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# The construction of a long-term Total Solar Irradiance record and its uncertainties

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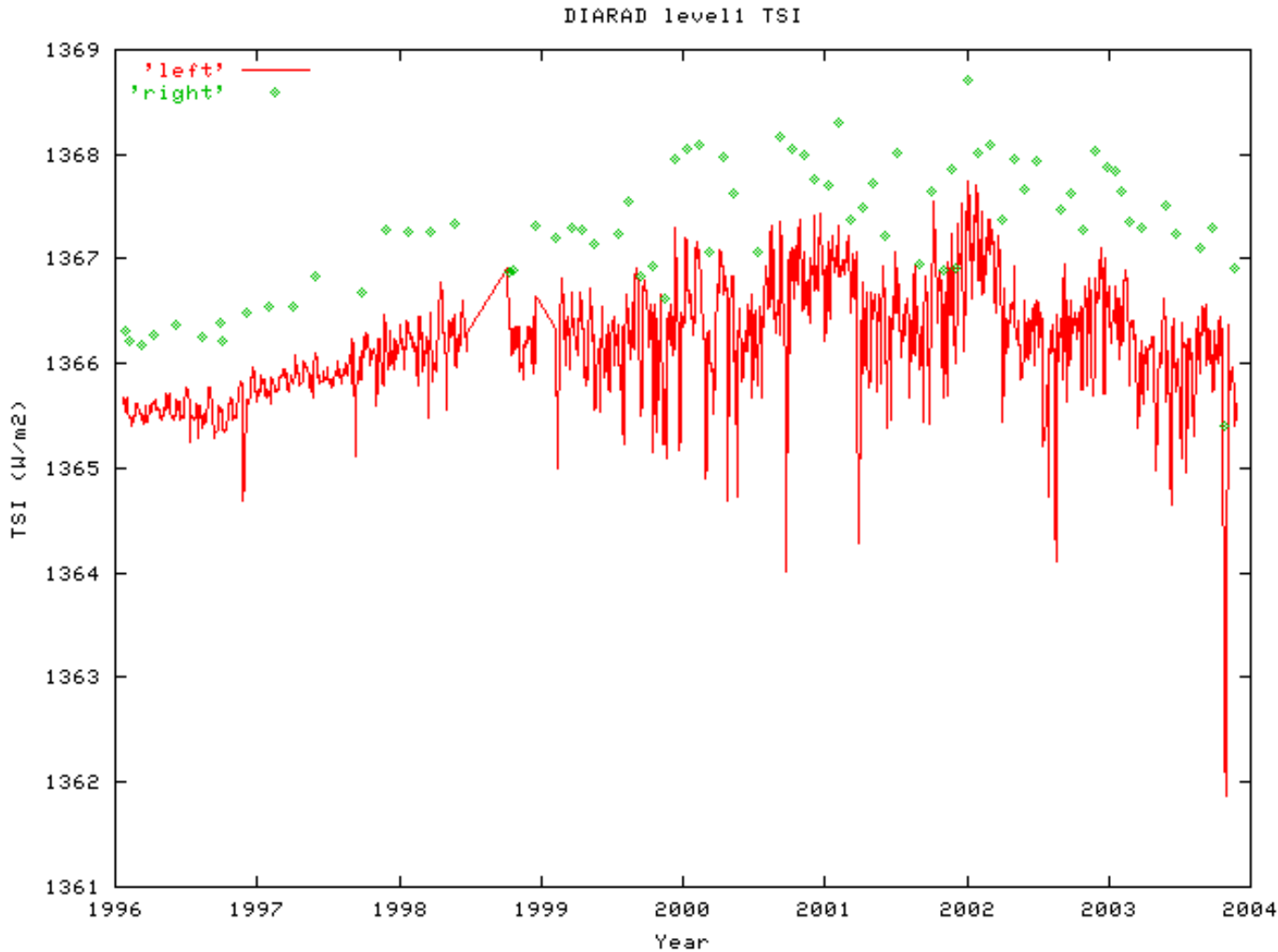
Royal Meteorological Institute of Belgium

# Overview

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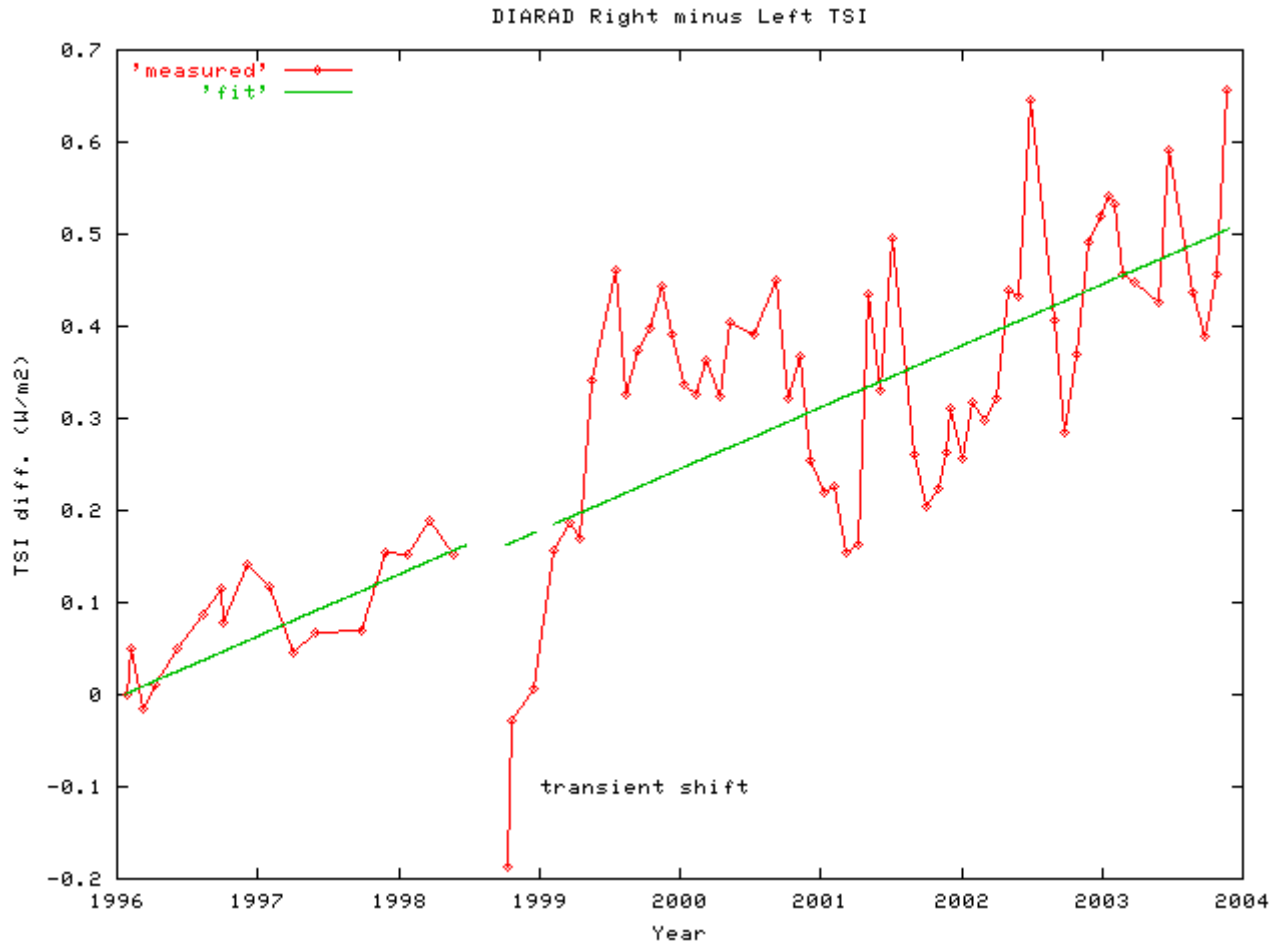
- ◆ DIARAD
- ◆ SOLCON
- ◆ SARR composite
- ◆ uncertainty

# TSI measurements



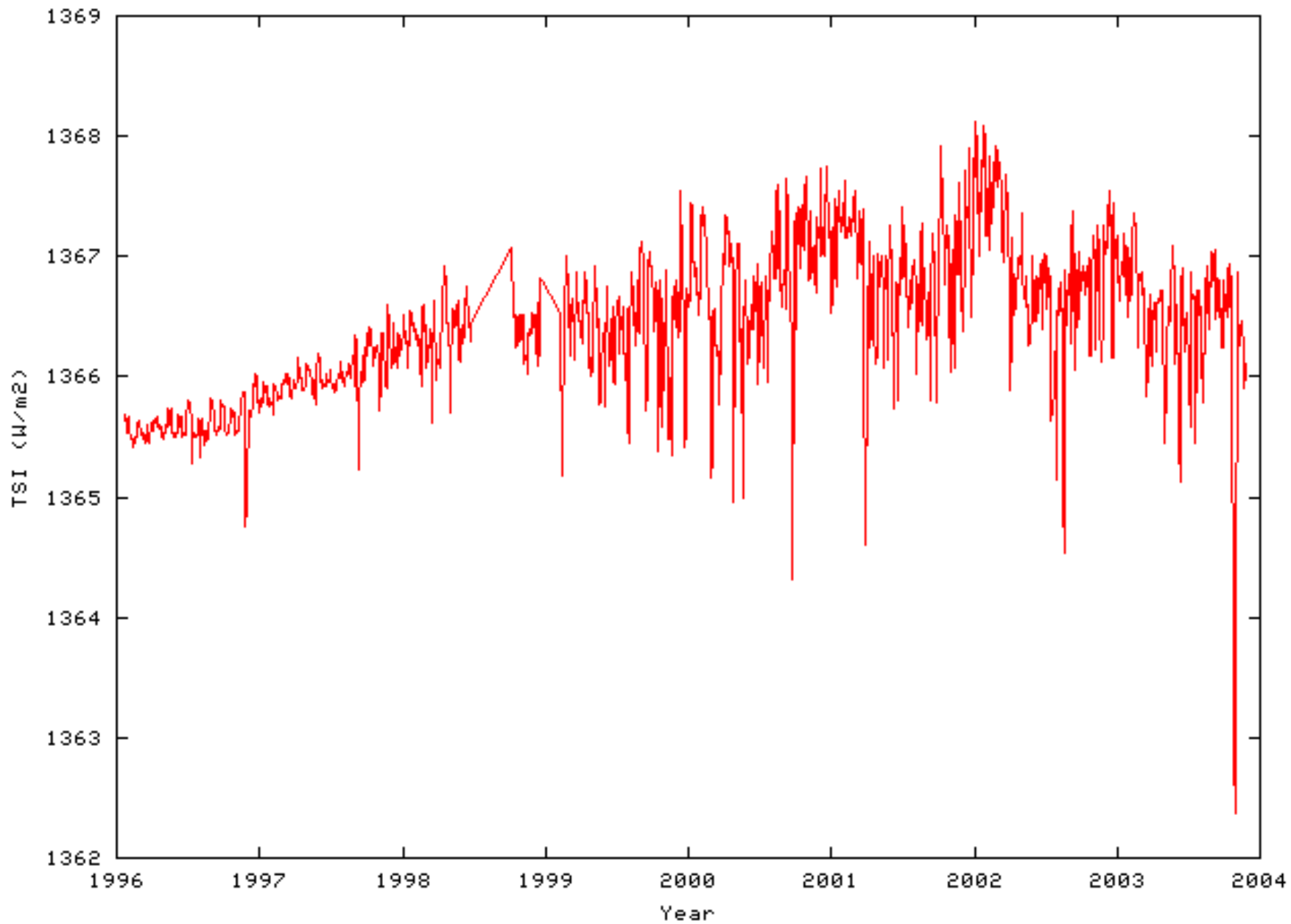
- ◆ left: continuous measuring
- ◆ right: backup channel, shifted down by 5 W/m<sup>2</sup>

# Ageing correction



- ◆ linear fit to right-left difference
- ◆ continuous over SOHO gap

Level 2 DIARAD daily mean irradiance

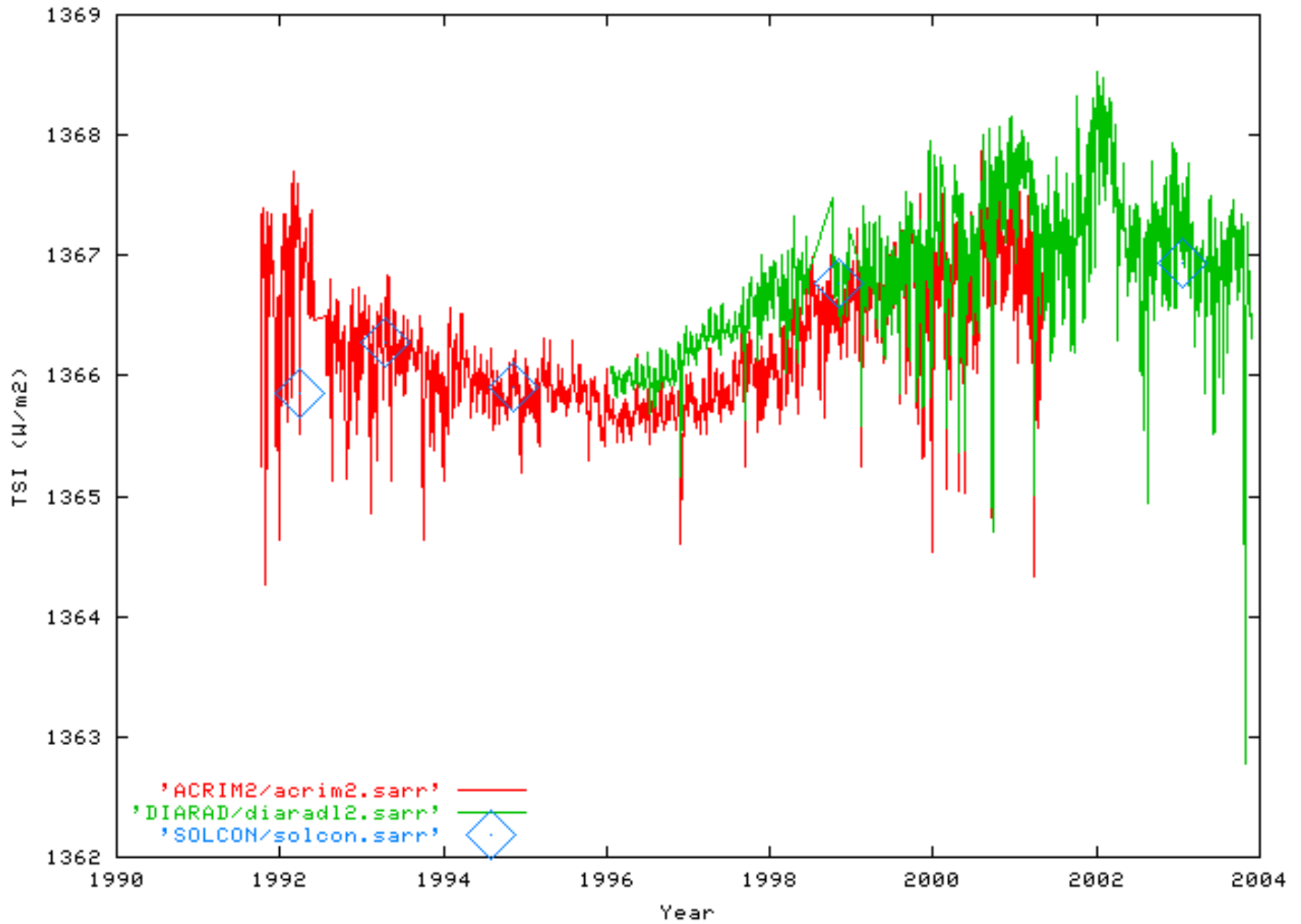


# SOLCON / SARR

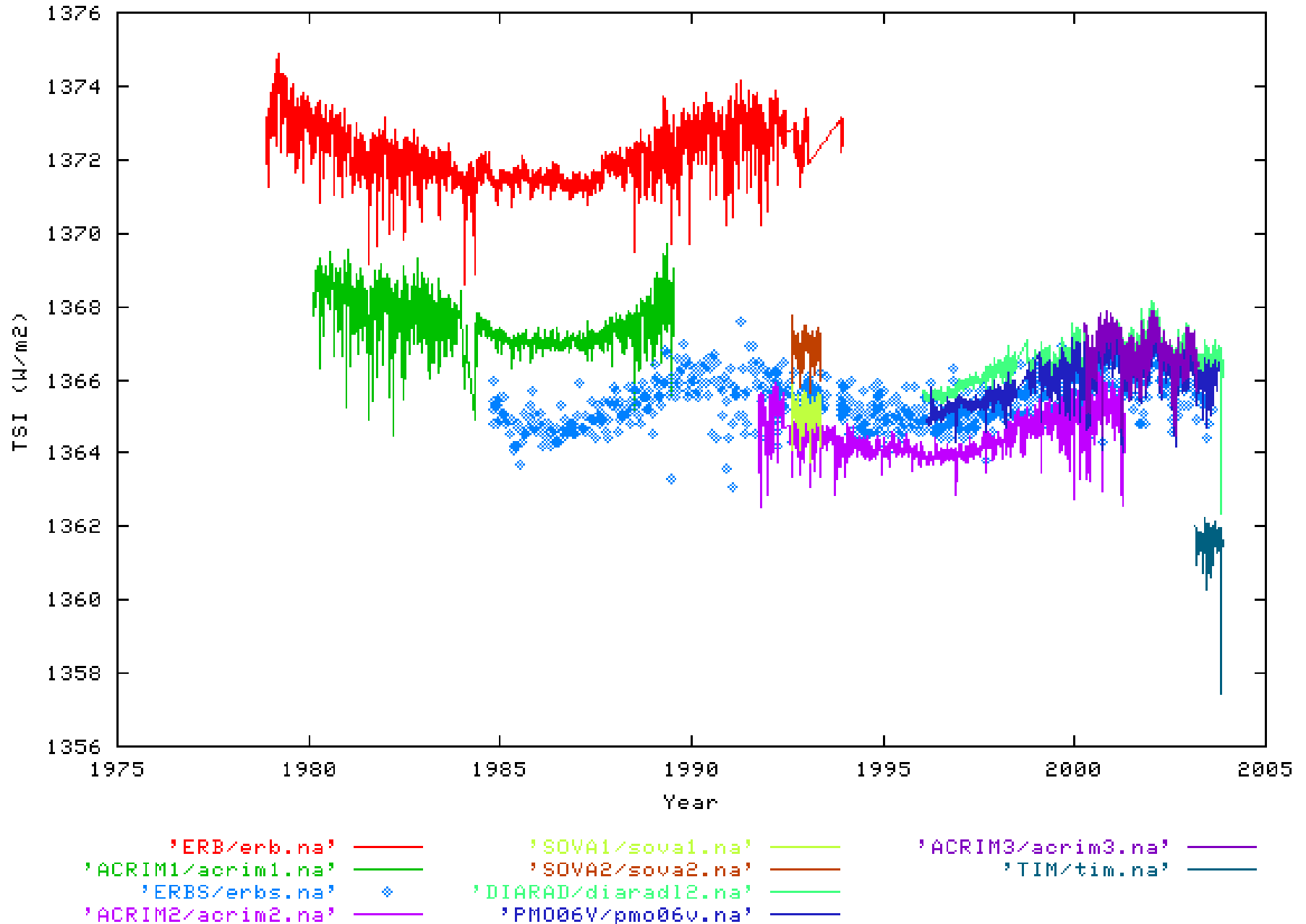
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- ◆ point measurements from space shuttle in 1992,1993,1994,1998,2003
- ◆ 1993: definition of Space Absolute Radiometric Reference as mean of 8 radiometric channels

# SARR adjustment ACRIM2 and DIARAD



# Long term Total Solar Irradiance measurements

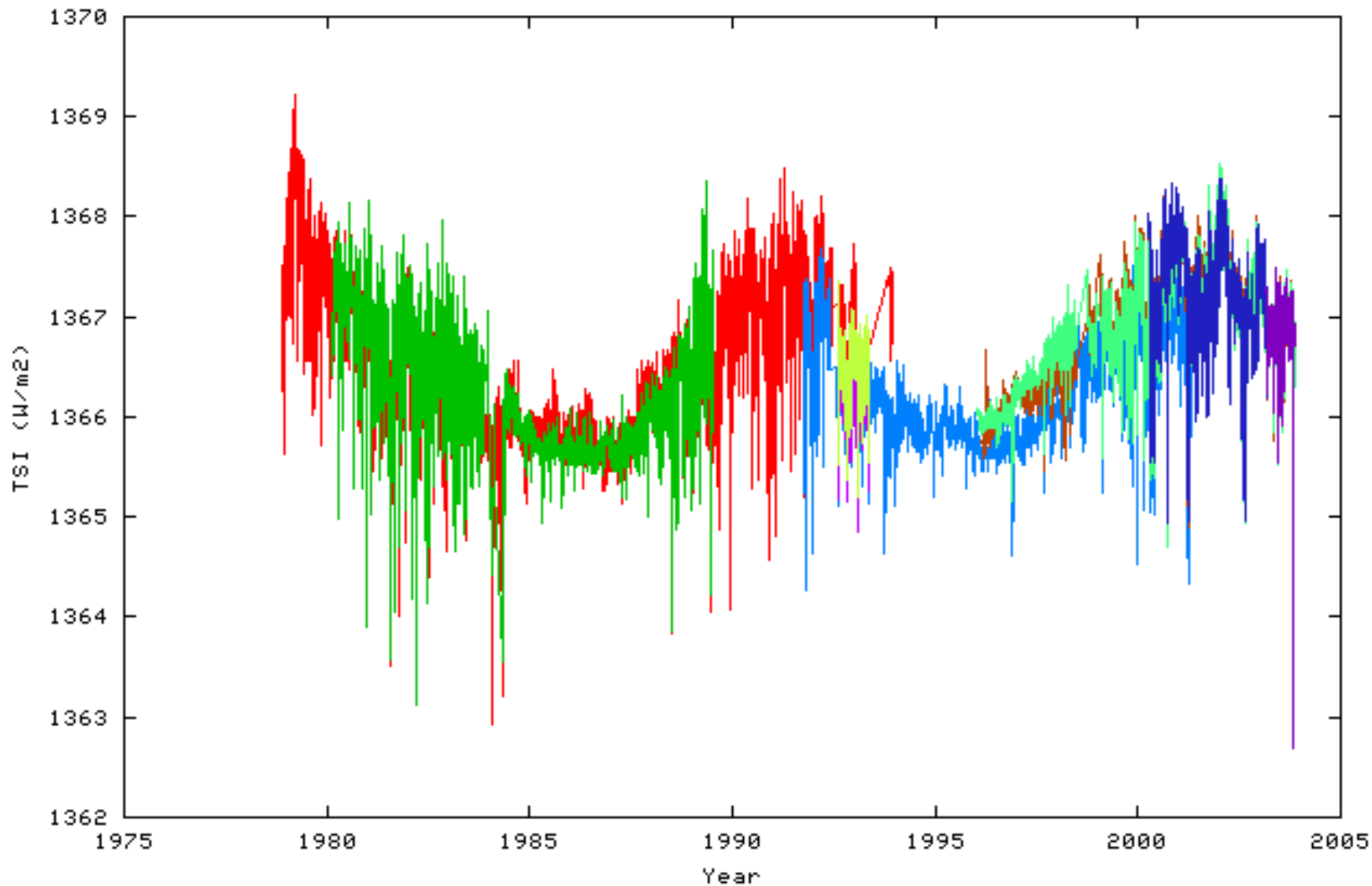


# SARR adjustment

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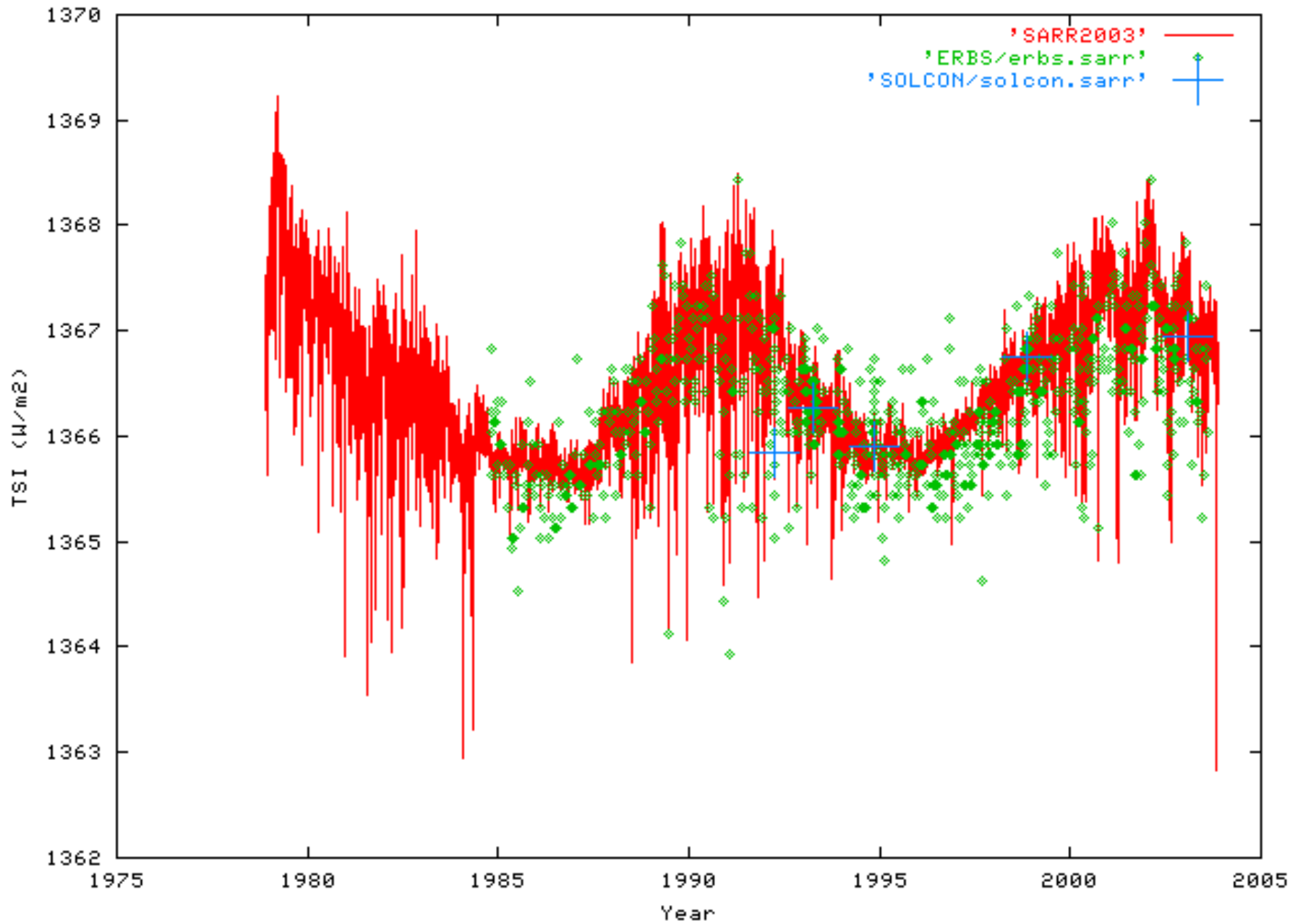
- ◆ All instruments are brought to same level by multiplicative factor
- ◆ reference > 1996: SOLCON 1998 -> DIARAD
- ◆ reference [1991,1996]: SOLCON 1993 -> ACRIM2
- ◆ reference [1989,1991]: ERBS
- ◆ reference < 1991: ACRIM1

SARR adjusted Total Solar Irradiance measurements

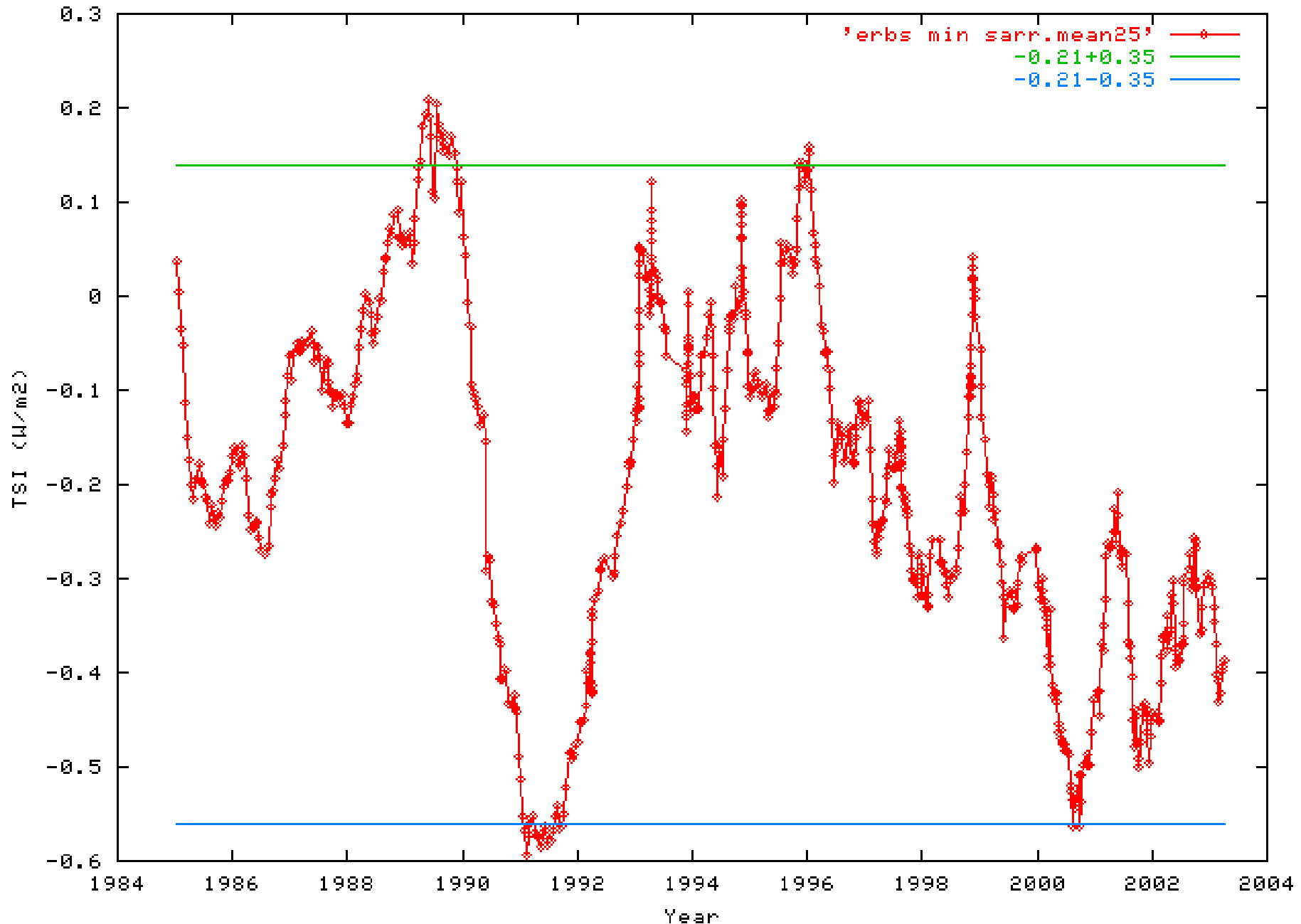


- |                      |   |                      |   |                        |   |
|----------------------|---|----------------------|---|------------------------|---|
| 'ERB/erb.sarr'       | — | 'SOVA1/sova1.sarr'   | — | 'DIARAD/diarad12.sarr' | — |
| 'ACRIM1/acrim1.sarr' | — | 'SOVA2/sova2.sarr'   | — | 'ACRIM3/acrim3.sarr'   | — |
| 'ACRIM2/acrim2.sarr' | — | 'PM006V/pmo06v.sarr' | — | 'TIM/tim.sarr'         | — |

# SARR adjusted Total Solar Irradiance



# ERBS minus composite Total Solar Irradiance

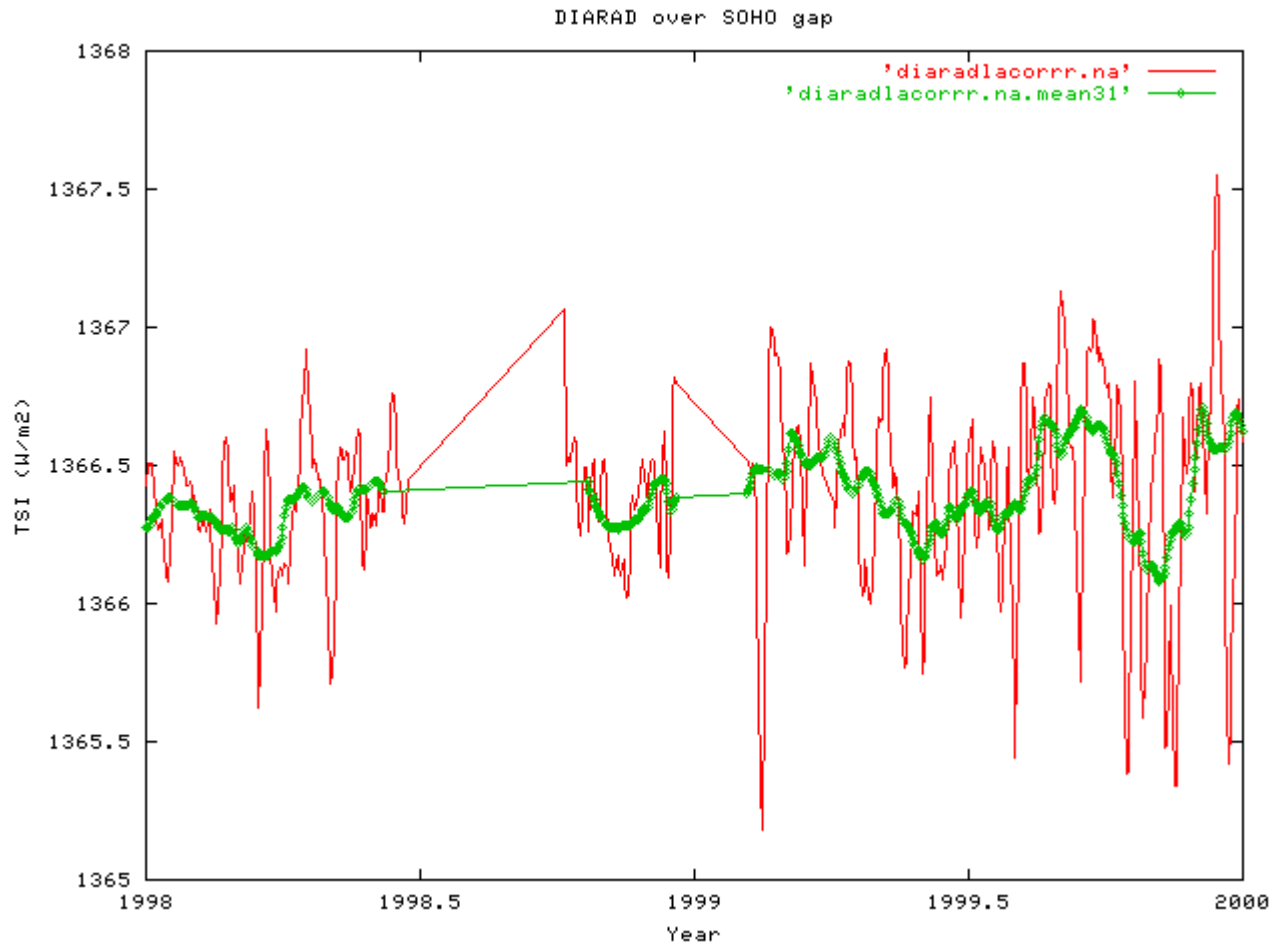


# Conclusions

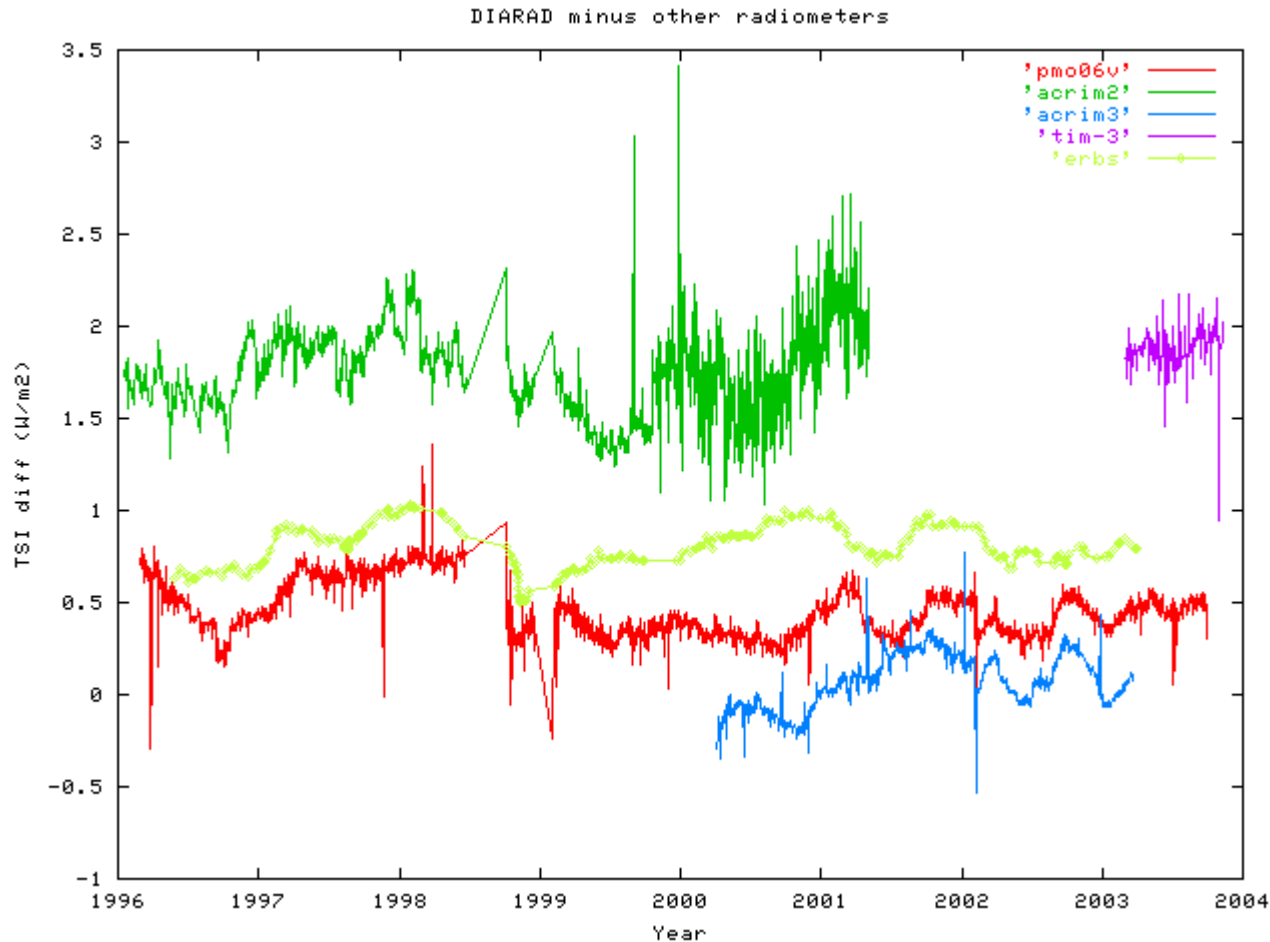
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- ◆ A long term TSI record has been constructed from all long term continuously measuring radiometers
- ◆ DIARAD and ACRIM 2 have been connected through SOLCON
- ◆ ACRIM 1 and ACRIM 2 have been connected through ERBS
- ◆ 95% uncertainty long term TSI variation : +/- 0.35 W/m<sup>2</sup>

# Stability DIARAD over SOHO gap



# Comparison with other radiometers



# 95% difference intervals

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- ◆ DIARAD - PMO06V =  $0.49 \text{ W/m}^2 \pm 0.26 \text{ W/m}^2$
- ◆ DIARAD - ERBS =  $0.77 \text{ W/m}^2 \pm 0.24 \text{ W/m}^2$
- ◆ DIARAD - ACRIM2 =  $1.78 \text{ W/m}^2 \pm 0.47 \text{ W/m}^2$
- ◆ DIARAD - ACRIM3 =  $0.05 \text{ W/m}^2 \pm 0.25 \text{ W/m}^2$
- ◆ DIARAD - TIM =  $4.89 \text{ W/m}^2 \pm 0.21 \text{ W/m}^2$