

Space experiments of PMOD/WRC to measure the solar constant and the influence of the solar irradiance on the terrestrial climate

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PMOD/WRC

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PMOD 1907-2007 **WRC since 1971**

Two activities:



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Research

Energy balance and influence
of radiation on the terrestrial
climate

- Green house effect
- Sun-Earth connection

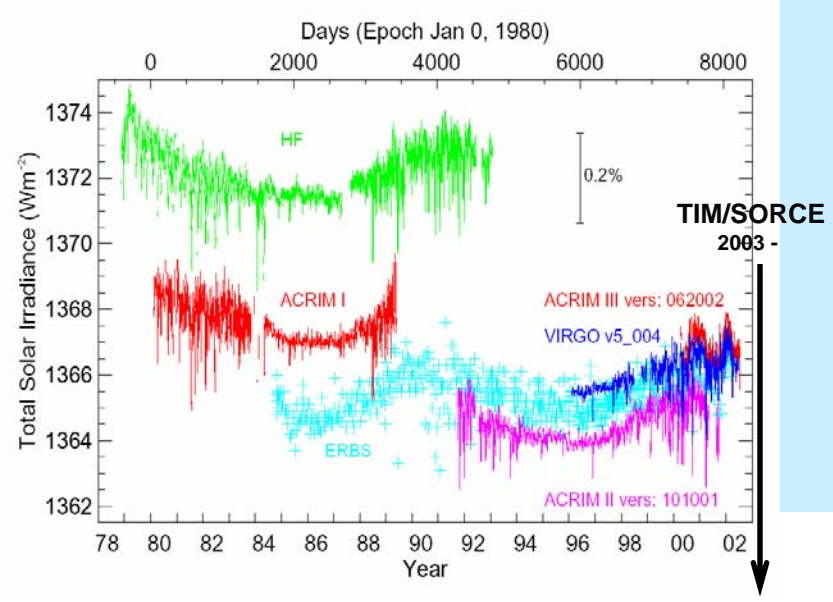
Overview



- Past observations of the Total Solar Irradiance (TSI) and the TSI-composite
- Why irradiance measurements
- Why continue to measure TSI
- Future irradiance observations

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Absolutely calibrated TSI observations



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A side note: Need for improved Quality Assurance! *pmod wrc*

Difficulties:

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- Instr
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- (gain a

BIPM and WMO are proposing and preparing a meeting in 2008 or 2009 dedicated to calibration and traceability problems

Courtesy of Nigel Fox

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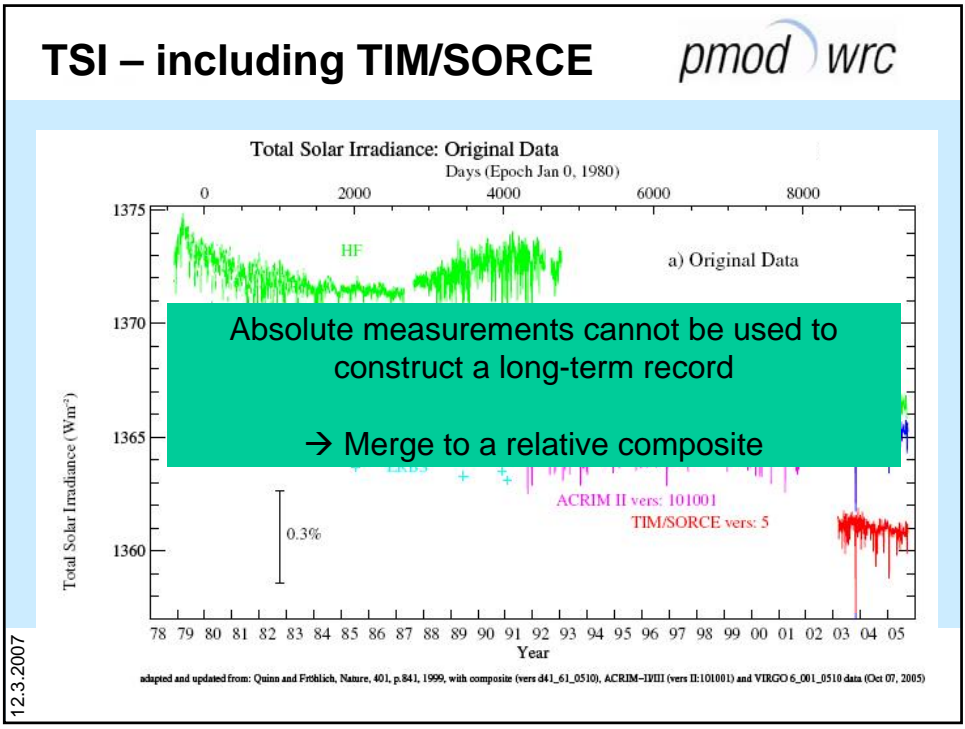
Traceable Radiometry Underpinning Terrestrial- & Helio- Studies *pmod wrc*

Mission proposal: TRUTHS

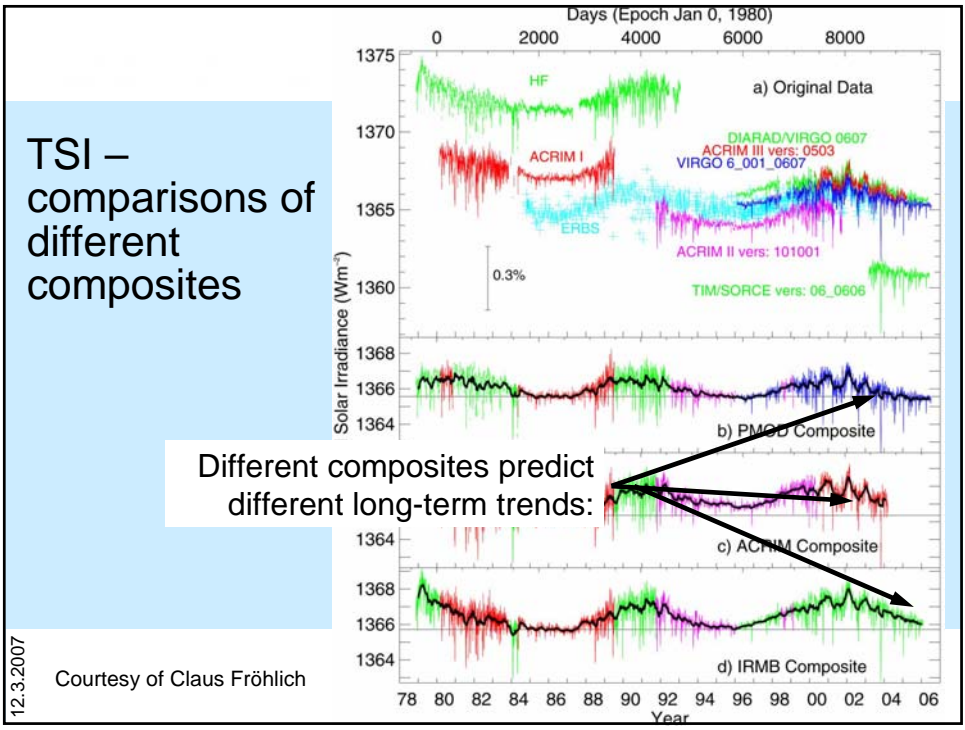
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Steve Groom Plym Mar Lab	Phil Teillet CCRS
Claus Frohlich PMOD/WRC	Theo Theocharous NPL
Jo Haigh Imp Coll	Kurtis Thome U of Ariz
Olivier Hagolle CNES	Terry Quinn BIPM
Hugh Kieffer USGS	Michel Verstraete JRC(Italy)
Judith Lean NRL	Emma Woolliams NPL
John Martin NPL	Ed Zalewski U of Ariz

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TSI – including TIM/SORCE



TSI – comparisons of different composites



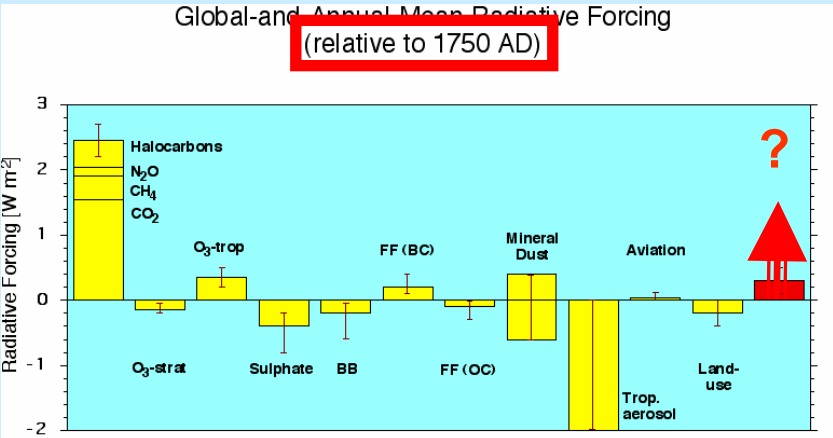
Why irradiance measurements?



- IUGG 2007:
Session MS020
Solar Activity and its Influences on the Earth's Weather and Climate (IRC)
- **Space Climate:**
On long term, it is not known what dominates, secular change of Total Solar Irradiance or spectral (UV) variations
But: although UV variations are much larger (up to 100%) all spectral variations are highly correlated to TSI variations

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What is the influence of the Sun on the climate?



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Graphics: Dr. J. Beer EAWAG, Switzerland

IPCC 2001

Climate Anomalies versus solar influence

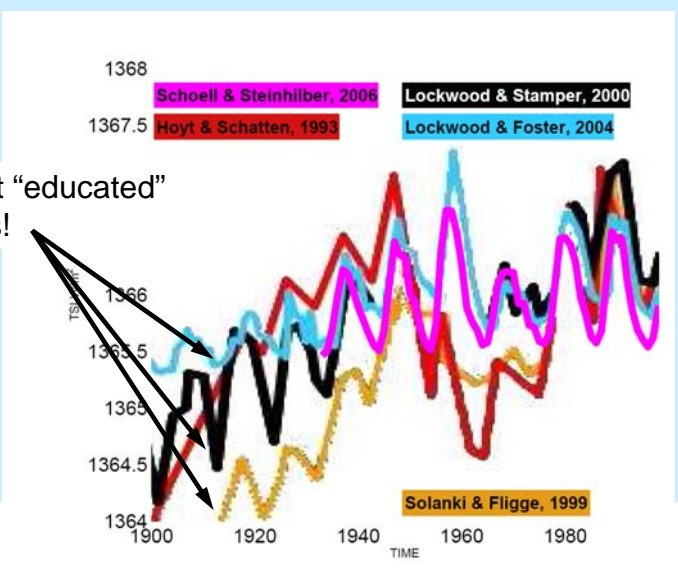


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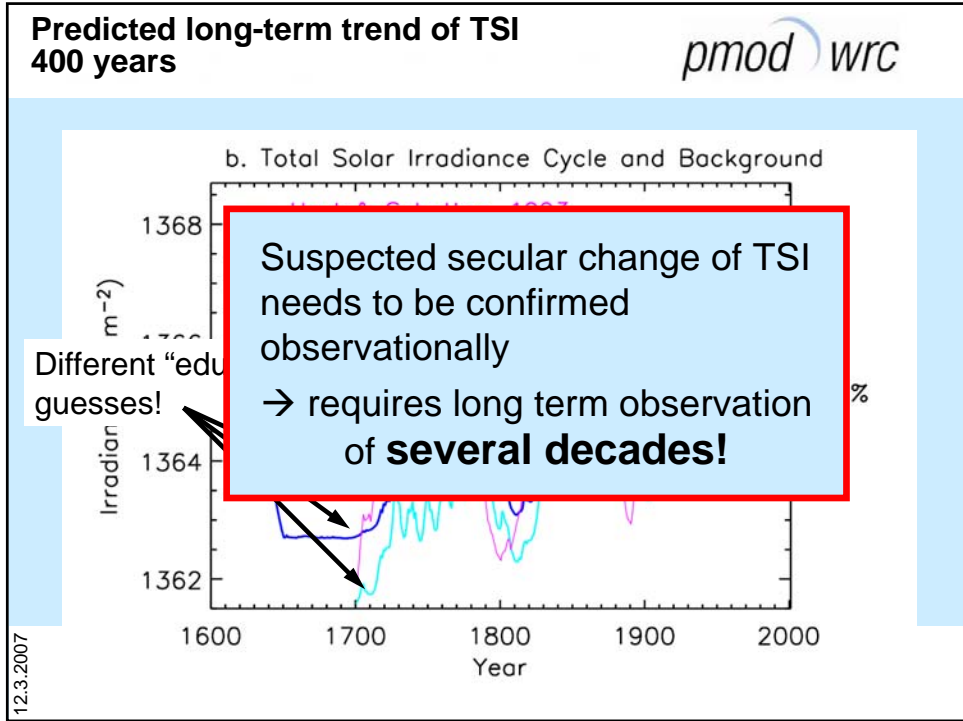
Predicted long-term trend of TSI 100 years



Different "educated" guesses!



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Three minima in the latest (August 2006) version of the PMOD-composite


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It is essential to design the irradiance measurements at the highest possible accuracy!

→ Solution: twin instrument experiment as VIRGO on SoHO and PREMOS+SOVAP on PICARD

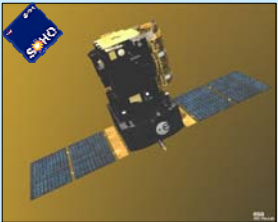
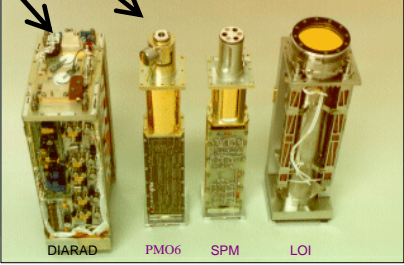
<http://www.pmodwrc.ch> follow the links:
→ projects → Solar Constant / Solar Irradiance

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 **VIRGO/SoHO:**
operational since 1996

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- Two absolute radiometers:
 - PMO6V (A & B)
 - DIARAD (L & R)
- Precision Filter Radiometer (blue, green, red)
- Image of the Sun in the green light in low resolution (12 pixels): 1 minute sampling

SoHO launch 2. December 1995

VIRGO instruments

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Future TSI experiments

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- GLORY (USA: no launch date – ready to be used as gap-filler)
- SOVIM/ISS and
- PREMOS+SOVAP/PICARD
approved TSI experiments of PMOD/WRC
- RAD/KuaFu-A only future TSI experiment presently being considered

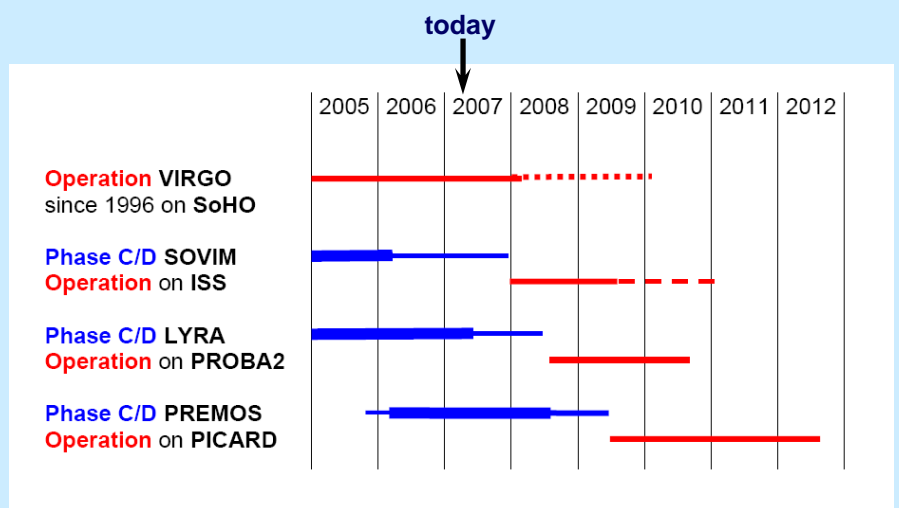
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Space experiments are being built in house at PMOD/WRC

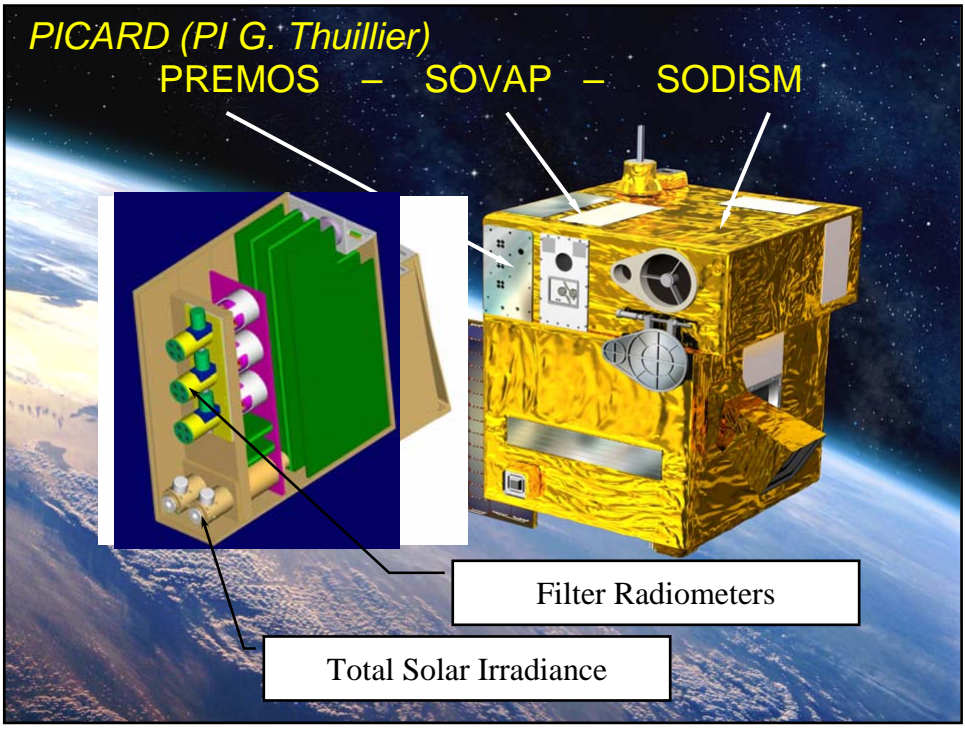


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Space experiments of PMOD/WRC



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Total Solar Irradiance observations until 2012 pmod wrc

ACRIM III	2000 - ?		
VIRGO/SOHO	1996	-	2009 (+?)
TIM/SORCE	2003	-	2008 - (?)
SOVIM/ISS			2008 – 2009 ?
PREMOS/PICARD			2009 – 2011
SOVAP/PICARD			
(SDO 2008-2012 has no TSI instrument)			
NPOESS			2012
National Operational Environmental Satellite System may have TSI instrument but are planned to start not earlier than 2009 (?), more information as 2010			

TSI on NPOESS canceled June 2006

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Total Solar Irradiance observations until 2012




ACRIM III	2000 - ?	
VIRGO/SOHO	1996 -	2007 - 2009
TIM/SORCE	2003 -	2008 - (GLORY?)
SOVIM/ISS		2007 - 2009 ?
PREMOS-TSI/PICARD		2009 - 2013
SOVAP/PICARD		

(SDO 2008-2012 has no TSI instrument)

KuaFu-A **2012 -**
 irradiance measurement experiment comprising:
 → SIM = Solar Irradiance Monitor (CN: PI Daren Lu)
 → DOR = Davos Observatory Radiometer (CH: Werner Schmutz)

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Conclusions



- Short-term irradiance variations (days) are closely related to variations of the chemical composition of the upper atmosphere
 → space weather: **operational monitoring of TSI**
- Long-term irradiance variations (tens to thousands of years) are probably (!) related to climate variations
 → space climate: **secular long term change of TSI**
- TSI observations are most likely continuous and overlapping until about 2012
- RAD/KuaFu-A would be a matching continuation

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Thank you for your attention!

Integration of LYRA
on PROBA2
5.3.2007

