

Earth Rotation and Earth Orientation

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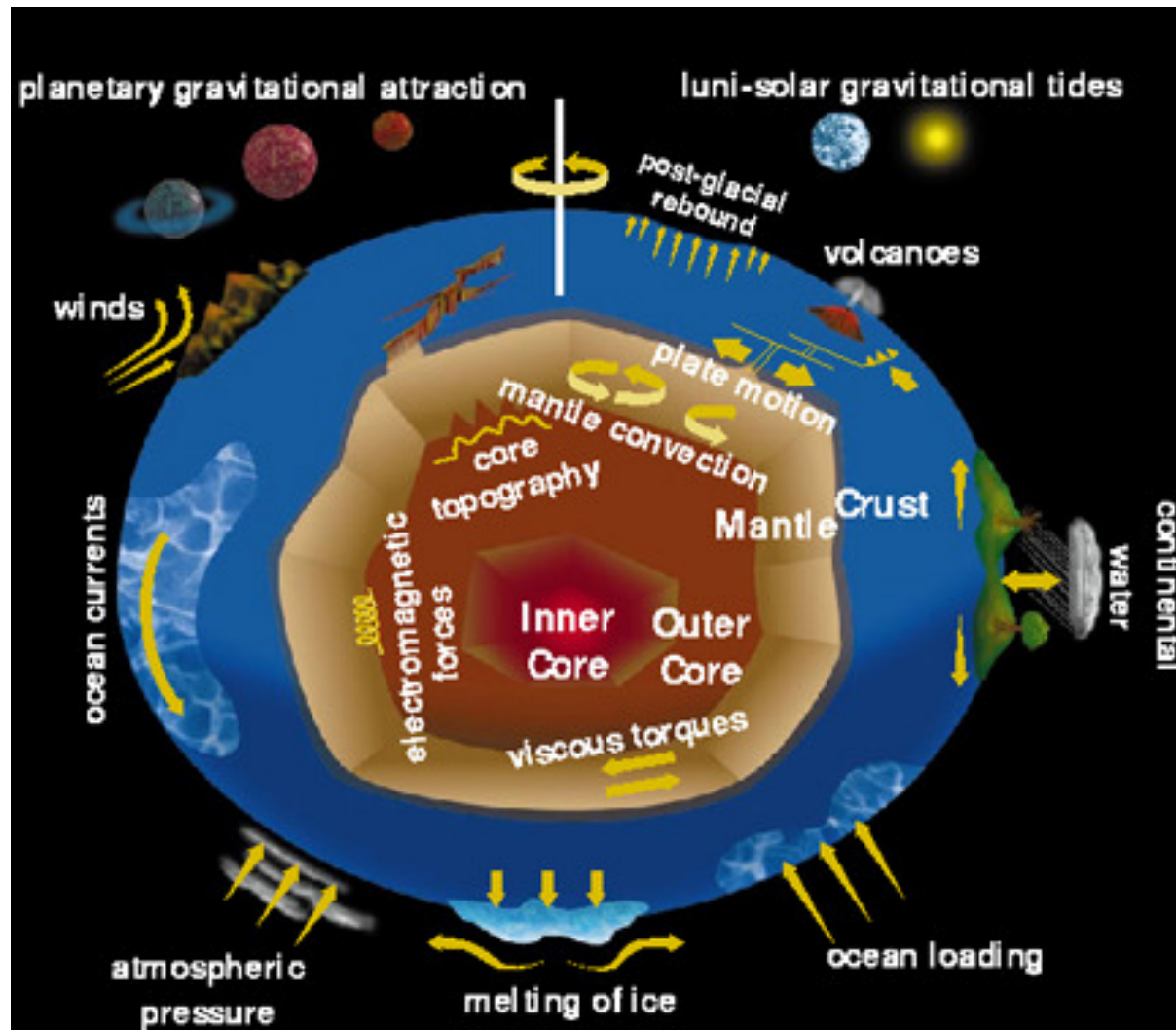
- Concept of Lecture
- Dynamical causes of Earth orientation variations
- Kinematic manifestations of Earth orientation variations
- VLBI observations of Earth orientation variations
- VLBI contributions to the International Earth Rotation and Reference Systems Service (IERS)

Concepts of Earth Rotation

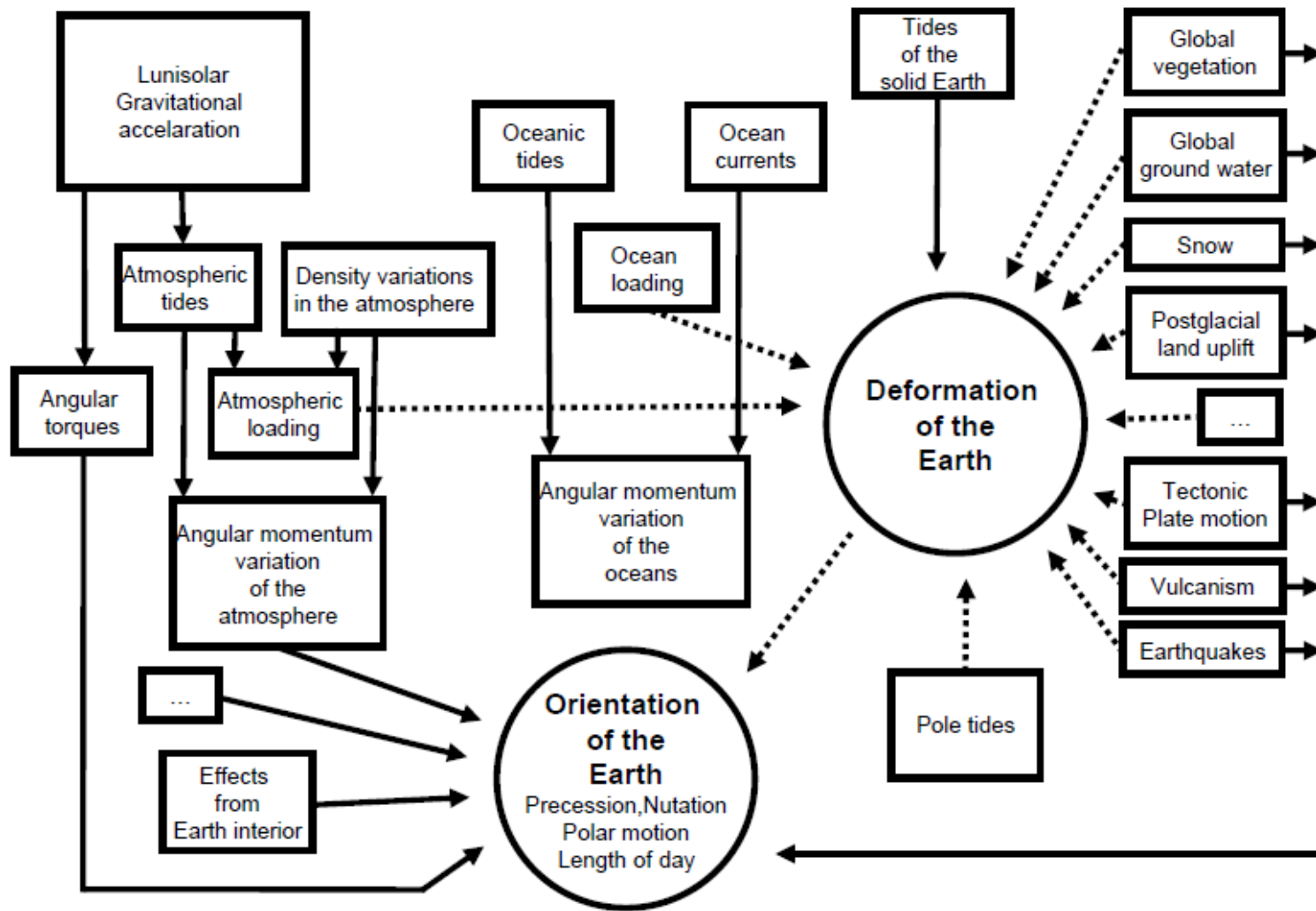
Earth rotation is an apparently regular motion. However, with increasing precision of the observations, Earth rotation appears more and more irregular. We are interested (only) in the irregular behaviour.

- Dynamics
 - Driving mechanisms
 - Correlations/Dependencies
- Kinematics
 - Earth fixed system in space fixed system
 - Earth rotation axis
- VLBI observations
 - Sensitivity of baselines
 - Results

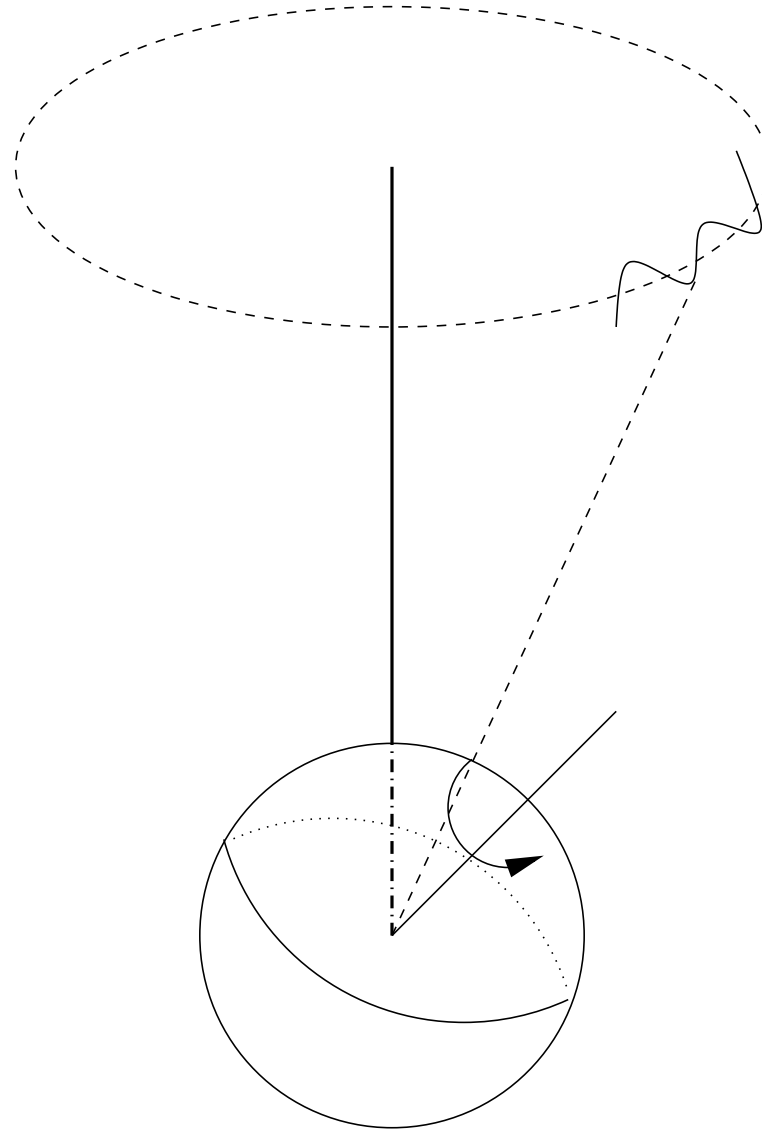
Causes of Earth Orientation Variations I



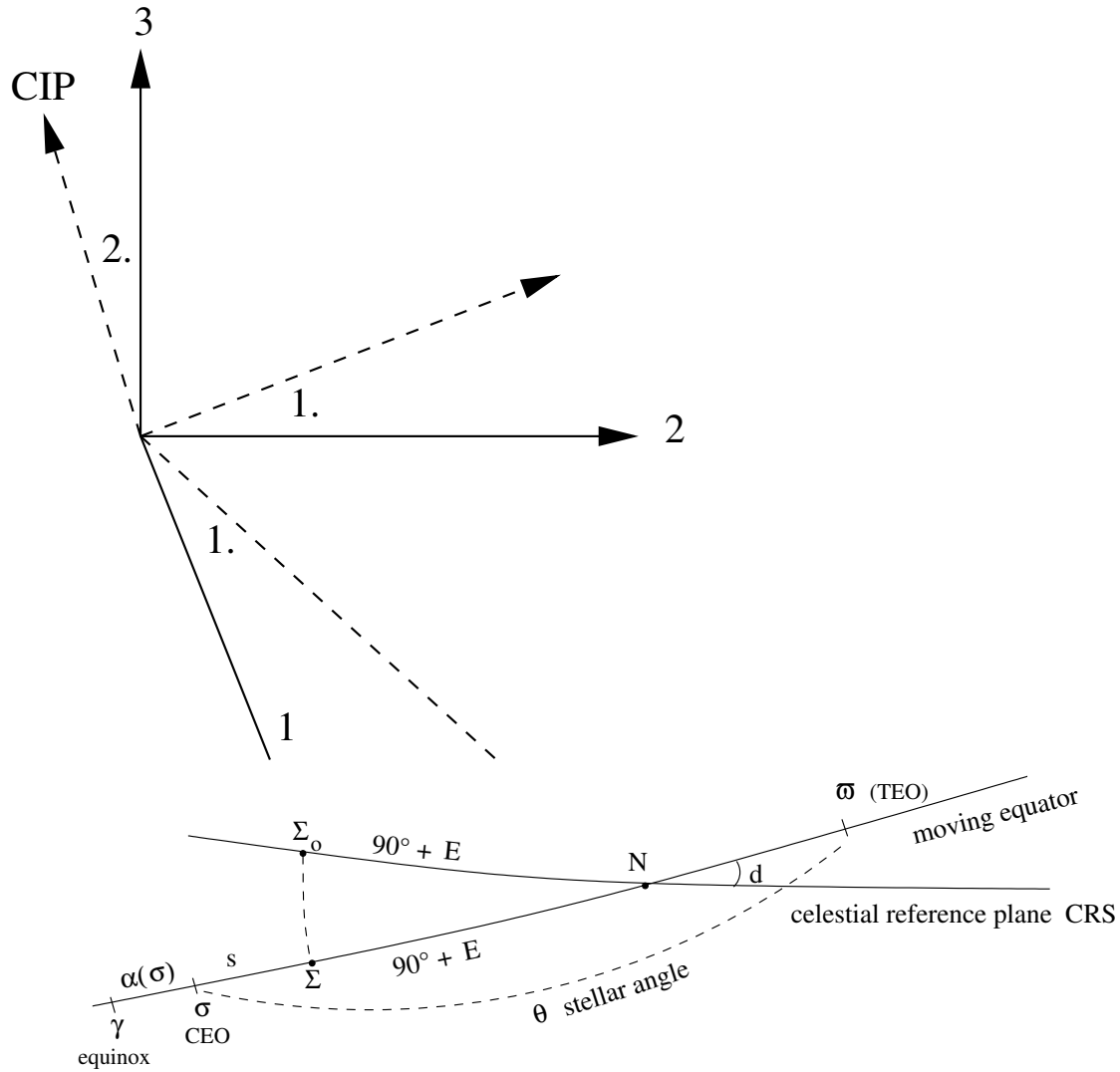
Causes of Earth Orientation Variations II



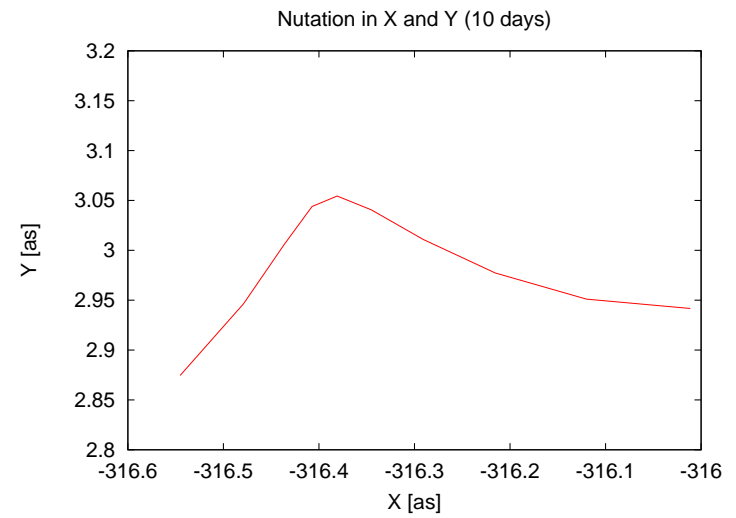
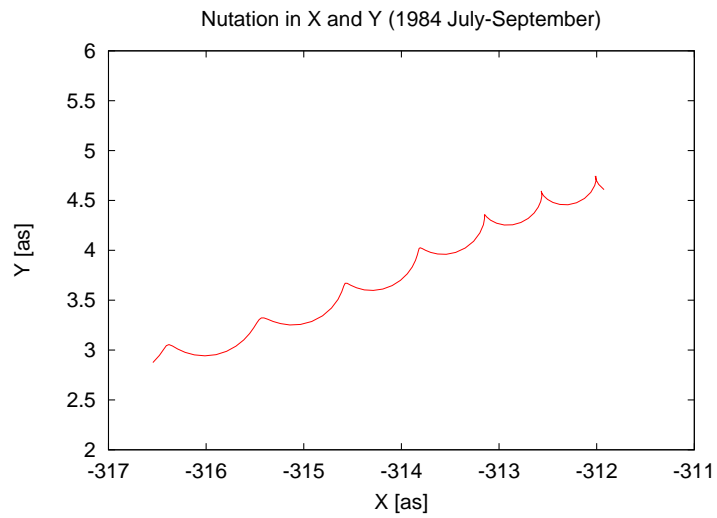
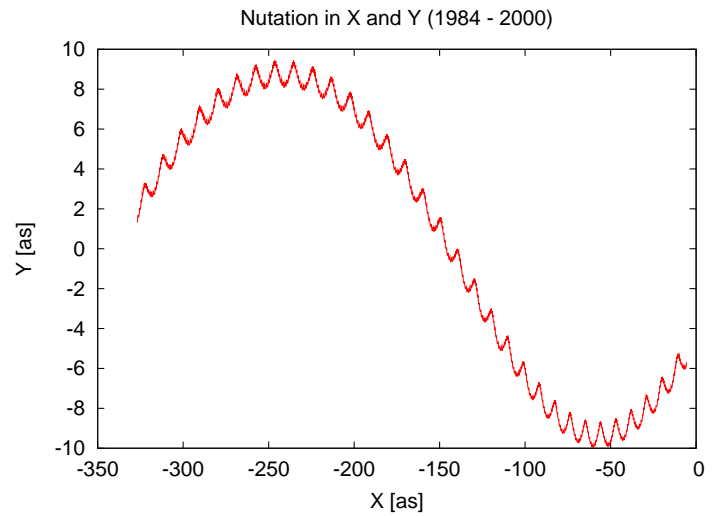
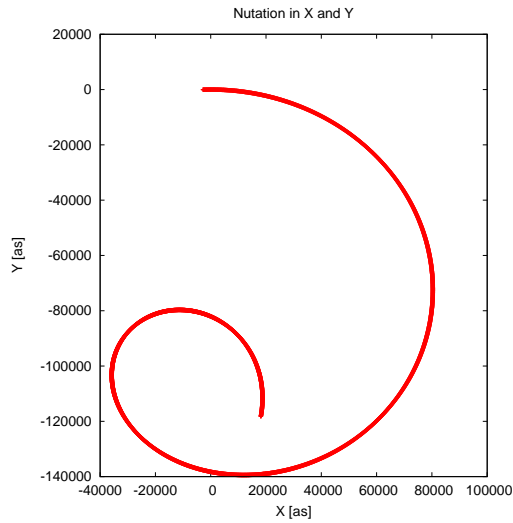
Precession/Nutation



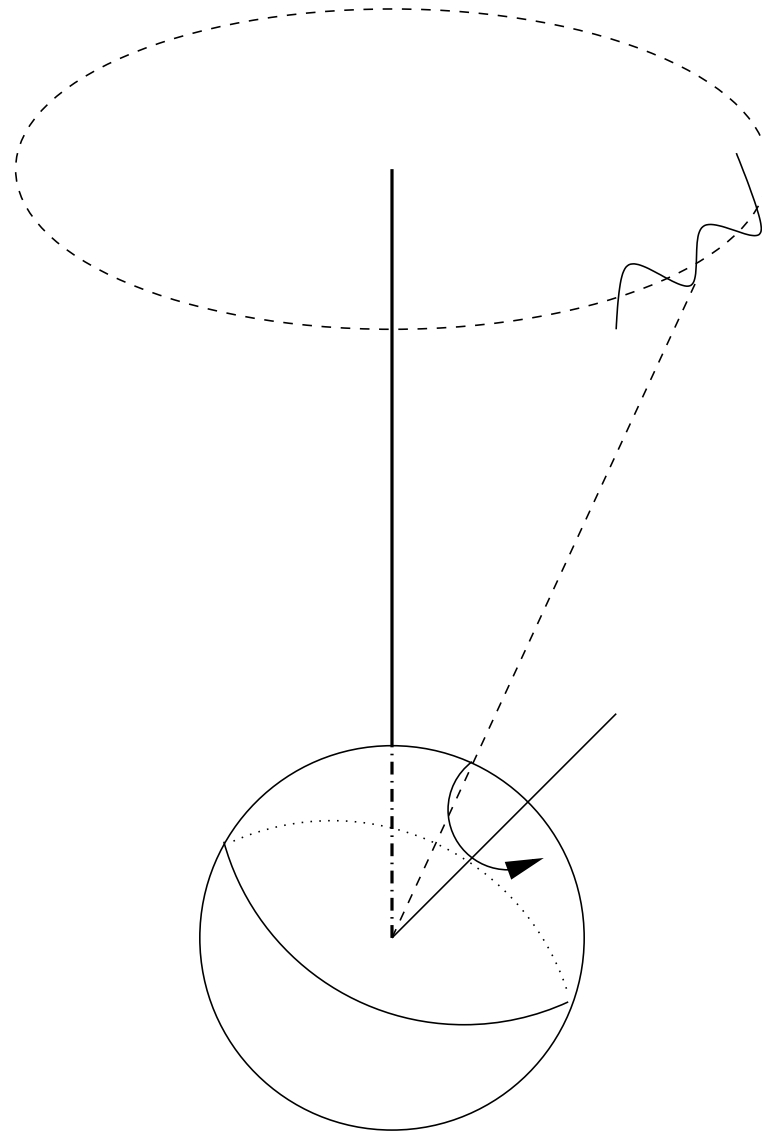
Precession/Nutation in X and Y



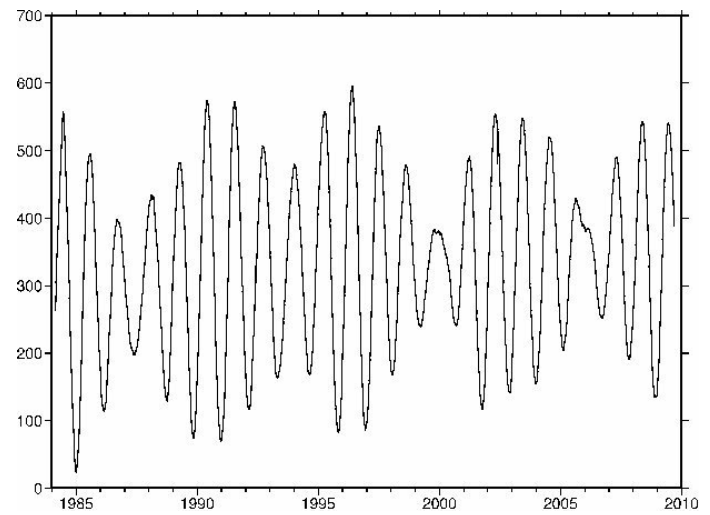
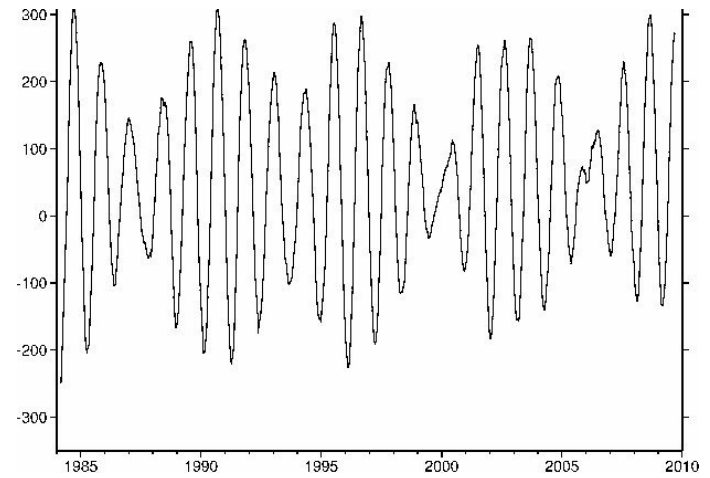
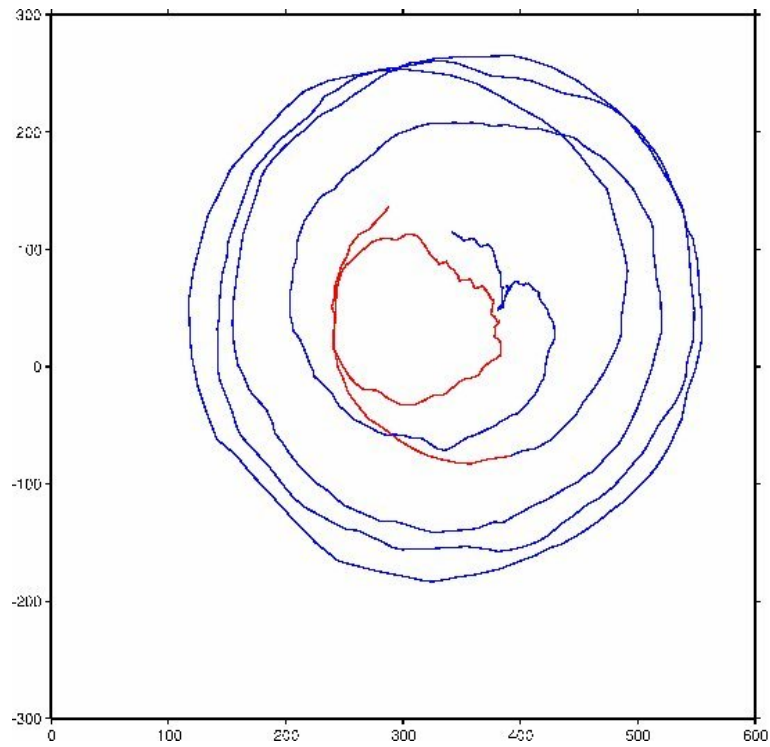
Precession/Nutation in X and Y



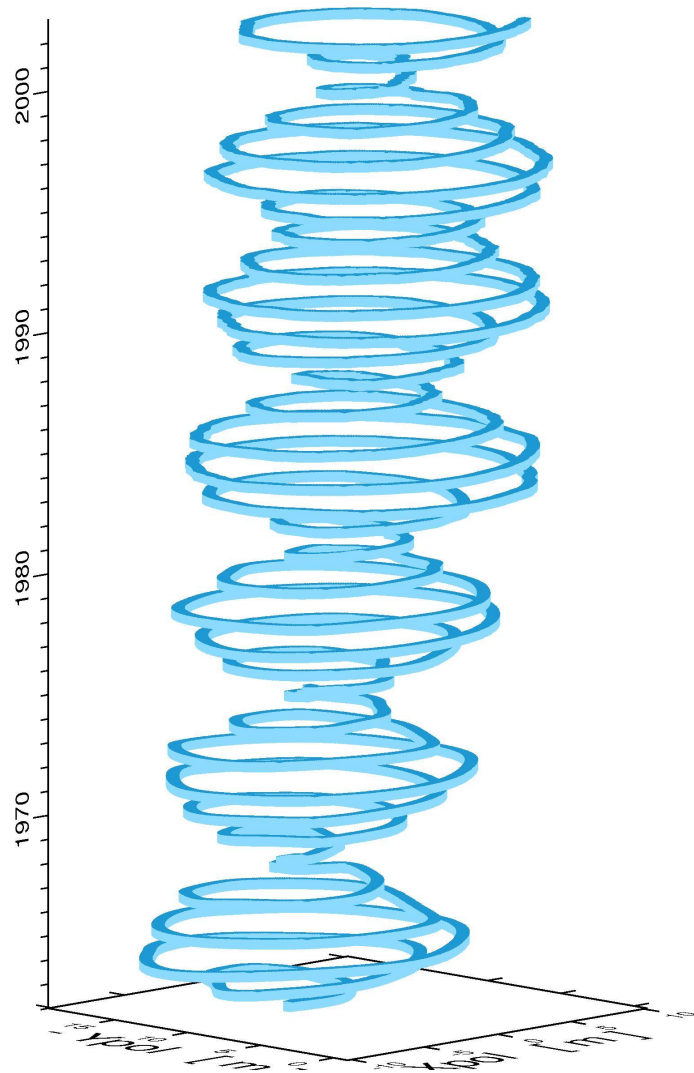
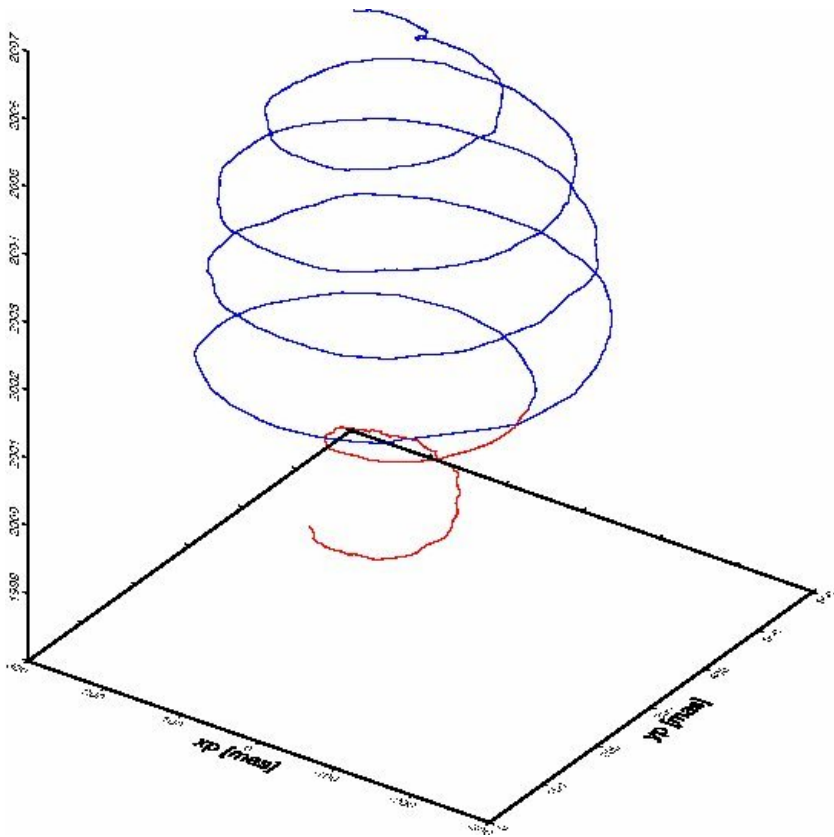
Polar Motion and Daily Rotation



Polar Motion 2D (x_p, y_p)

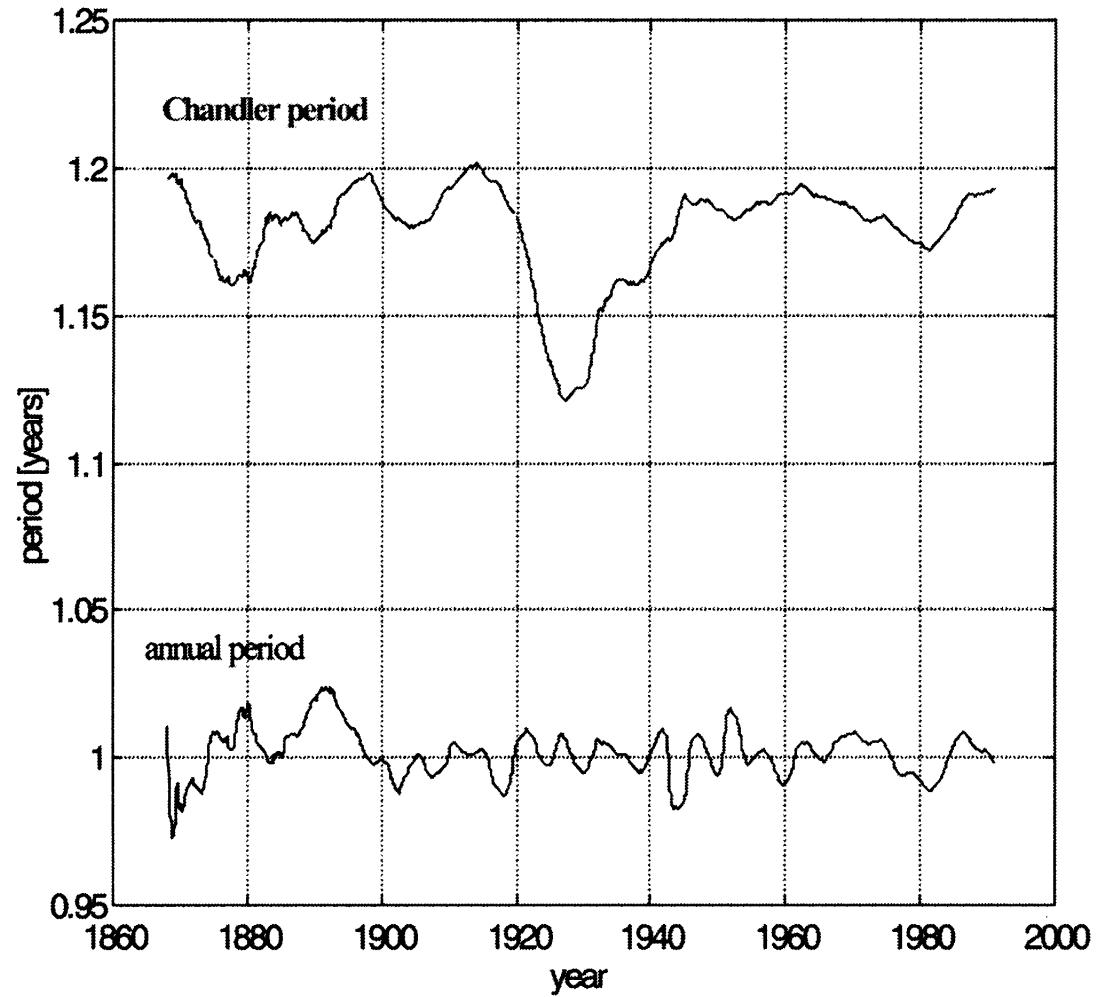


Polar Motion 3D



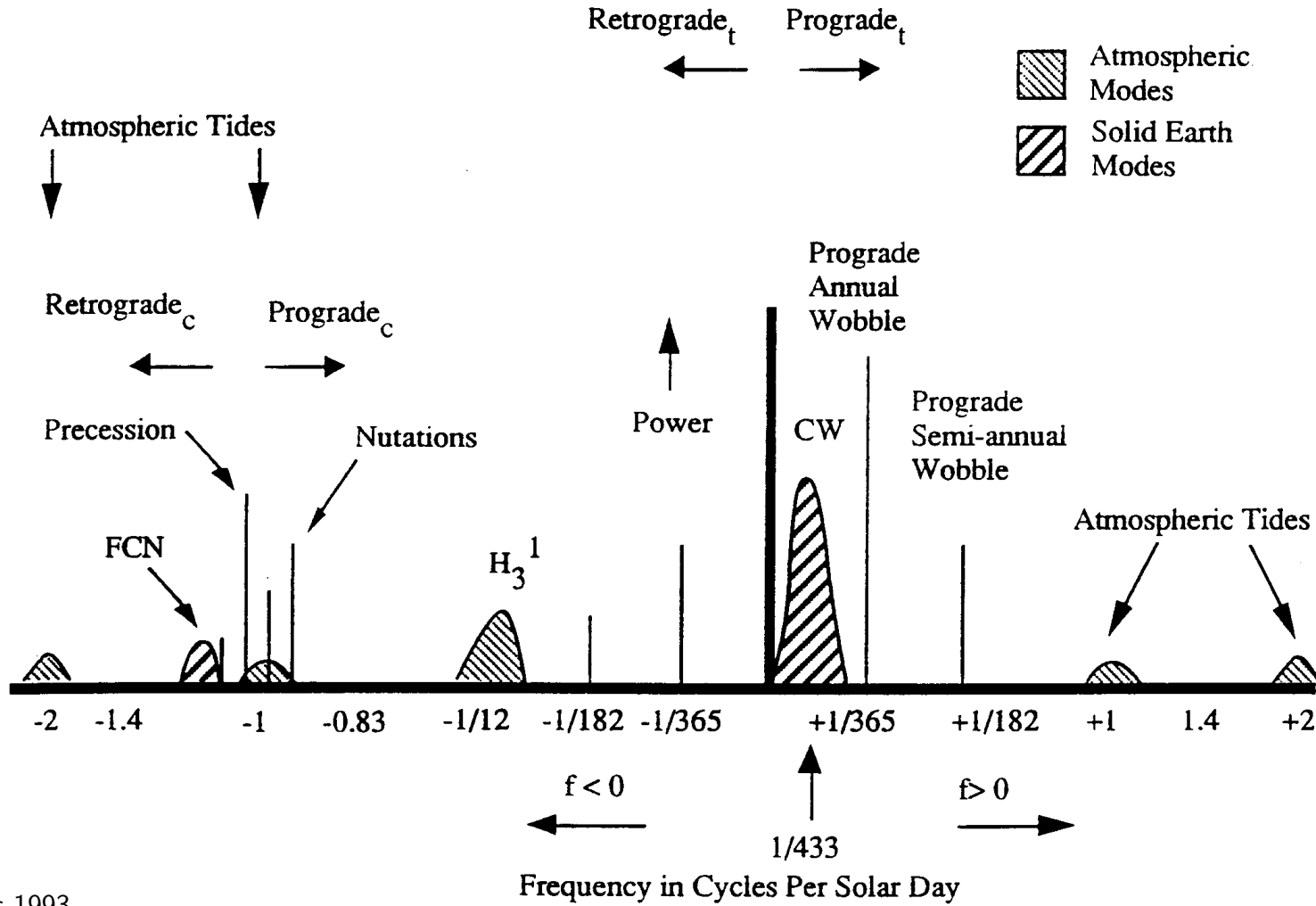
Chandler Wobble

a Variation of annual and Chandler period, IERS C01

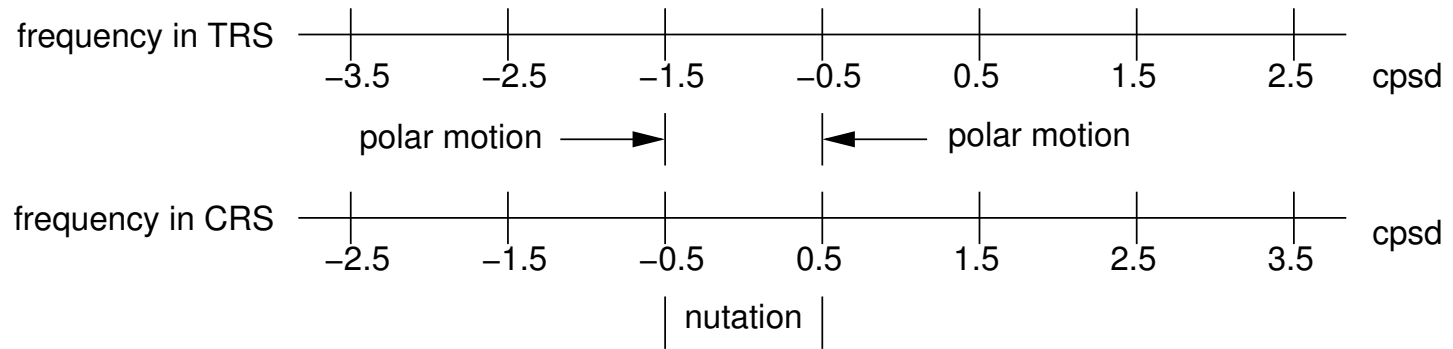


Spectrum of Polar Motion

Polar Motion Spectrum (schematic)



Separation of Precession/Nutation and Polar Motion

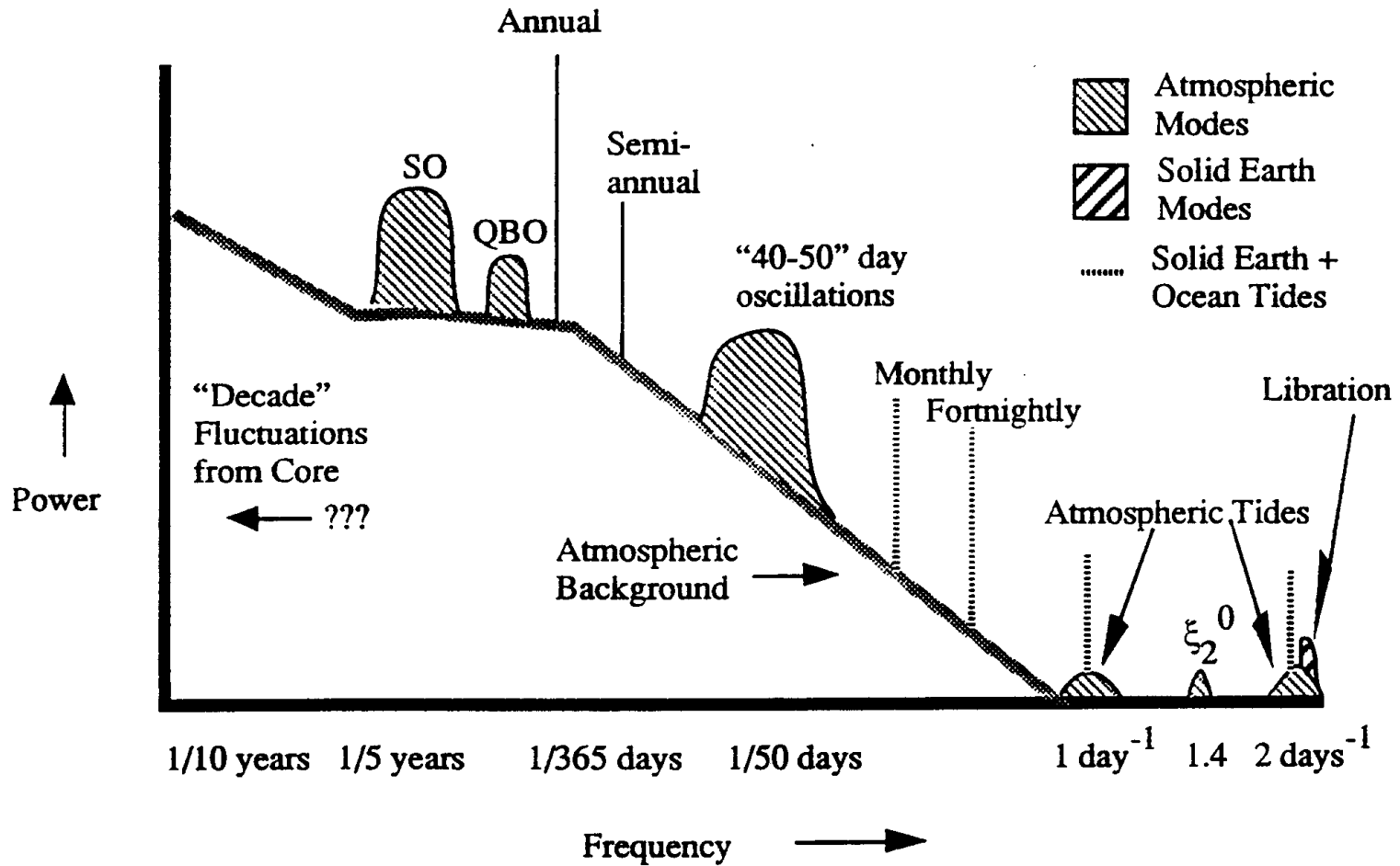


Daily rotation

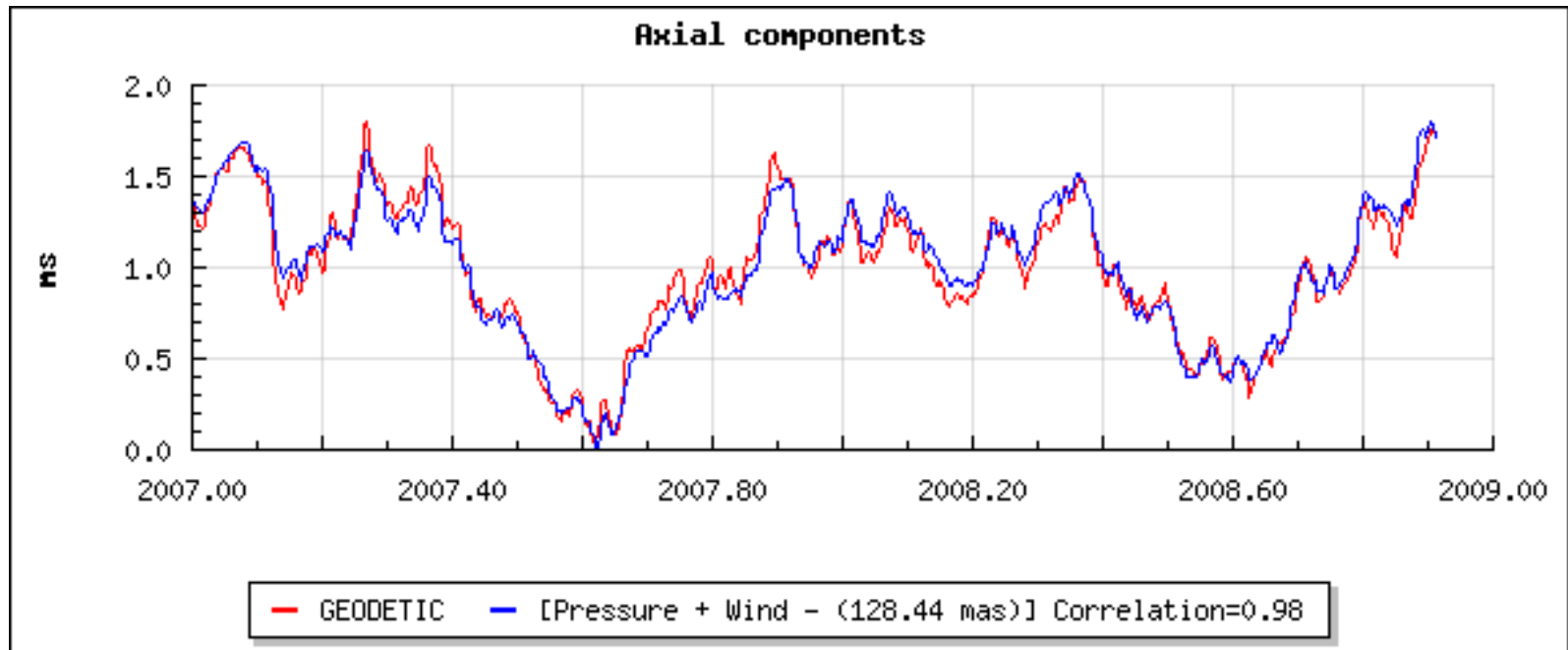
- UT1–UTC
 - Earth rotation phase (Earth rotation angle / Stellar angle (Slide 6))
 - Sidereal time converted to solar time
 - highest variability of all EOP components
- LOD
 - Length of day (w.r.t. 24 h TAI)
 - (negative) time derivative of UT1–UTC

Spectrum of Length of Day

Length of Day Spectrum (schematic)



Excitation of Earth Rotation Variations



Observations of Earth Rotation

- Regular observations by space geodetic techniques

IVS (VLBI)

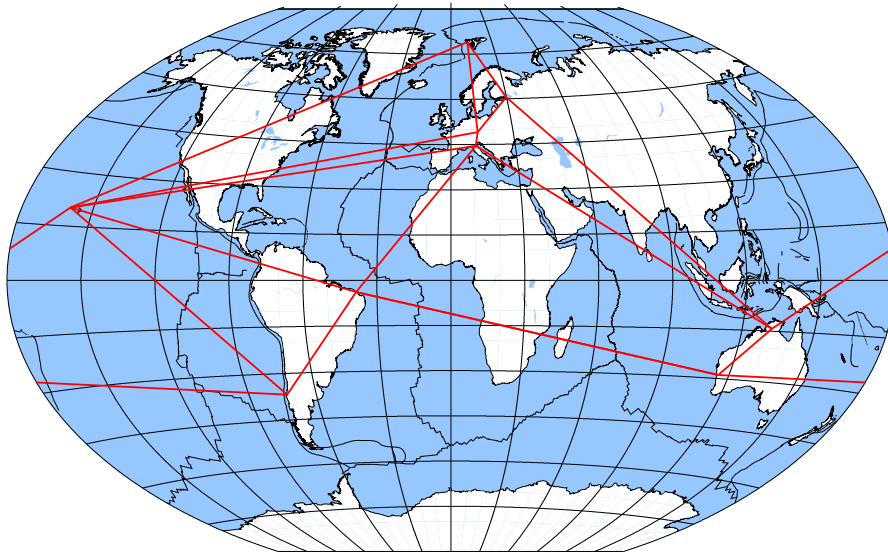
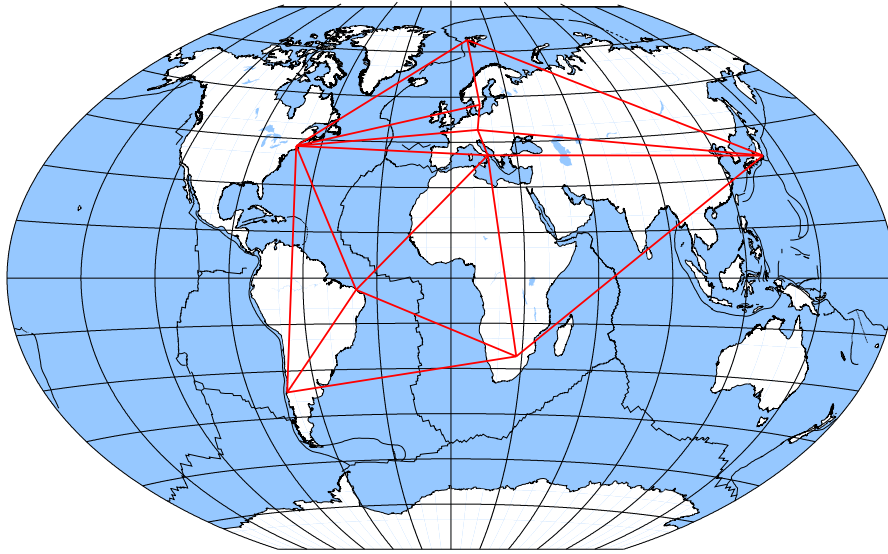
IGS (GNSS/GPS)

ILRS (SLR)

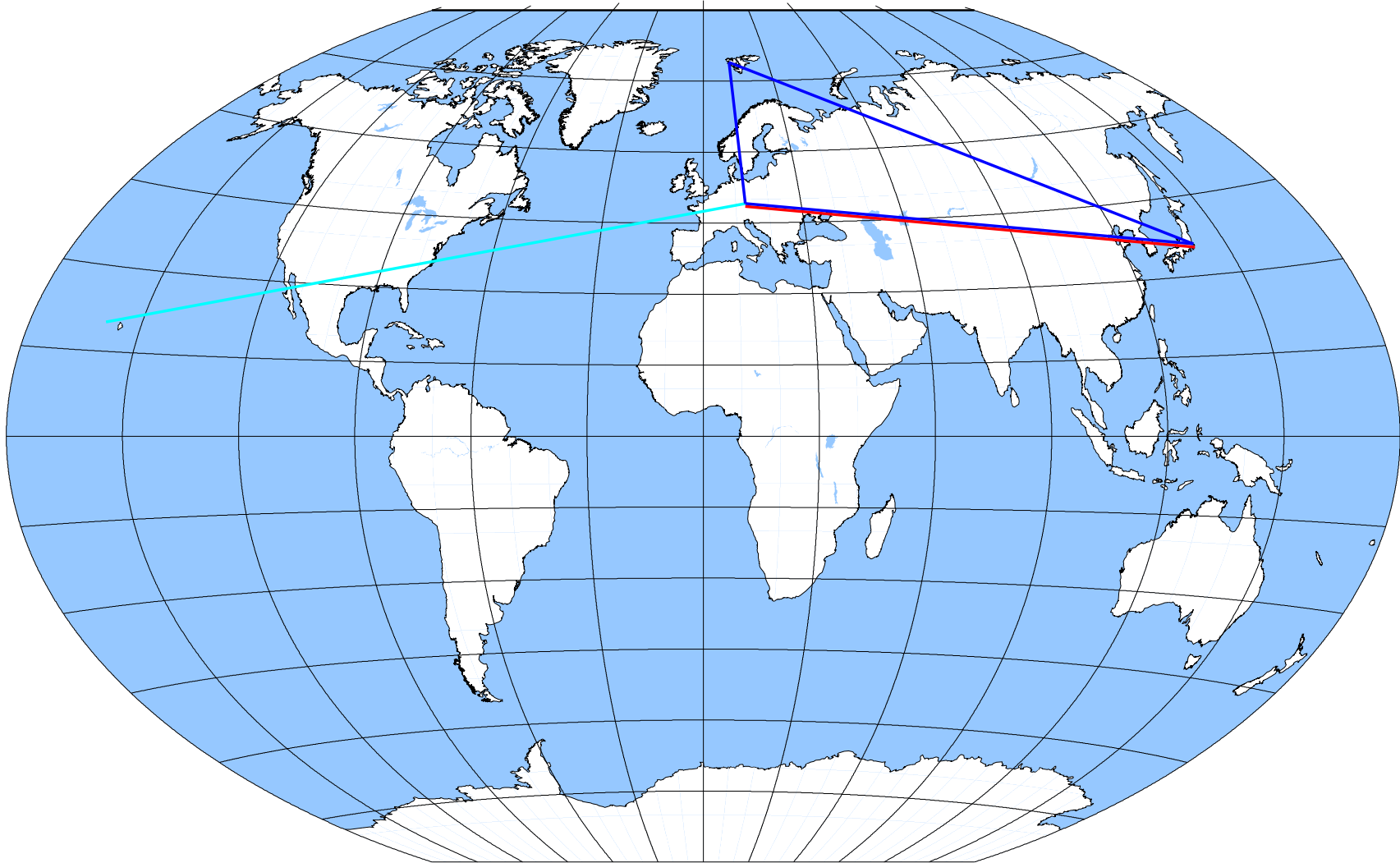
Technique	Polar Motion				Daily Rotation		Nutation			
	x-Pol	dx-Pol/dt	y-Pol	dy-Pol/dt	UT1-UTC	dUT1-UTC/dt	dX	dX/dt	dY	dY/dt
VLBI	X	X	X	X	X	X	X	X	X	X
GNSS	X	X	X	X		X		X		X
SLR	X	X	X	X		X		X		X

- IVS
 - Observations by VLBI networks, correlation, data available at IVS Data Centers
 - Analysis by 6 IVS Analysis Centers → 6 independent EOP series
 - Combination by IVS Combination Center → 1 combined IVS EOP series
- IGS and ILRS
 - similar to IVS
 - ...
- International Earth Rotation and Reference Systems Service (IERS)
 - Combination of EOP results from IVS, IGS, ILRS

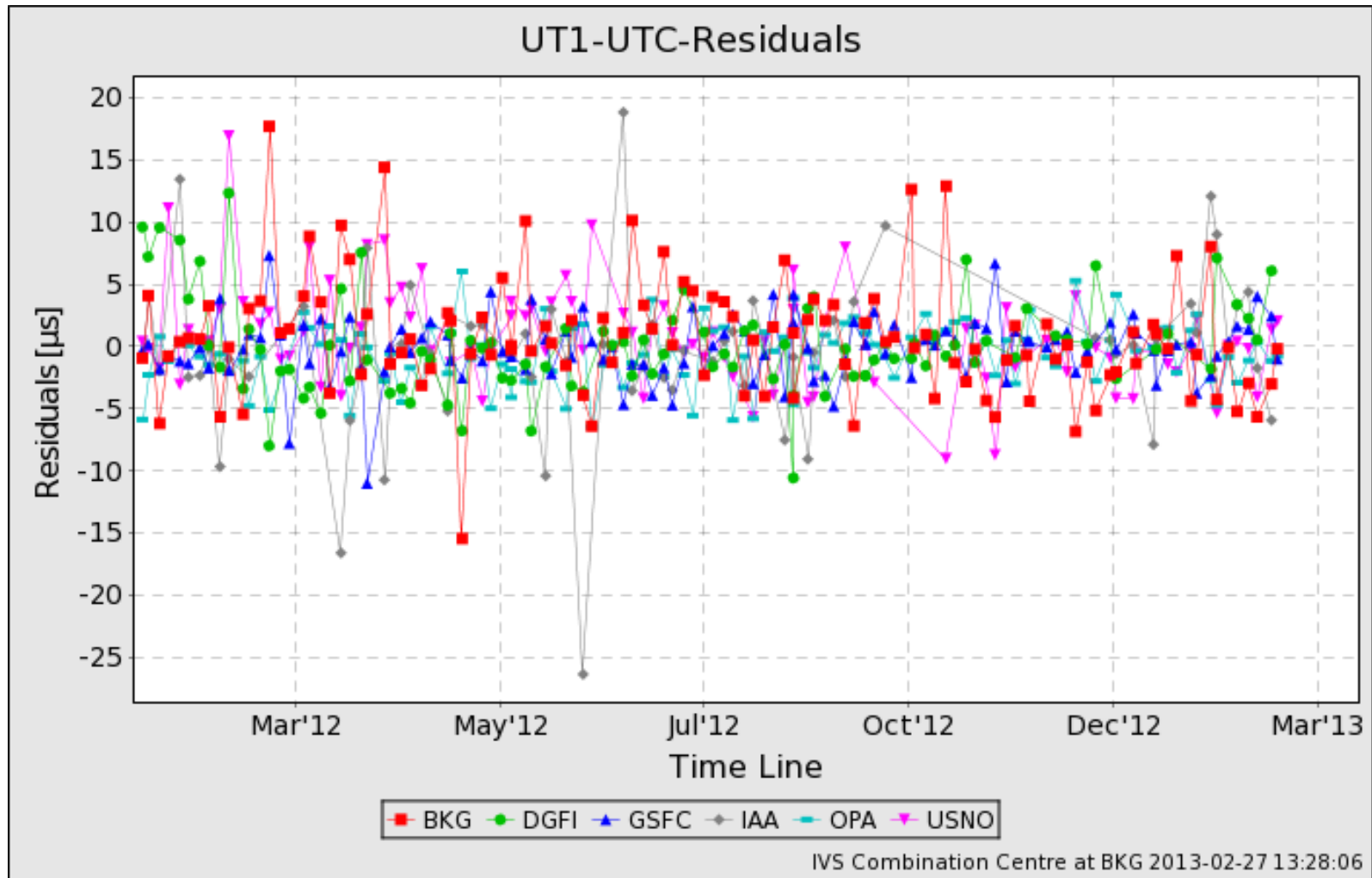
IVS Observing Concepts I



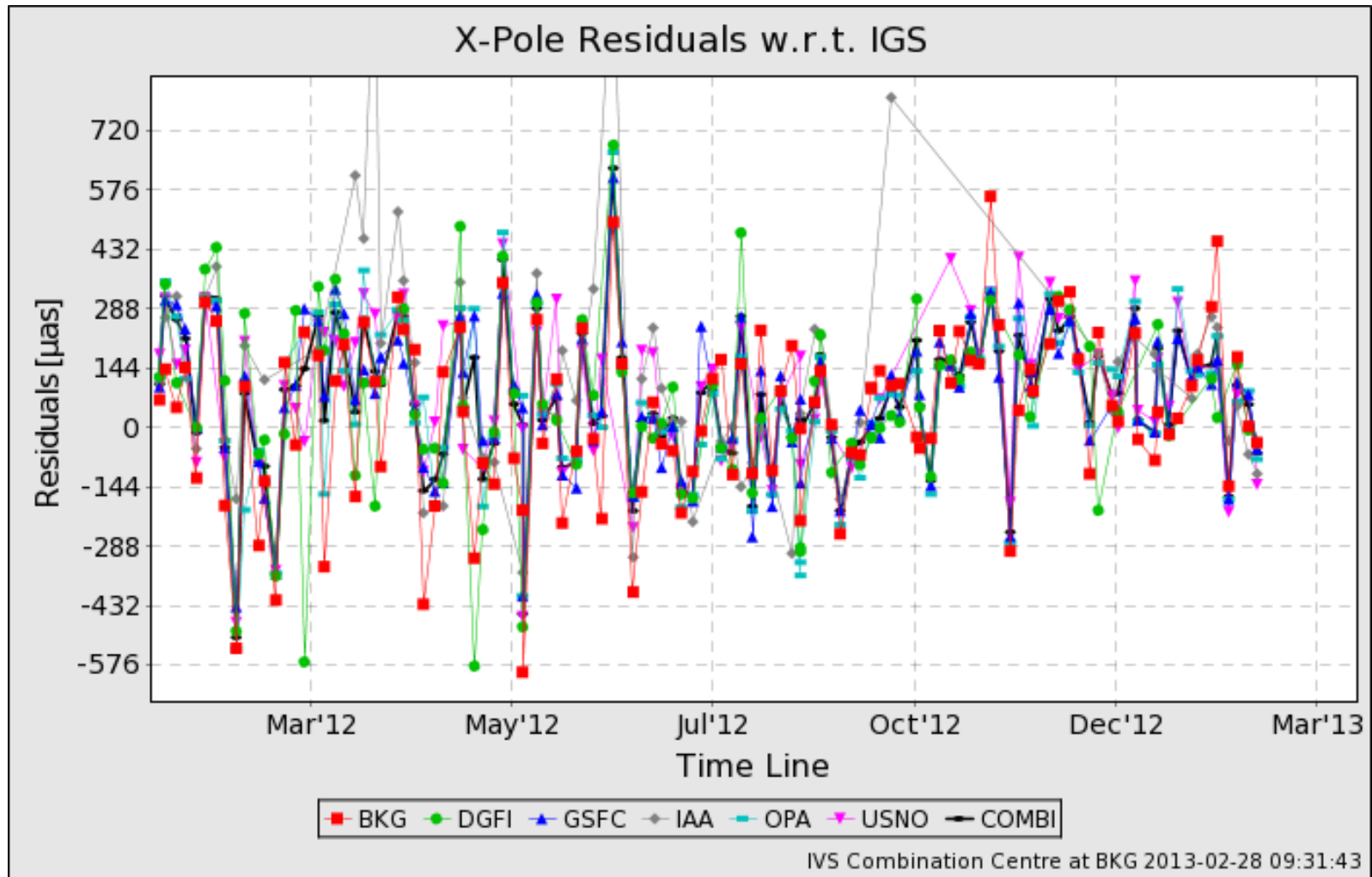
IVS Observing Concepts II



Results from IVS Combinations I

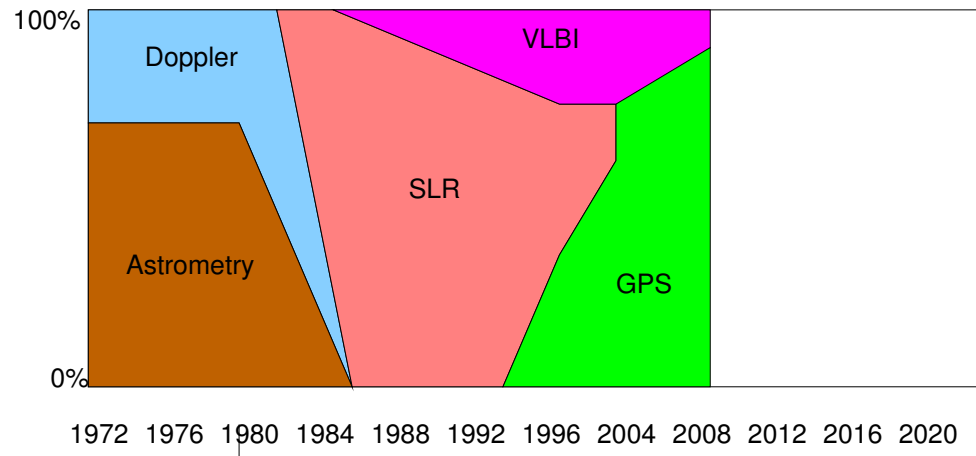


Results from IVS Combinations II



Contributions to operational IERS Products

Polar Motion



UT1-UTC

