Proposal for a new dissemination of time scales

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- Continuous series of [*UT1- TAI*] for the period 1955-2003 (corrected for secular variation).

- « predicted series » of [*UT1-UTC*] based on a simple extrapolation over 2 (3) years.

- Analyzed the deviation « real-predicted »data.

- Inconveniences of leap seconds.

- Proposal (personal point of view of the authors)

Continuous series [*UT1-TAI*] since 1955

- 1955 - 1975: Bulletin Horaire (BIH)
BIH Annual Report
  - 1955, NPL (atomic time)
  - 1971, International Atomic Time (TAI)
- 1975 - 2003: IERS series EOP C02

Values of UT1-TAI at 5-day intervals

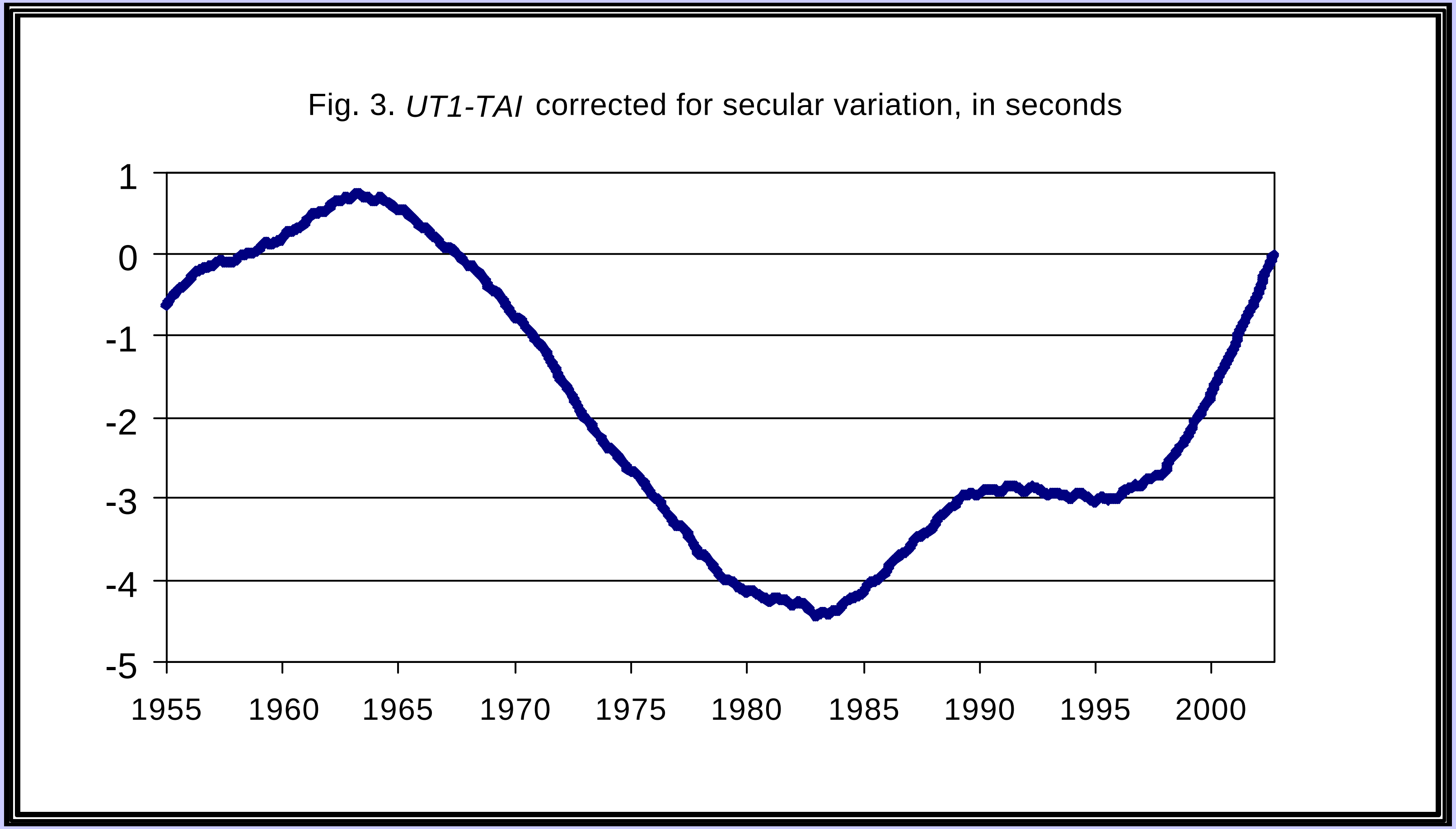
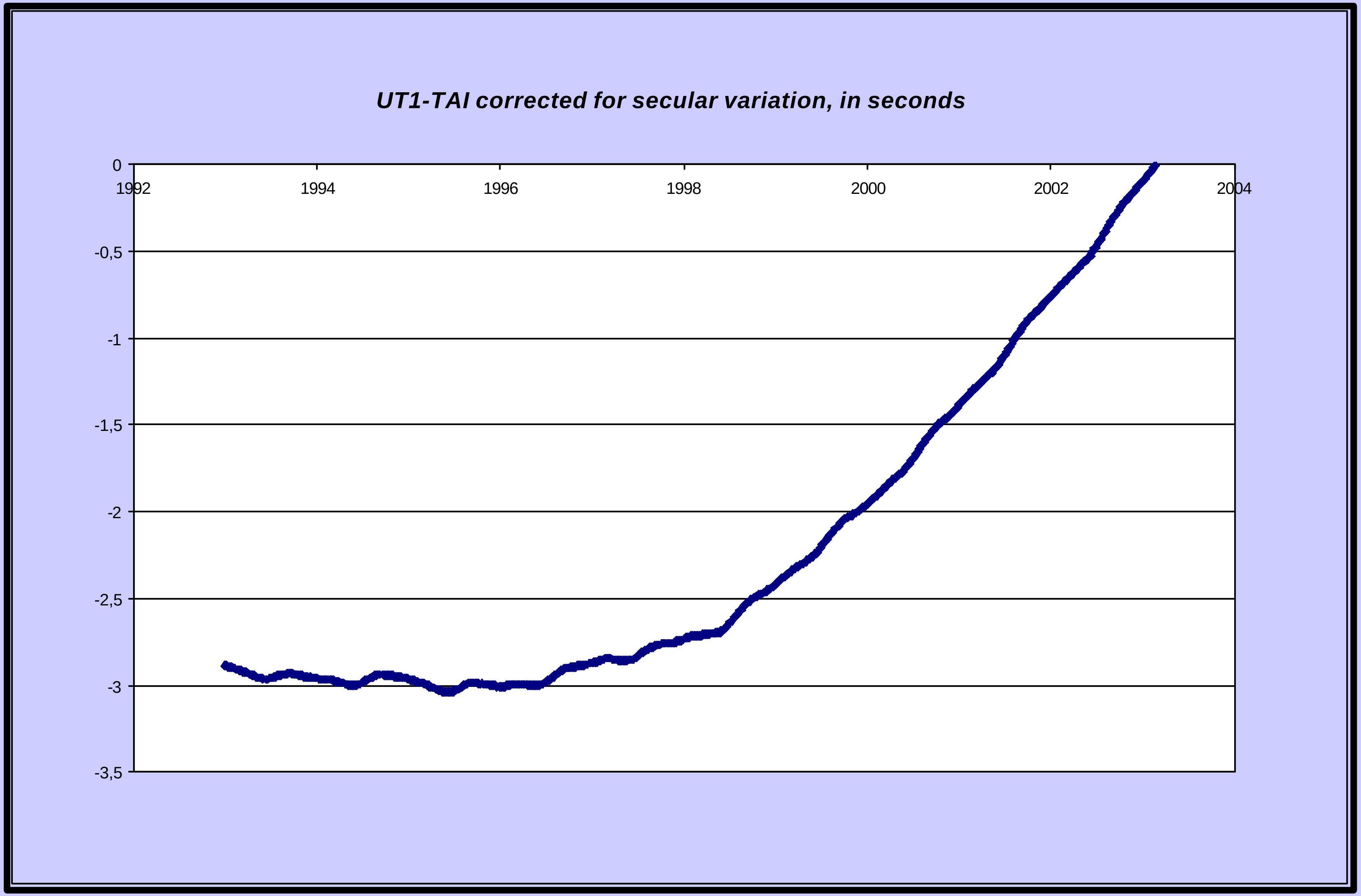
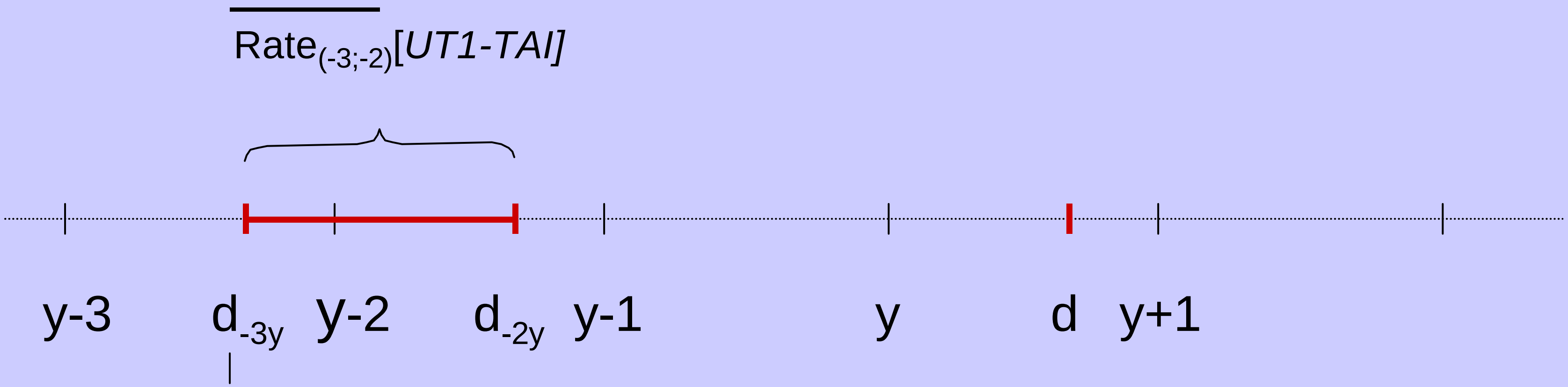


Fig. 3. UT1-TAI corrected for secular variation, in seconds
1
0
-1
-2
-3
-4
-5
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000



UT1-TAI corrected for secular variation, in seconds
0
-0,5
-1
-1,5
-2
-2,5
-3
-3,5
1992
1994
1996
1998
2000
2002
2004

Prediction of *UT1 - UTC* over 2 to 3 years



$$[UT1\text{-}TAI](d) = (d\text{-}2y) + \overline{\text{Rate}}_{(-3;-2)} \times 2y$$

Fig. 4. Two-year prediction of *UT1-TAI* (observed - predicted) in seconds

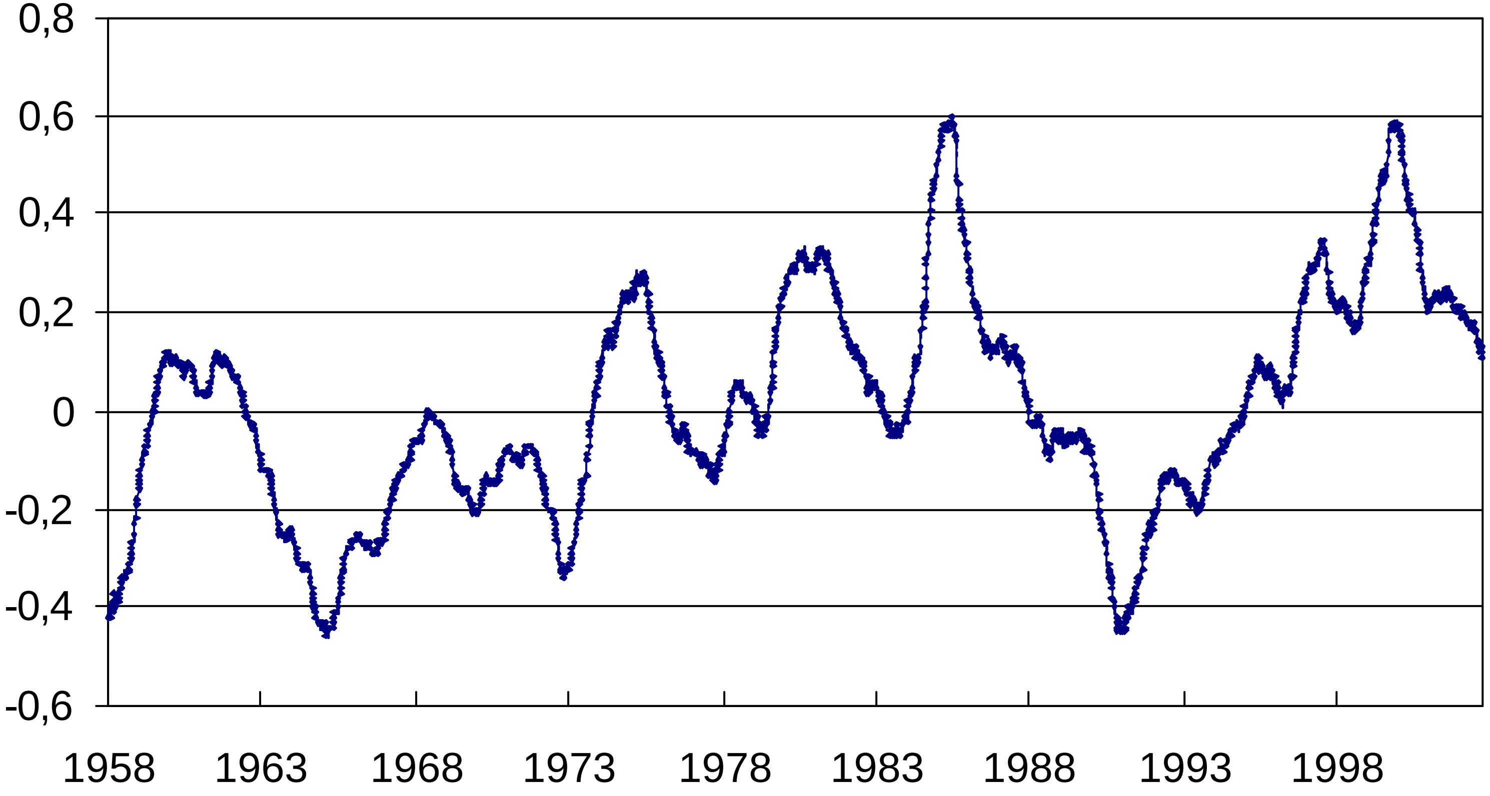
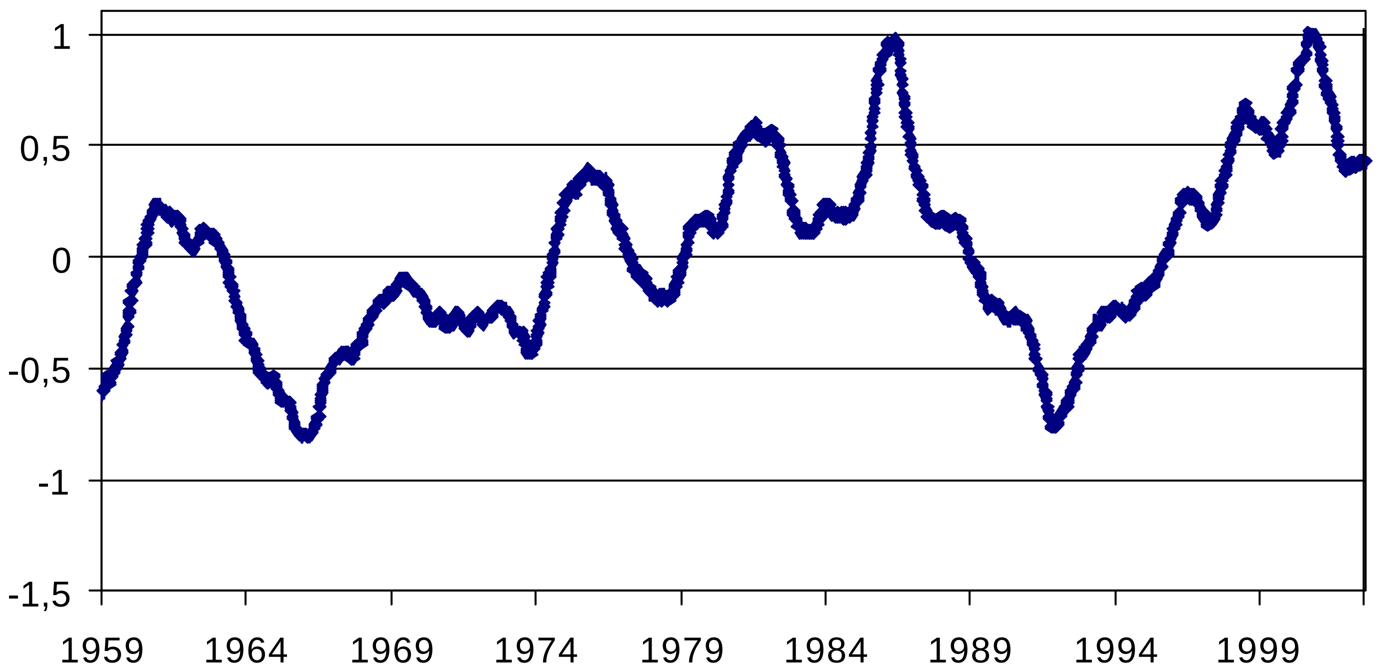


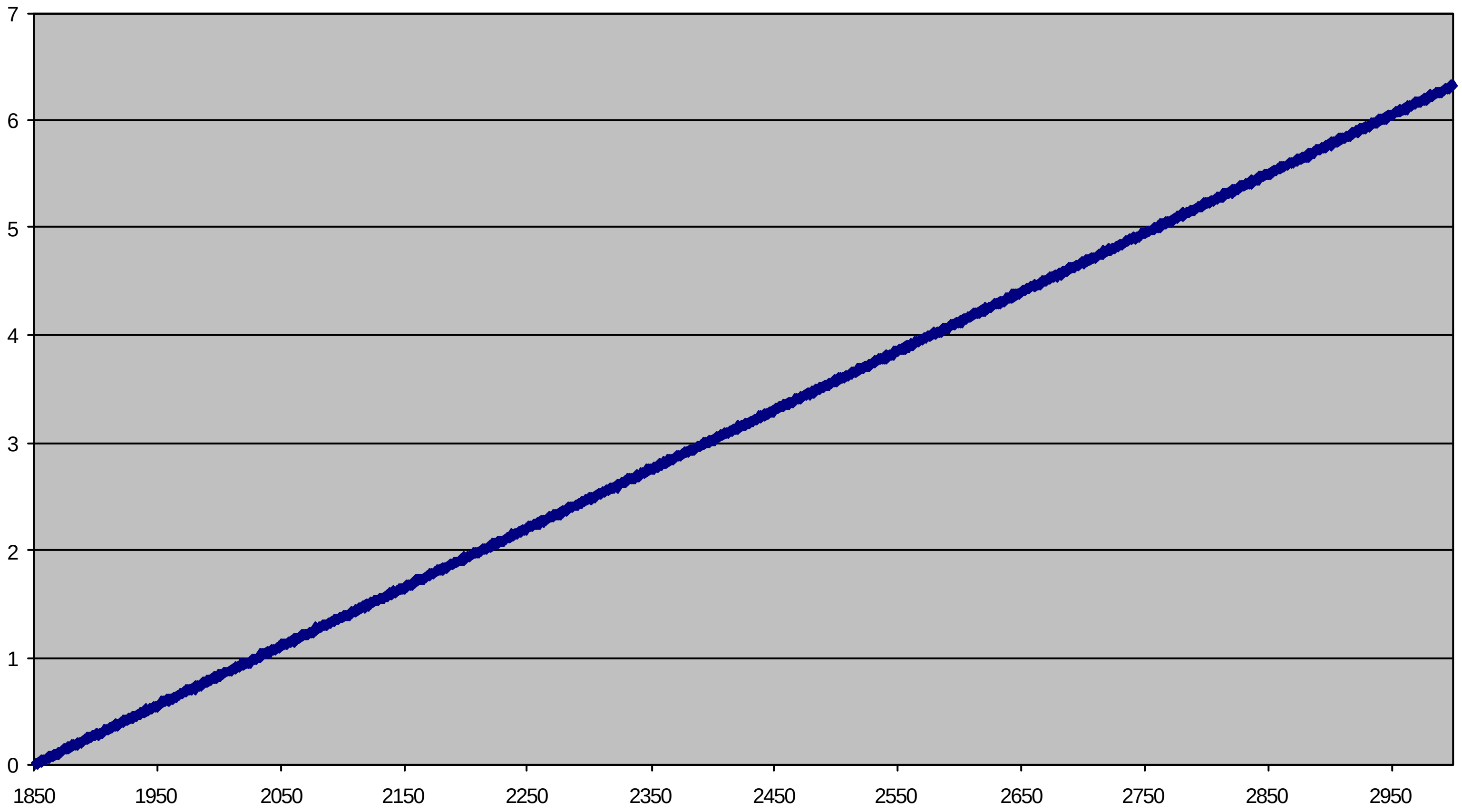
Fig. 5. Three-year prediction of *UT1-TAI* (observed - predicted) in seconds



Why are leap seconds becoming increasingly inconvenient?

- Growing need of a continuous time scale;
- [*UTC - TAI*] increases at irregular intervals;
- ambiguous dating in UTC at the moment of occurrence of the leap second;
- frequency of occurrence of (positive) leap seconds will increase in the long term; decade fluctuations of the Earth ’s rotation may lead to 2 leap seconds per year;

Fig. 9. Number of leap seconds per year



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- frequency of occurrence of (positive) leap seconds will increase in the long term; decade fluctuations of the Earth 's rotation may lead to 2 leap seconds per year;
- the present situation favours the proliferation of time scales (GPS, GLONASS, GALILEO).

consequently...

…

- adoption of a continuous, world-wide time scale (or at least continuous for several centuries);
- single change;
- users should be given enough time to get adapted to the new situation before application;
- during this period of preparation UTC should be kept as it is.

Possible solutions

I	II
(continuity is assured)	(discontinuous in the very long term)

I (continuity is assured)

- TAI should be the world-wide time scale (renamed TI);
- step to UTC to align it to TAI at the moment of application;
- legal times based on TAI by correction of an integer nb. of hours (system of time zones at present not fully respected).

II (discontinuous in the very long term)

- TAI should be preserved as it is; UTC should be maintained but under a new definition;
- interrupt the application of leap seconds to UTC, add a leap hour in the far distant future (2600?);
- legal times continue to be based on the new UTC.

Access to UT1

- dissemination of data depending on UT1 is essential;
- annual ephemerides (1 s precision) based on a prediction of [*UT1-TAI*] the time argument being
  - TAI (proposal I)
  - UTC (proposal II)
- IERS (or any responsible authority for monitoring Earth rotation) should predict [*UT1-TAI*] for the ephemerides;
- for other needs of UT1 dissemination of values of
  - [*UT1-TAI*] (proposal I)
  - [*UT1-UTC*] (proposal II)

  either predicted for real time or observed for deferred time.