

SOFA's Earth Orientation Routines

- Look at the SOFA website www.iausofa.org
Library of routines in Fortran 77 & ANSI C
Routines are building blocks
- Look at specific routines for:
 - X, Y CIP, s the CIO locator & Earth rotation angle
 - Matrices: CRS to:
CIRS, TIRS and the ITRS
- Example programs

C2I—Celestial to Intermediate Matrix

EXAMPLE 1 – Generating matrix **C** in a 1-step process

- Using SOFA routines (IAU 2006/2000A) **C** may be calculated directly

```
CALL iau_C2I06A ( TT1, TT2, C )
```

- **06** => IAU 2006 + small adjustments **A** => IAU 2000A
- TT1, TT2 the required instant expressed as Julian date and fraction, split into two arguments e.g.

TT1 = 2400000D0

TT2 = MJD

- Run Example

**All internal
SOFA Routines**

CIP (X,Y) & CIO Locator (s) & the C2I Matrix C

EXAMPLES 2 & 3: A 2-step process

- **Step 1a:** Series representation for X,Y of CIP

```
CALL iau_XY06 ( TT1, TT2, X, Y )
```

Series form,
IAU
2006/2000A

```
S = iau_s06 ( TT1, TT2, X, Y )
```

*Angles in
radians*

OR

- **Step 1b:** Bias-precession-nutation angle formulation for X,Y

```
CALL iau_XYS06A ( TT1, TT2, X, Y, S )
```

SOFA's routines,
IAU 2006/2000A

- **Step 2:** Form matrix with **DX, DY** from IERS

```
CALL iau_C2IXYS ( X+DX, Y+DY, S, C )
```

- Run Examples

C2T—Celestial to ITRS – Example 4

Method A – Generating matrix \mathbf{Q} in a 1-step process

- Using SOFA routines (IAU 2006/2000A) \mathbf{Q} may be calculated directly

```
CALL iau_C2T06A ( TT1, TT2, UT1A, UT1B, XP, YP, Q )
```

- 06** => IAU 2006 + small adjustments + **A** => IAU 2000A
- TT** and
- UT1** instant required
- XP, YP IERS coordinates of CIP wrt ITRS

**All internal
SOFA Routines**

- IERS: \mathbf{Q}^{-1} as IERS provide **Terrestrial** => Celestial transformation

ERA, Polar Motion and Matrix Q

Method B: A 2-step process

- **Step 1:** Earth rotation angle

ERA = iau_ERA00 (UT1A, UT1B)

Needs IERS
UT1-UTC

- **Step 2:** Polar motion matrix (**W**), GCRS → CIRS → ITRS

SP = iau_SP00 (TT1, TT2)

CALL iau_POM00 (XP, YP, SP, W)

CALL iau_C2TCIO (C, ERA, W, Q)

IERS-user
supplied

- Run Example 4

ERA, Matrix Q (No Polar Motion)

Method B: A 2-step process

- **Step 1:** Earth rotation angle

ERA = [iau_ERA00](#) (UT1A, UT1B)

- **Step 2:** GCRS->CIRS (matrix **C**) → TIRS (i.e. no polar motion)

```
CALL iau_CR ( C, Q ) ! Copy matrix
```

```
CALL iau_RZ ( ERA, Q )
```

Finally

- Example Fortran and ANSI C programs plus output will be available, also these slides.
- If you have further questions e-mail me Catherine.Hohenkerk@ukho.gov.uk or at sofa@ukho.gov.uk

Thank You