



International  
Association  
of Oil & Gas  
Producers

# Surveying & Positioning Guidance note 2

## Use of bin grids and coordinate reference systems in workstations

### Revision history

Version	Date	Amendments
1.1	May 2002	Incorporated ISO 19111 terminology
1.0	May 1998	First release

### 1 Introduction

Seismic bin grids are related to the earth through a projected coordinate reference system (projected CRS). Projected CRSs contain distortion. The distortion changes differ between projection transformation methods and also by geographical location within a particular projected CRS area. Bin grids inherit this distortion. In general changing from one CRS to another will alter the distortion. This may have implications for the properties of a seismic bin grid, constructed to have orthogonal axes and equally sized bins. This guideline highlights potential pitfalls associated with the use of CRSs in seismic workstations.

### 2 Map distortion

Mathematical cartographers have studied the distortions and produced projection methods (coordinate conversion formulae) in which the behaviour of the distortions is controlled. Projection methods in common use have names such as “Albers Equal Area” (which controls distortion of area), “Lambert Conic Conformal”, “Transverse Mercator” (both of which control angular distortion), *etc.*

Projection distortions that are important to the oil industry are:

- angle distortion. This results in map grid north differing from true north. The difference is known as “grid convergence”. It varies across a map grid, generally from 0 to  $\pm 3$  degrees. At any particular point the convergence on different CRSs will not be the same. The practical effect of this is that the relative direction of north may differ by up to 6 degrees. Care needs to be taken to ensure a correct understanding of the sign convention for convergence.
- linear distortions. Because of distortions in length inherent in most map projections, distances measured on a map are only approximate. So too are areas. If projections are used within their designed area of use the errors in distance are no greater than 1 part in 1000 - not significant for most exploration purposes. However, if the projections are used beyond their designed area - usually more than 3 or 4 degrees from the origin - the errors increase exponentially.

#### Conversion of gridded data

A significant problem associated with projection distortion is that the distortions on two map grids are different. Because of this it is not possible to convert a grid from one coordinate reference system to another and retain the orthogonal property of the grid. This can be a problem if partners adopt different coordinate reference systems for working the same area. It may be impossible to merge the two sets of work exactly - errors of several hundred metres could be present.

### 3 Coordinate handling in workstations

The choice of coordinate reference system is important when projects are created in workstations or databases

- consult an expert.
- reach early agreement with partners.

For applications which define the location of the seismic grid through three points on a map grid, ensure these embrace the whole project area and that coordinate precision is adequate.

For applications which define the location of the seismic grid by the map grid location of one corner and an orientation, it is essential that the orientation is relative to the correct north. If the projected CRS of the workstation project is different to that used for the seismic grid definition, the difference in convergence must be applied to the defined seismic grid orientation.

Quality Assurance procedures are required for checking that there has been no loss of positional integrity of seismic data during data loading. The procedures should include:

- ensuring that a seismic bin grid definition accompanies every processed seismic data set. The UKOOA Bin Grid Definition (P6/98) is recommended.
- for two or three sample locations throughout the project area, note bin grid values from workstation.
- scale off location map grid coordinates at workstation.
- using the UKOOA bin grid definition, convert the bin cell inline/crossline values to map grid.
- compare these with coordinates scaled from the workstation. Any significant difference suggests a problem with the loading of data to the workstation.

It would clearly be preferable that bin grid definitions in an industry standard format were included within digital seismic data sets, and that this definition was read and applied by workstation loading software. Seismic processing contractors and workstation vendors are encouraged to include these functions within their products.

### 4 Terminology

#### Coordinate system

set of mathematical rules for specifying how coordinates are to be assigned to points.

#### Coordinate Reference System

a coordinate system related to the Earth through a datum.

#### Projected Coordinate Reference System

two-dimensional Cartesian coordinate reference system resulting from applying a map projection to a geographic coordinate reference system

#### Projection Method

the ensemble of mathematical formulae used to create a projected CRS

#### Map grid

grid of equally spaced orthogonal lines constructed on a projected CRS



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