Coordinate reference systems in INSPIRE

1.2. Datum for three-dimensional and two-dimensional coordinate reference systems

For the three-dimensional and two-dimensional coordinate reference systems and the horizontal component of compound coordinate reference systems used for making spatial data sets available, the datum shall be the datum of the European Terrestrial Reference System 1989 (ETRS89) in areas within its geographical scope, or the datum of the International Terrestrial Reference System (ITRS) or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89. Compliant with the ITRS means that the system definition is based on the definition of the ITRS and there is a well documented relationship between both systems, according to EN ISO 19111.

1.3. Coordinate Reference Systems

Spatial data sets shall be made available using at least one of the coordinate reference systems specified in sections 1.3.1, 1.3.2 and 1.3.3, unless one of the conditions specified in section 1.3.4 holds.

1.3.1. *Three-dimensional Coordinate Reference Systems*

— Three-dimensional Cartesian coordinates based on a datum specified in 1.2 and using the parameters of the Geodetic Reference System 1980 (GRS80) ellipsoid.

— Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height) based on a datum specified in 1.2 and using the parameters of the GRS80 ellipsoid.

1.3.2. *Two-dimensional Coordinate Reference Systems*

— Two-dimensional geodetic coordinates (latitude and longitude) based on a datum specified in 1.2 and using the parameters of the GRS80 ellipsoid.

— Plane coordinates using the ETRS89 Lambert Azimuthal Equal Area coordinate reference system.

— Plane coordinates using the ETRS89 Lambert Conformal Conic coordinate reference system.

— Plane coordinates using the ETRS89 Transverse Mercator coordinate reference system.

IR interoperability of spatial data sets and services, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02010R1089-20141231&from=EN#tocId131

1.2. Datum for three-dimensional and two-dimensional coordinate reference systems

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— Three-dimensional Cartesian coordinates based on a datum specified in 1.2 and using the parameters of the Geodetic Reference System 1980 (GRS80) ellipsoid.

— Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height) based on a datum specified in 1.2 and using the parameters of the GRS80 ellipsoid.

1.3.2. *Two-dimensional Coordinate Reference Systems*

— Two-dimensional geodetic coordinates (latitude and longitude) based on a datum specified in 1.2 and using the parameters of the GRS80 ellipsoid.

— Plane coordinates using the ETRS89 Lambert Azimuthal Equal Area coordinate reference system.

— Plane coordinates using the ETRS89 Lambert Conformal Conic coordinate reference system.

— Plane coordinates using the ETRS89 Transverse Mercator coordinate reference system.

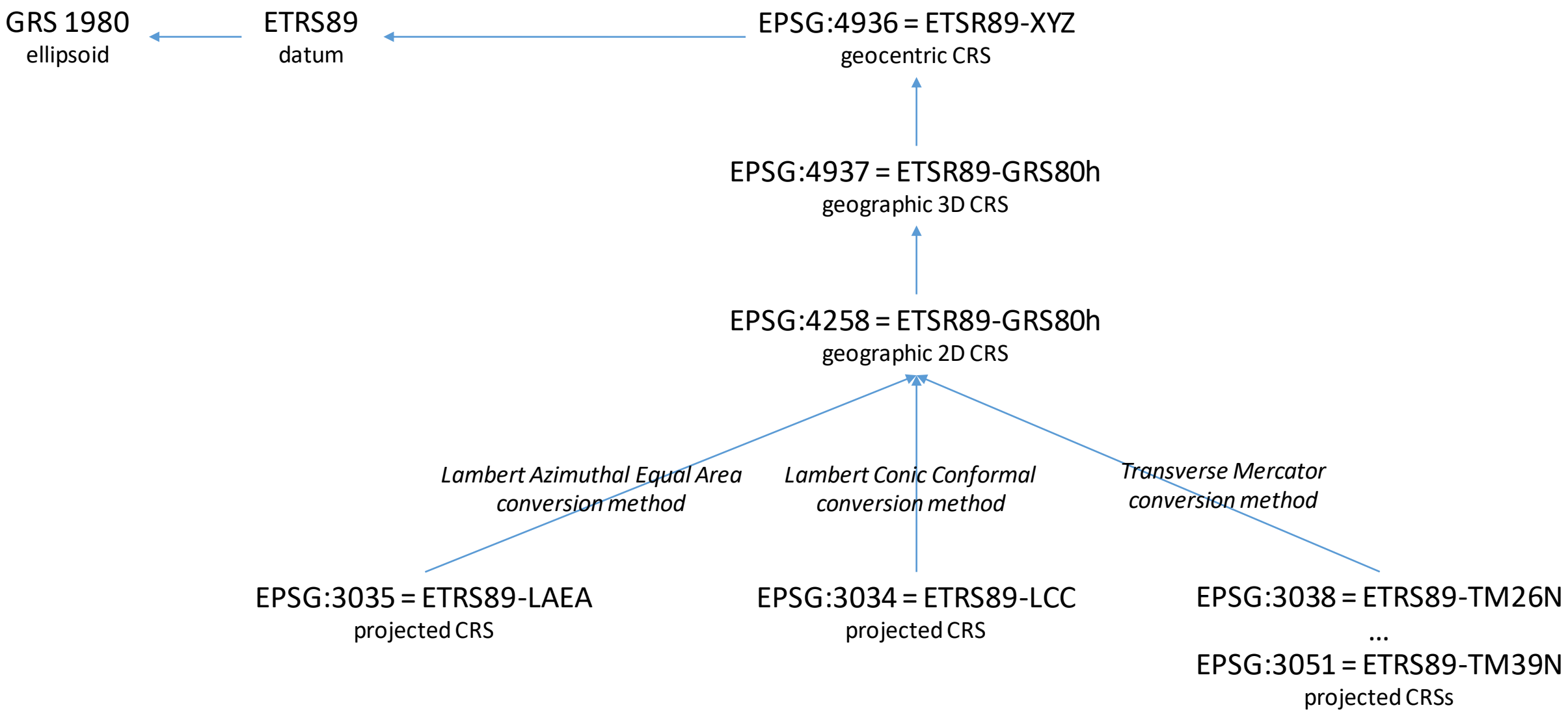
IR interoperability of spatial data sets and services, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02010R1089-20141231&from=EN#tocId131

TG Requirement 2	The identifiers listed in Table 2 shall be used for referring to the coordinate reference systems used in a data set.

NOTE CRS identifiers may be used e.g. in:
- data encoding,
- data set and service metadata, and
- requests to INSPIRE network services.

Table 2. http URIs for the default coordinate reference systems

Coordinate reference system	Short name	http URI identifier
3D Cartesian in ETRS89	ETRS89-XYZ	*http://www.opengis.net/def/crs/EPSG/0/4936*
3D geodetic in ETRS89 on GRS80	ETRS89-GRS80h	*http://www.opengis.net/def/crs/EPSG/0/4937*
2D geodetic in ETRS89 on GRS80	ETRS89-GRS80	*http://www.opengis.net/def/crs/EPSG/0/4258*
2D LAEA projection in ETRS89 on GRS80	ETRS89-LAEA	*http://www.opengis.net/def/crs/EPSG/0/3035*
2D LCC projection in ETRS89 on GRS80	ETRS89-LCC	*http://www.opengis.net/def/crs/EPSG/0/3034*
2D TM projection in ETRS89 on GRS80, zone 26N (30°W to 24°W)	ETRS89-TM26N	*http://www.opengis.net/def/crs/EPSG/0/3038*
2D TM projection in ETRS89 on GRS80, zone 27N (24°W to 18°W)	ETRS89-TM27N	*http://www.opengis.net/def/crs/EPSG/0/3039*
2D TM projection in ETRS89 on GRS80, zone 28N (18°W to 12°W)	ETRS89-TM28N	*http://www.opengis.net/def/crs/EPSG/0/3040*
2D TM projection in ETRS89 on GRS80, zone 29N (12°W to 6°W)	ETRS89-TM29N	*http://www.opengis.net/def/crs/EPSG/0/3041*
2D TM projection in ETRS89 on GRS80, zone 30N (6°W to 0°)	ETRS89-TM30N	*http://www.opengis.net/def/crs/EPSG/0/3042*
2D TM projection in ETRS89 on GRS80, zone 31N (0° to 6°E)	ETRS89-TM31N	*http://www.opengis.net/def/crs/EPSG/0/3043*
2D TM projection in ETRS89 on GRS80, zone 32N (6°E to 12°E)	ETRS89-TM32N	*http://www.opengis.net/def/crs/EPSG/0/3044*
2D TM projection in ETRS89 on GRS80, zone 33N (12°E to 18°E)	ETRS89-TM33N	*http://www.opengis.net/def/crs/EPSG/0/3045*
2D TM projection in ETRS89 on GRS80, zone 34N (18°E to 24°E)	ETRS89-TM34N	*http://www.opengis.net/def/crs/EPSG/0/3046*
2D TM projection in ETRS89 on GRS80, zone 35N (24°E to 30°E)	ETRS89-TM35N	*http://www.opengis.net/def/crs/EPSG/0/3047*
2D TM projection in ETRS89 on GRS80, zone 36N (30°E to 36°E)	ETRS89-TM36N	*http://www.opengis.net/def/crs/EPSG/0/3048*
2D TM projection in ETRS89 on GRS80, zone 37N (36°E to 42°E)	ETRS89-TM37N	*http://www.opengis.net/def/crs/EPSG/0/3049*
2D TM projection in ETRS89 on GRS80, zone 38N (42°E to 48°E)	ETRS89-TM38N	*http://www.opengis.net/def/crs/EPSG/0/3050*
2D TM projection in ETRS89 on GRS80, zone 39N (48°E to 54°E)	ETRS89-TM39N	*http://www.opengis.net/def/crs/EPSG/0/3051*
Height in EVRS	EVRS	*http://www.opengis.net/def/crs/EPSG/0/5730*
3D compound: 2D geodetic in ETRS89 on GRS80, and EVRS height	ETRS89-GRS80-EVRS	*http://www.opengis.net/def/crs/EPSG/0/7409*


GRS 1980
ellipsoid
ETRS89
datum
EPSG:4936 = ETSR89-XYZ
geocentric CRS
EPSG:4937 = ETSR89-GRS80h
geographic 3D CRS
EPSG:4258 = ETSR89-GRS80h
geographic 2D CRS
Lambert Azimuthal Equal Area
conversion method
Lambert Conic Conformal
conversion method
Transverse Mercator
conversion method
EPSG:3035 = ETRS89-LAEA
projected CRS
EPSG:3034 = ETRS89-LCC
projected CRS
EPSG:3038 = ETRS89-TM26N
...
EPSG:3051 = ETRS89-TM39N
projected CRSs

Lambert Azimuthal Equal Area conversion method

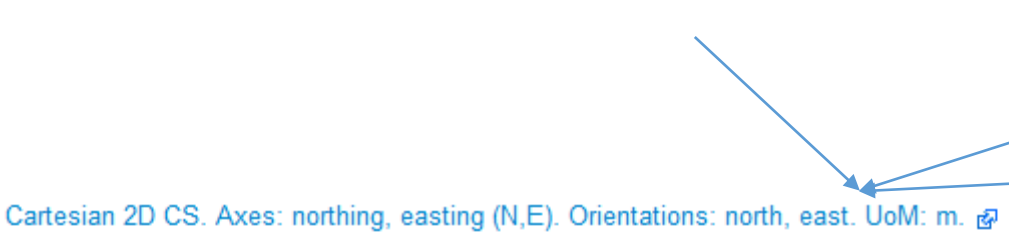
EPSG:3035 = ETRS89-LAEA
projected CRS

Lambert Conic Conformal conversion method

EPSG:3034 = ETRS89-LCC
projected CRS

Transverse Mercator conversion method

EPSG:3038 = ETRS89-TM26N
...
EPSG:3051 = ETRS89-TM39N
projected CRSs



Cartesian 2D CS. Axes: northing, easting (N,E). Orientations: north, east. UoM: m.

Coordinate System Details [VALID]

NAME:	Cartesian 2D CS. Axes: northing, easting (N,E). Orientations: north, east. UoM: m.
CODE:	4500
TYPE:	Cartesian
DIMENSION:	2

AXES:

Order	Name	Abbreviation	Direction	Unit
1	Northing	N	north	metre
2	Easting	E	east	metre

Lambert Azimuthal Equal Area conversion method

EPSG:3035 = ETRS89-LAEA
projected CRS

Lambert Conic Conformal conversion method

EPSG:3034 = ETRS89-LCC
projected CRS

Transverse Mercator conversion method

EPSG:3038 = ETRS89-TM26N
...
EPSG:3051 = ETRS89-TM39N
projected CRSs

Cartesian 2D CS. Axes: northing, easting (N,E). Orientations: north, east. UoM: m.

EPSG:25832 = ETRS89/UTM zone 32N
EPSG:25833 = ETRS89/UTM zone 33N
projected CRSs

Coordinate System Details [VALID]

NAME:	Cartesian 2D CS. Axes: northing, easting (N,E). Orientations: north, east. UoM: m.
CODE:	4500
TYPE:	Cartesian
DIMENSION:	2
AXES:	

Order
1
2

Cartesian 2D CS. Axes: easting, northing (E,N). Orientations: east, north. UoM: m.

Coordinate System Details [VALID]

NAME:	Cartesian 2D CS. Axes: easting, northing (E,N). Orientations: east, north. UoM: m.
CODE:	4400
TYPE:	Cartesian
DIMENSION:	2
AXES:	

Order	Name	Abbreviation	Direction	Unit
1	Easting	E	east	metre
2	Northing	N	north	metre

```
projinfo -o WKT2:2019 EPSG:25832
WKT2:2019 string:
PROJCRS["ETRS89 / UTM zone 32N",
    BASEGEOGCRS["ETRS89",
        DATUM["European Terrestrial Reference System 1989",
            ELLIPSOID["GRS 1980",6378137,298.257222101,
                LENGTHUNIT["metre",1]]],
        PRIMEM["Greenwich",0,
            ANGLEUNIT["degree",0.0174532925199433]],
        ID["EPSG",4258]],
    CONVERSION["UTM zone 32N",
        METHOD["Transverse Mercator",
            ID["EPSG",9807]],
        PARAMETER["Latitude of natural origin",0,
            ANGLEUNIT["degree",0.0174532925199433],
            ID["EPSG",8801]],
        PARAMETER["Longitude of natural origin",9,
            ANGLEUNIT["degree",0.0174532925199433],
            ID["EPSG",8802]],
        PARAMETER["Scale factor at natural origin",0.9996,
            SCALEUNIT["unity",1],
            ID["EPSG",8805]],
        PARAMETER["False easting",500000,
            LENGTHUNIT["metre",1],
            ID["EPSG",8806]],
        PARAMETER["False northing",0,
            LENGTHUNIT["metre",1],
            ID["EPSG",8807]]],
    CS[Cartesian,2],
        AXIS["(E)",east,
            ORDER[1],
            LENGTHUNIT["metre",1]],
        AXIS["(N)",north,
            ORDER[2],
            LENGTHUNIT["metre",1]],
    USAGE[
        SCOPE["unknown"],
        AREA["Europe - 6°E to 12°E and ETRS89 by country"],
        BBOX[38.76,6,83.92,12]],
    ID["EPSG",25832]]
```

```
projinfo -o WKT2:2019 EPSG:3044
WKT2:2019 string:
PROJCRS["ETRS89 / UTM zone 32N (N-E)",
    BASEGEOGCRS["ETRS89",
        DATUM["European Terrestrial Reference System 1989",
            ELLIPSOID["GRS 1980",6378137,298.257222101,
                LENGTHUNIT["metre",1]]],
        PRIMEM["Greenwich",0,
            ANGLEUNIT["degree",0.0174532925199433]],
        ID["EPSG",4258]],
    CONVERSION["UTM zone 32N",
        METHOD["Transverse Mercator",
            ID["EPSG",9807]],
        PARAMETER["Latitude of natural origin",0,
            ANGLEUNIT["degree",0.0174532925199433],
            ID["EPSG",8801]],
        PARAMETER["Longitude of natural origin",9,
            ANGLEUNIT["degree",0.0174532925199433],
            ID["EPSG",8802]],
        PARAMETER["Scale factor at natural origin",0.9996,
            SCALEUNIT["unity",1],
            ID["EPSG",8805]],
        PARAMETER["False easting",500000,
            LENGTHUNIT["metre",1],
            ID["EPSG",8806]],
        PARAMETER["False northing",0,
            LENGTHUNIT["metre",1],
            ID["EPSG",8807]]],
    CS[Cartesian,2],
        AXIS["northing (N)",north,
            ORDER[1],
            LENGTHUNIT["metre",1]],
        AXIS["easting (E)",east,
            ORDER[2],
            LENGTHUNIT["metre",1]],
    USAGE[
        SCOPE["unknown"],
        AREA["Europe - 6°E to 12°E and ETRS89 by country"],
        BBOX[38.76,6,83.92,12]],
    ID["EPSG",3044]]
```

parallel infrastructures?

Reference frame

The Danish reference frame currently in use is a realisation of the European Terrestrial Reference System 1989 (ETRS89).

Older data was typically referred to the European Datum 1950 (ED50).

Plane coordinates: UTM and DKTM

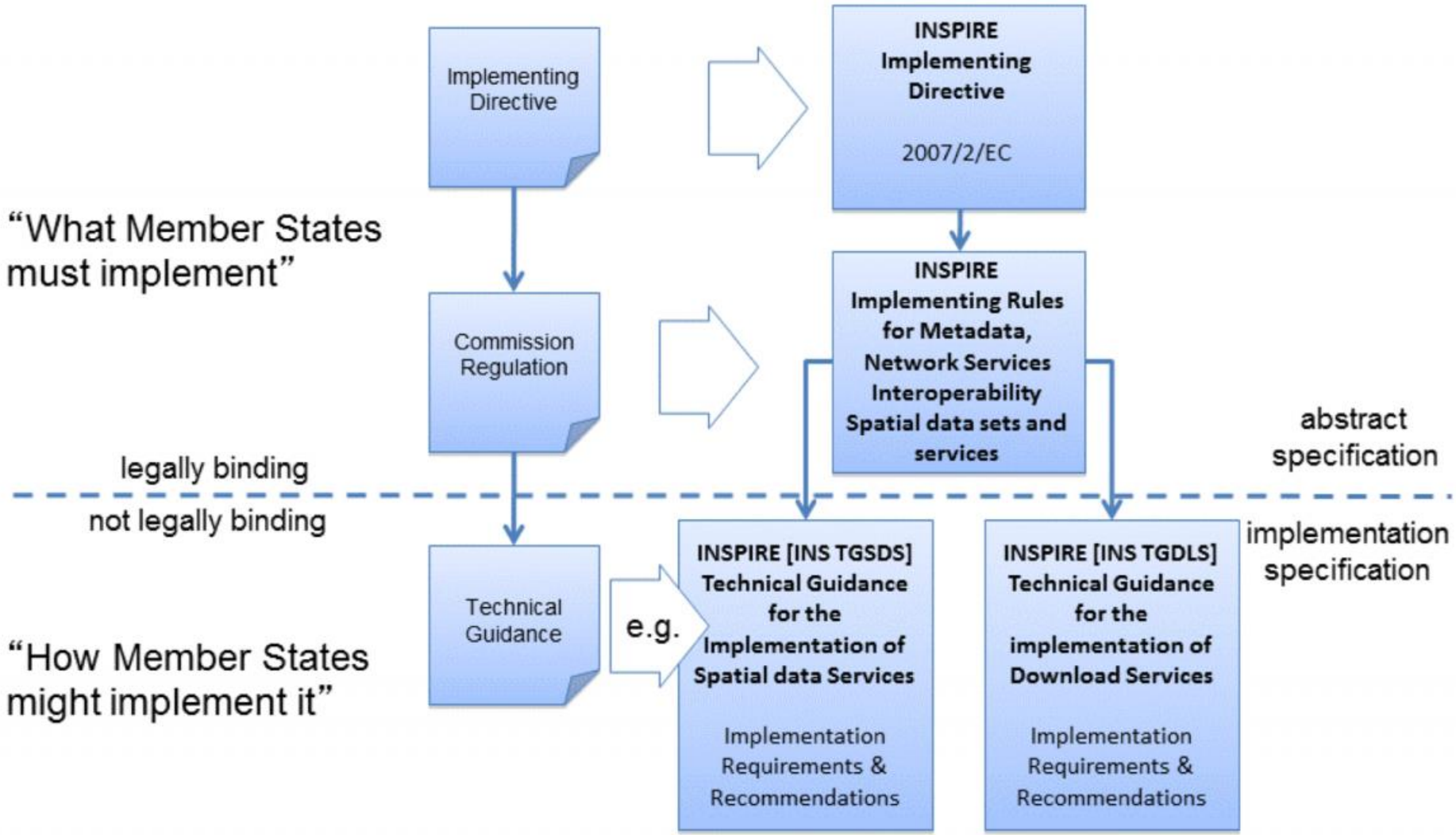
In Denmark, the primary plane coordinate system for mapping and planning is the Universal Transverse Mercator, UTM, referred to ETRS89. But as the Danish land mass crosses the border between two UTM zones (32 and 33), there are often slight adjustments to the formal UTM definition

Formally, zone 32 ends at 12E, west of Copenhagen; but zone 32 is often also used for the entire group of islands surrounding Zealand, leaving only Bornholm and its archipelago in zone 33.

The relevant EPSG codes are EPSG:25832 (UTM zone 32, ETRS89) and EPSG:25833 (UTM zone 33, ETRS89).

https://eng.sdfe.dk/product-and-services/professional-users/

Relationship between INSPIRE Implementing Rules and Technical Guidance



Other issues: deprecated codes

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2D geodetic in ETRS89 on GRS80	ETRS89-GRS80	*http://www.opengis.net/def/crs/EPSG/0/4258*
2D LAEA projection in ETRS89 on GRS80	ETRS89-LAEA	*http://www.opengis.net/def/crs/EPSG/0/3035*
2D LCC projection in ETRS89 on GRS80	ETRS89-LCC	*http://www.opengis.net/def/crs/EPSG/0/3034*
2D TM projection in ETRS89 on GRS80, zone 26N (30°W to 24°W)	ETRS89-TM26N	*http://www.opengis.net/def/crs/EPSG/0/3038*
2D TM projection in ETRS89 on GRS80, zone 27N (24°W to 18°W)	ETRS89-TM27N	*http://www.opengis.net/def/crs/EPSG/0/3039*
2D TM projection in ETRS89 on GRS80, zone 28N (18°W to 12°W)	ETRS89-TM28N	*http://www.opengis.net/def/crs/EPSG/0/3040*
2D TM projection in ETRS89 on GRS80, zone 29N (12°W to 6°W)	ETRS89-TM29N	*http://www.opengis.net/def/crs/EPSG/0/3041*
2D TM projection in ETRS89 on GRS80, zone 30N (6°W to 0°)	ETRS89-TM30N	*http://www.opengis.net/def/crs/EPSG/0/3042*
2D TM projection in ETRS89 on GRS80, zone 31N (0° to 6°E)	ETRS89-TM31N	*http://www.opengis.net/def/crs/EPSG/0/3043*
2D TM projection in ETRS89 on GRS80, zone 32N (6°E to 12°E)	ETRS89-TM32N	*http://www.opengis.net/def/crs/EPSG/0/3044*
2D TM projection in ETRS89 on GRS80, zone 33N (12°E to 18°E)	ETRS89-TM33N	*http://www.opengis.net/def/crs/EPSG/0/3045*
2D TM projection in ETRS89 on GRS80, zone 34N (18°E to 24°E)	ETRS89-TM34N	*http://www.opengis.net/def/crs/EPSG/0/3046*
2D TM projection in ETRS89 on GRS80, zone 35N (24°E to 30°E)	ETRS89-TM35N	*http://www.opengis.net/def/crs/EPSG/0/3047*
2D TM projection in ETRS89 on GRS80, zone 36N (30°E to 36°E)	ETRS89-TM36N	*http://www.opengis.net/def/crs/EPSG/0/3048*

deprecated in the EPSG registry

2D TM projection in ETRS89 on GRS80, zone 37N (36°E to 42°E)	ETRS89-TM37N	*http://www.opengis.net/def/crs/EPSG/0/3049*
2D TM projection in ETRS89 on GRS80, zone 38N (42°E to 48°E)	ETRS89-TM38N	*http://www.opengis.net/def/crs/EPSG/0/3050*
2D TM projection in ETRS89 on GRS80, zone 39N (48°E to 54°E)	ETRS89-TM39N	*http://www.opengis.net/def/crs/EPSG/0/3051*
Height in EVRS	EVRS	*http://www.opengis.net/def/crs/EPSG/0/5730*
3D compound: 2D geodetic in ETRS89 on GRS80, and EVRS height	ETRS89-GRS80-EVRS	*http://www.opengis.net/def/crs/EPSG/0/7409*

Other issues: 2.5D data

- Discussion needed on how to distribute 2.5D data
- EPSG:5730 (in the list of INSPIRE CRSs) has been replaced by EPSG:5621
- EVRF vs EVRS
- DVR90 height (Danish system, EPSG:5799) is not a realisation of the European Vertical Reference System