodetic applications
- **2020: ISO Standard on ITRS/ITRF**
- **Specific recommendations at IAG regional sub-commissions: usage of the ITRS/ITRF as a standard for regional / national TRFs, e.g:**
  - **ETRS89/ITRS relationship**

# Other IAG Resolutions

- Prague 2015
  - Resolution 1: Definition and Realization of an International Height Reference System (IHR)
  - Resolution 2: Establishment of a global absolute gravity reference system ==> IGRS
- Montreal 2019
  - Resolution 3: Establishment of the International Height Reference Frame (IHRF)
  - Resolution 4: Establishment of the Infrastructure for the **International Gravity Reference Frame**
- « Résolutions en vue » : IGRS / IGRF
- Conflit d'acronymes:
  - International Gravity Reference Frame (IGRF)
  - International Geomagnetic Reference Field (IGRF)

# Conclusion

## L'ITRS/ITRF est la norme aujourd'hui

- Un certain nombre de résolutions et de recommandations
- Applications en science de la Terre
- Applications en géodésie opérationnelle
- Alignement à l'ITRS/ITRF
  - des références GNSS (WGS84, PZ90, etc.)
  - des produits de l'IGS
  - des références nationales
- Plus de 80% de références nationales sont alignées à l'ITRF (source UN-GGIM)