St Petersburg

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Since 1849

Russian contribution to APCC seasonal prediction

Vladimir Kattsov and Dmitry Kiktev

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APCC Symposium, Busan, 14-16 September 2006

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Seasonal prediction by Russian Federal Service for Hydrometeorology and Environment Monitoring

Hydrometeocenter of Russian Federation (HMC, Moscow)

Voeikov Main Geophysical Observatory (MGO, St.Petersburg)

Global spectral model (MGO_AM2) of the Voeikov MGO

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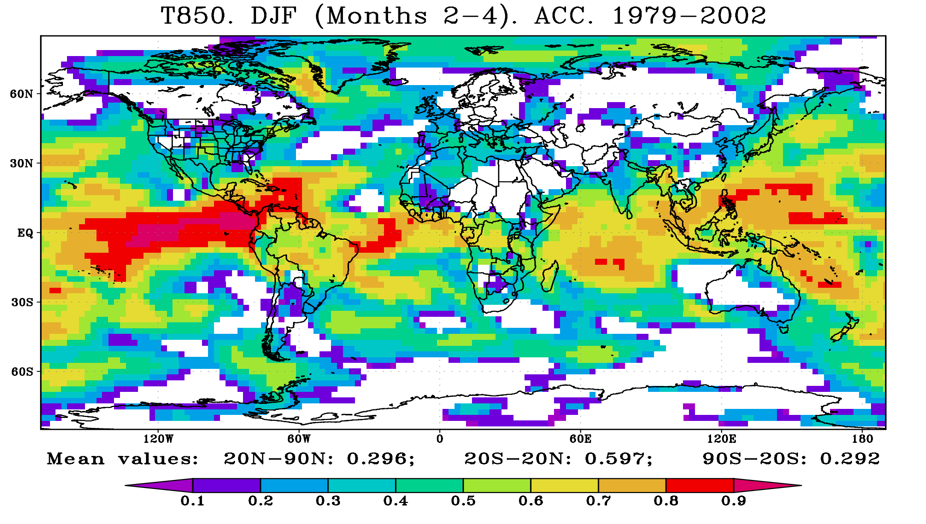
- Resolution T42L14
- Parameterizations: solar/terrestrial radiation with diurnal cycle; computed clouds/optical properties; Tiedtke convection; orography-induced gravity wave drag; boundary layer; land surface; slab ocean
- Ensemble size – 10 members (5 and 5 members produced by breeding technique from 2 sequential dates)
- 4 seasons with 1 month lead time
- Initial SST anomalies from NESDIS data set

Global semi-Lagrangian vorticity-divergence model (SL model) of the HMC

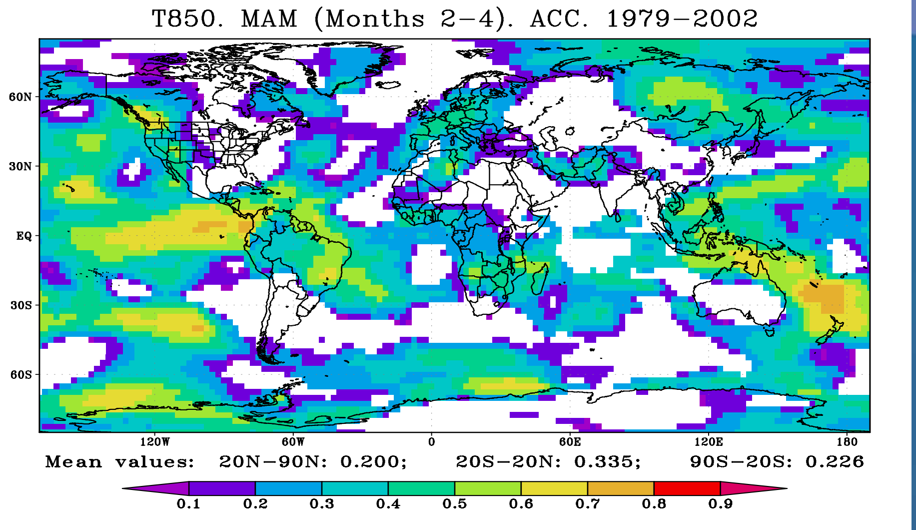
- Resolution 1.125°/ 1.40625° lat/lon, 28 sigma levels
- Parameterizations from operational Meteo-France ARPEGE/IFS model with some minor modifications
- Surface processes: (ISBA parameterization is being introduced)
- Ensemble size – 10 members with 12-hour time lag from NCEP/NCAR Reanalysis-2
- 4 seasons with 1 month lead time
- Persisted initial SST anomalies

T850. SL model. Months 2-4.
Potential predictability. 1979-2002.

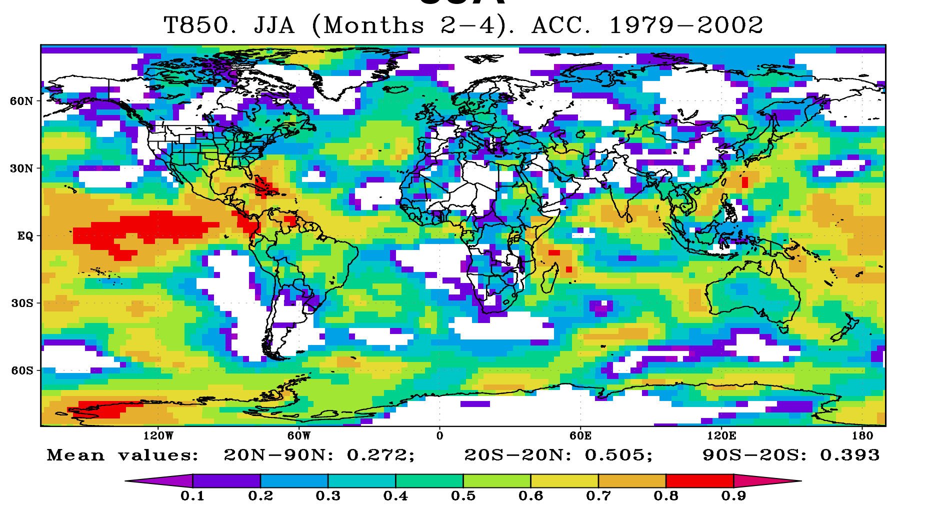
DJF



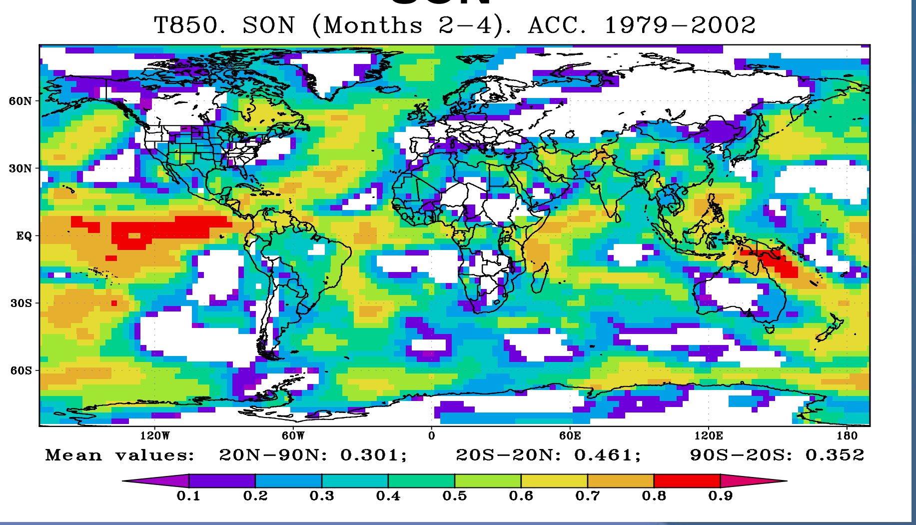
MAM



JJA



SON



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Global Warming: when, where… and why?

(An analysis of IPCC AR4 AOGCM simulations)

Vladimir Kattsov and Petr Sporyshev

APCC Symposium, Busan, 14-16 September 2006

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IPCC model name	Country
BCCR-BCM2.0	Norway
BCC-CM1	China
CCSM3	USA
CGCM3.1(T47)	Canada
CGCM3.1(T63)	Canada
CNRM-CM3	France
CSIRO-Mk3.0	Australia
FGOALS-g1.0	China
ECHAM5/MPI-OM	Germany
ECHO-G	Germany/Korea
GFDL-CM2.0	USA
GFDL-CM2.1	USA
GISS-AOM	USA
GISS-EH	USA
GISS-ER	USA
INM-CM3.0	Russia
IPSL-CM4	France
MIROC3.2 (hires)	Japan
MIROC3.2 (medres)	Japan
MRI-CGCM2.3.2	Japan
PCM	USA
UKMO-HadCM3	UK
UKMO-HadGEM1	UK

IPCC WG-1 Fourth Assessment Report (AR4) Modelling Project

http://www-pcmdi.llnl.gov

PCMDI

WMO INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE UNEP

Stable change of SAT (SCSAT)

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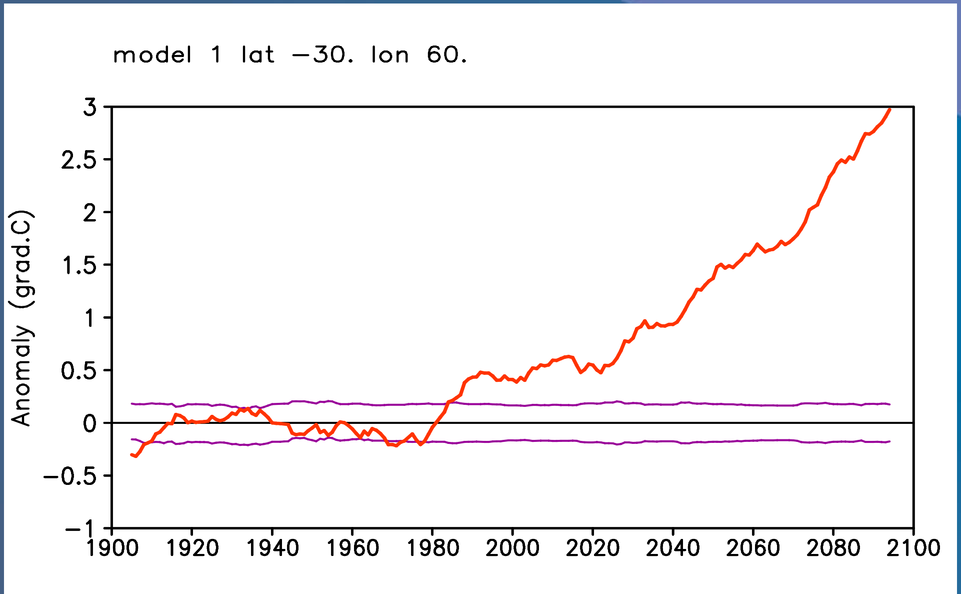
An evolving climate is regarded as a sequence of averages (a running average) with a fixed-length time period (here – 11-year running interval). The average over each consequent 11-year period is been assigned to its central (i.e. the 6th) year.

To determine the SCSAT in a geographical point, the running annual mean SAT values are compared against the baseline SAT.

SAT changes are regarded as SCSAT starting from a year, if for the interval centered at that year and all subsequent intervals (through the end of the 20th century in observations and 21st century in model simulations) the SAT deviation from the baseline retains its sign and remains statistically significant at 5% level.

Sporyshev and Kattsov (2006)

BCCR-BCM2.0



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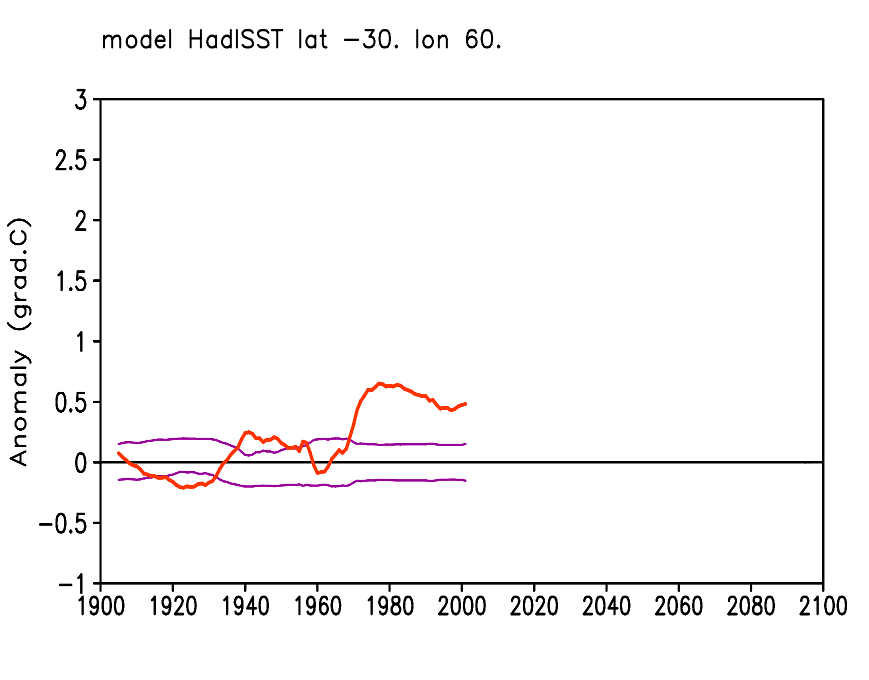
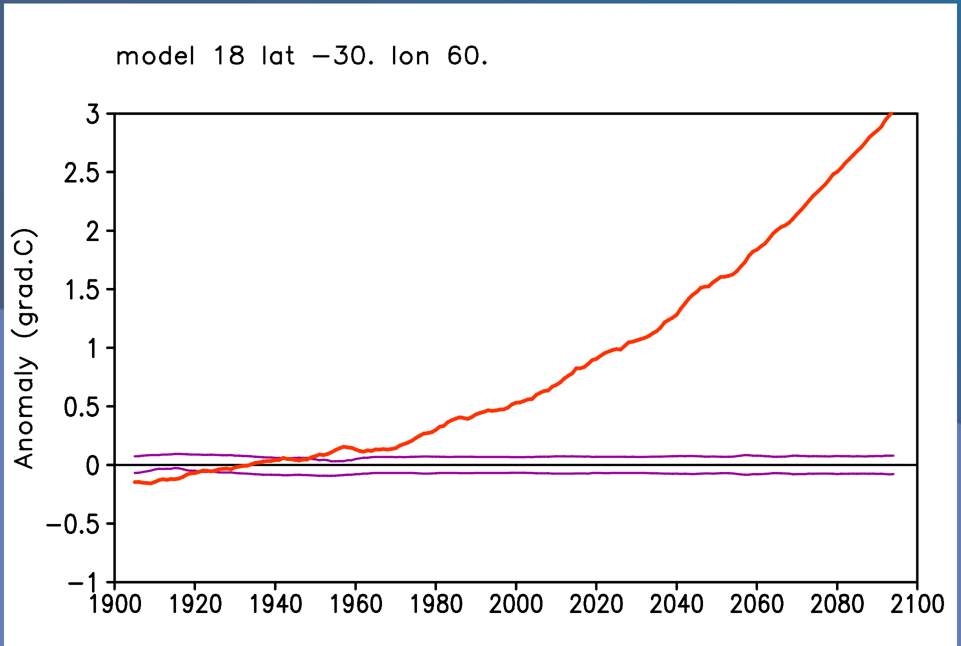
HadISST1.1



17-model ensemble



Timing of SAT stable change (A2): 17-model average

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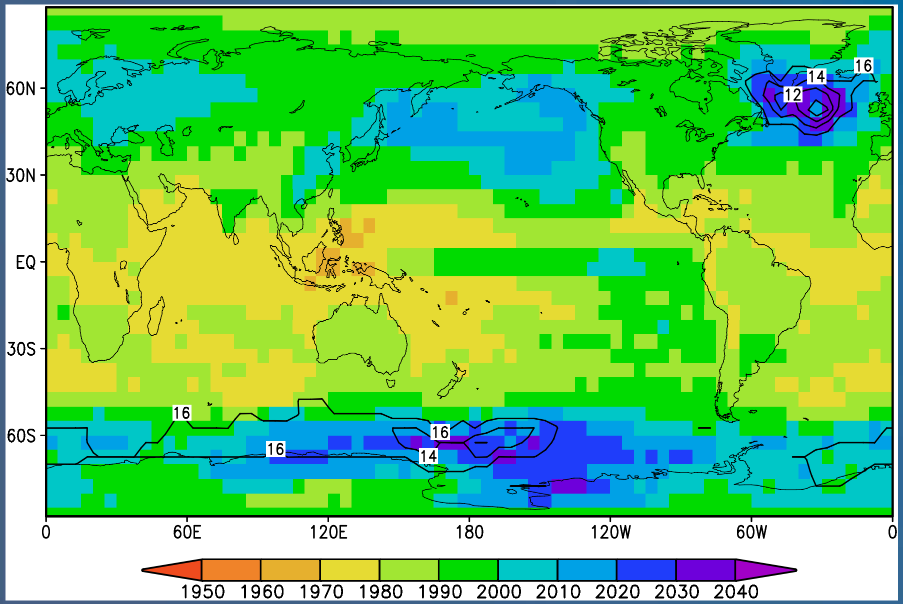

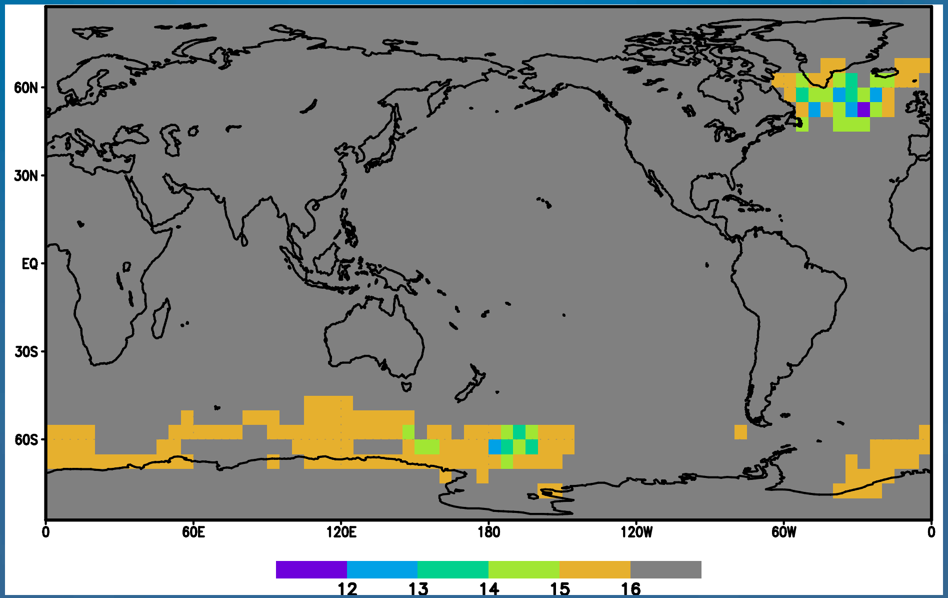

The geographical distributions of the first year of TAS stable change (SCTAS) were calculated for each of the 17 models, and then averaged across the models.
Note that several of 17 models locally do not achieve the SCC before 2100.
So, only those models who achieved SCTAS at given gridbox were used in averaging.

Sporyshev and Kattsov (2006)

Timing of SAT stable change (A2): 17-model average vs. observation

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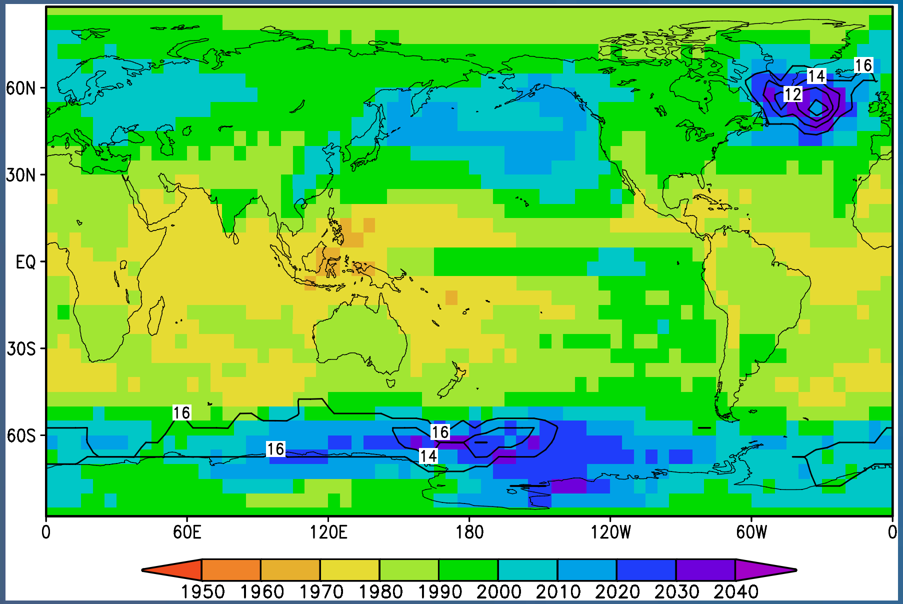

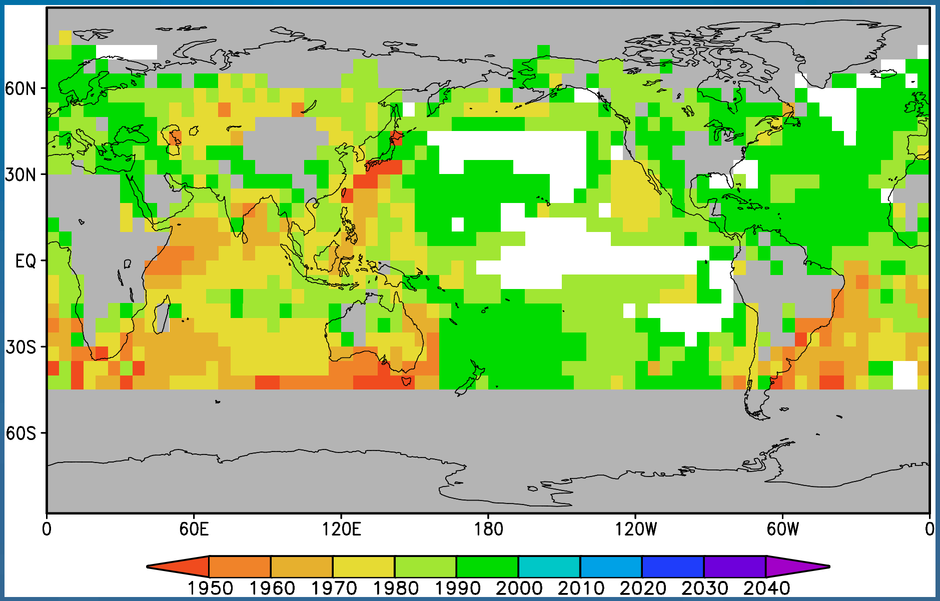

Sporyshev and Kattsov (2006)

Timing of SAT stable change (A2): 17-model average vs. observation

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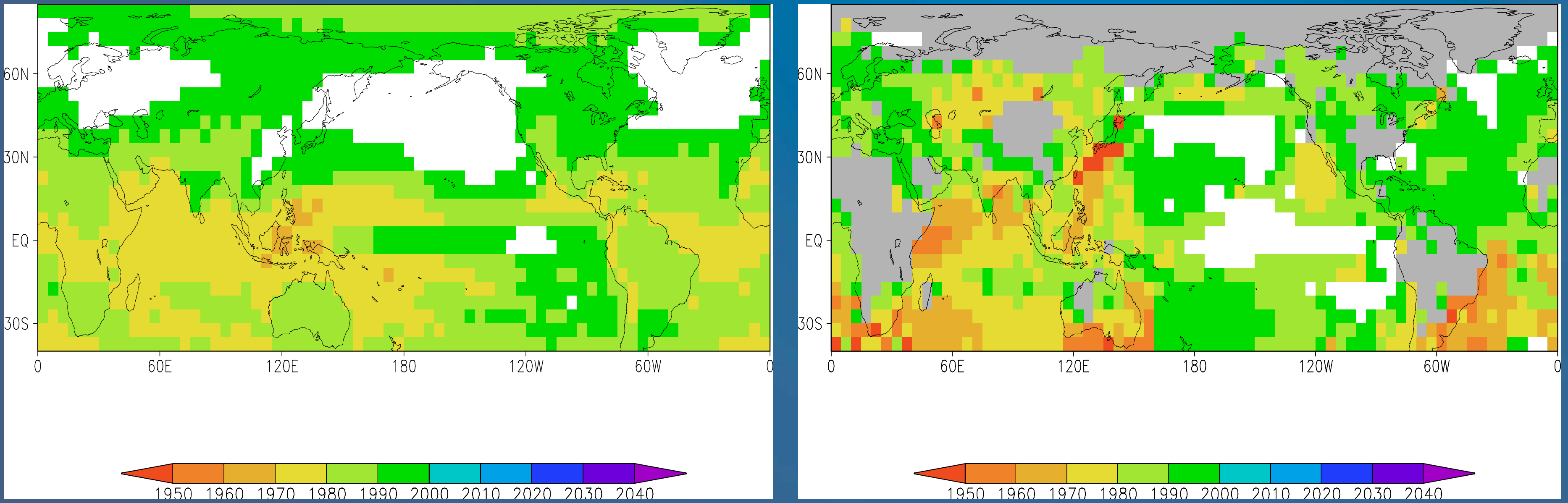

Sporyshev and Kattsov (2006)

Timing of SAT stable change (A2): 17 models

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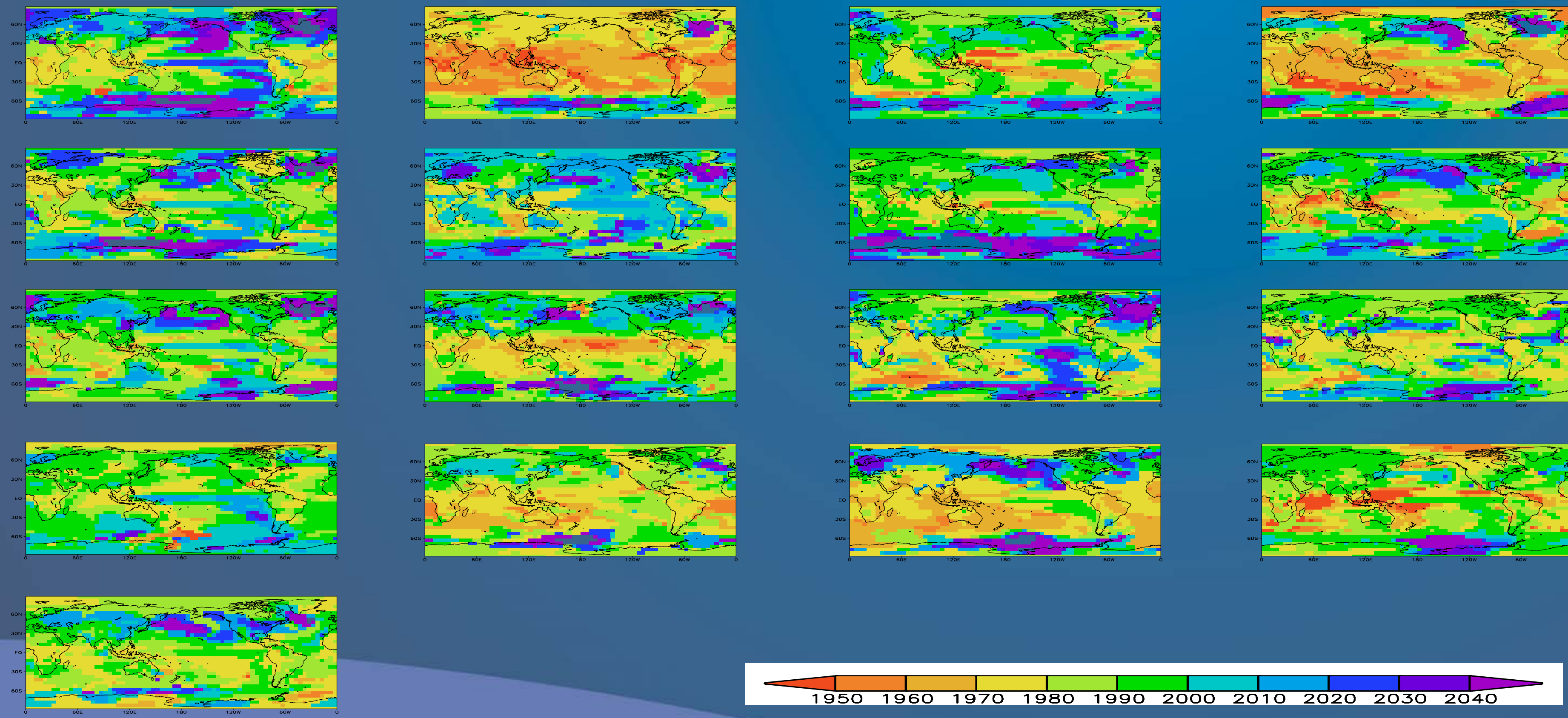
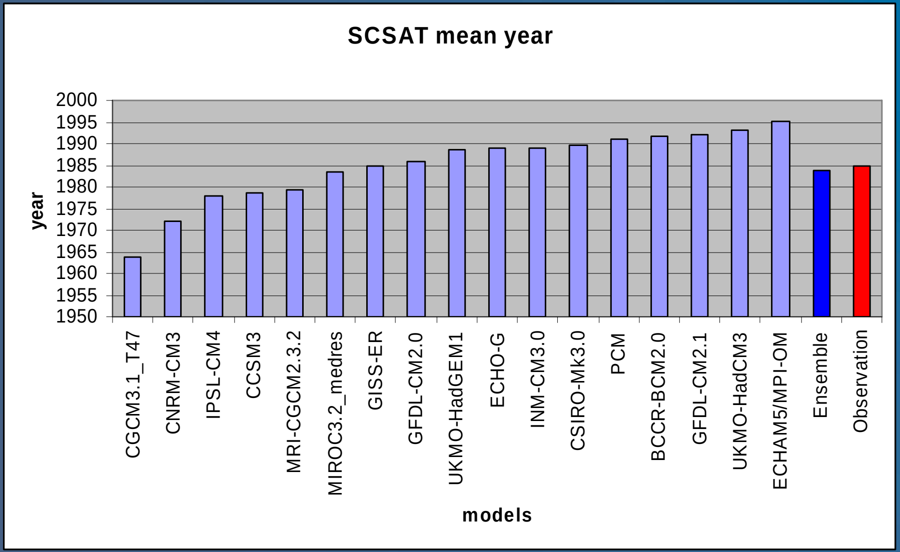
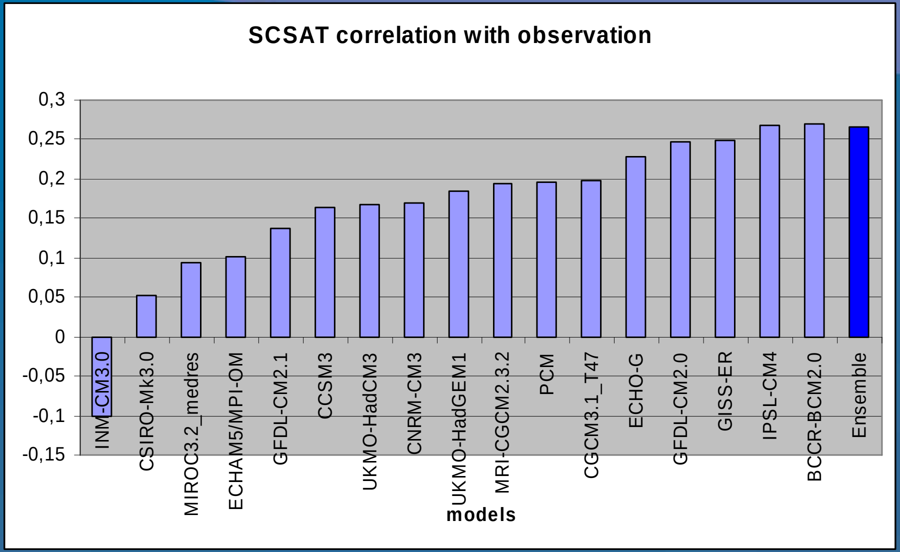
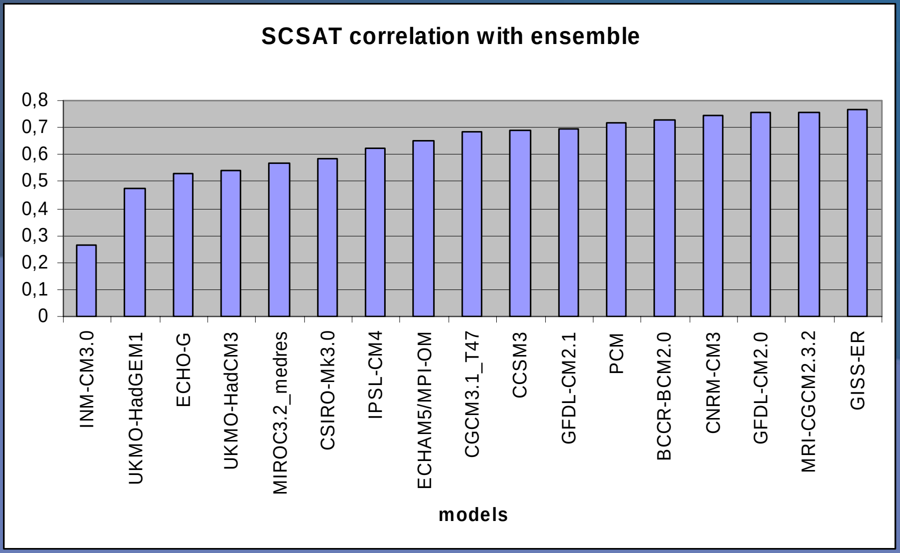


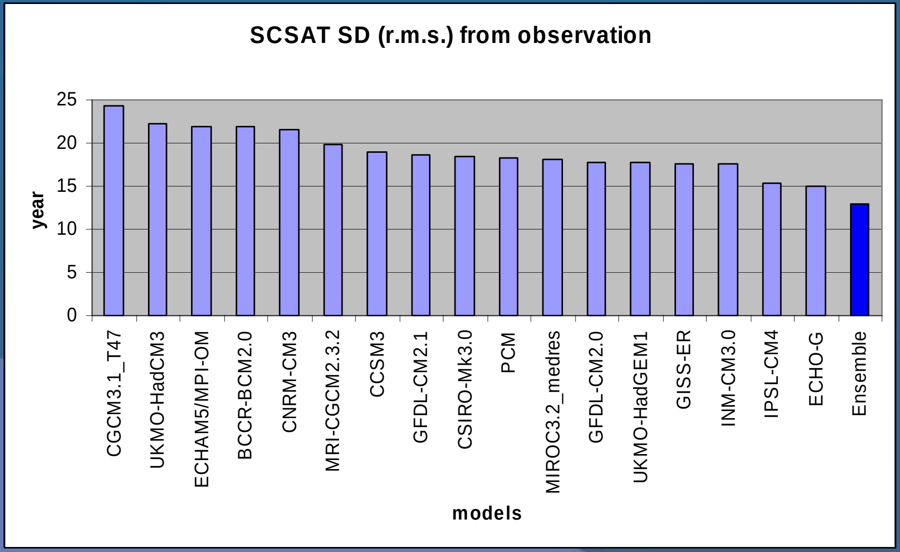
Kattsov and Sporyshev (2006)

Timing of SAT stable change (A2): statistics for the 30S-50N belt









Kattsov and Sporyshev (2006)

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Summary:

The analysis of SCSAT (SCSST) allows to conclude that:

(1) according both to the observations and simulations, the stable warming has already taken place in many regions of the Earth;

(2) some qualitative agreement between the observationally- and simulation based global pictures of the stable temperature change add optimism with regard to the models' credibility, at least when used as an ensemble;

(3) as the only cause of the SCSAT in the models is the GHG concentration increase, the observed SCSAT(SCSST) are very likely a result of the same anthropogenic forcing in the real world.

(4) The analysis of individual models' ability to reproduce the observed SCSAT is potentially useful as a model evaluation test.

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Acknowledgements:

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We acknowledge the international modeling groups for providing their data for analysis, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) for collecting and archiving the model data, the JSC/CLIVAR Working Group on Coupled Modelling (WGCM) and their Coupled Model Intercomparison Project (CMIP) and Climate Simulation Panel for organizing the model data analysis activity, and the IPCC WG1 TSU for technical support. The IPCC Data Archive at Lawrence Livermore National Laboratory is supported by the Office of Science, U.S. Department of Energy.

Additional figures

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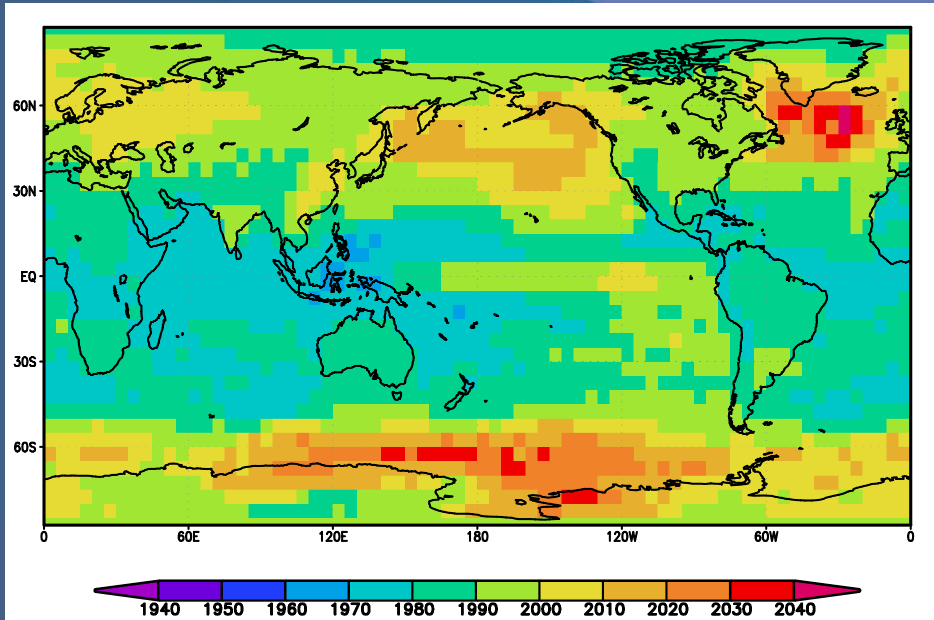
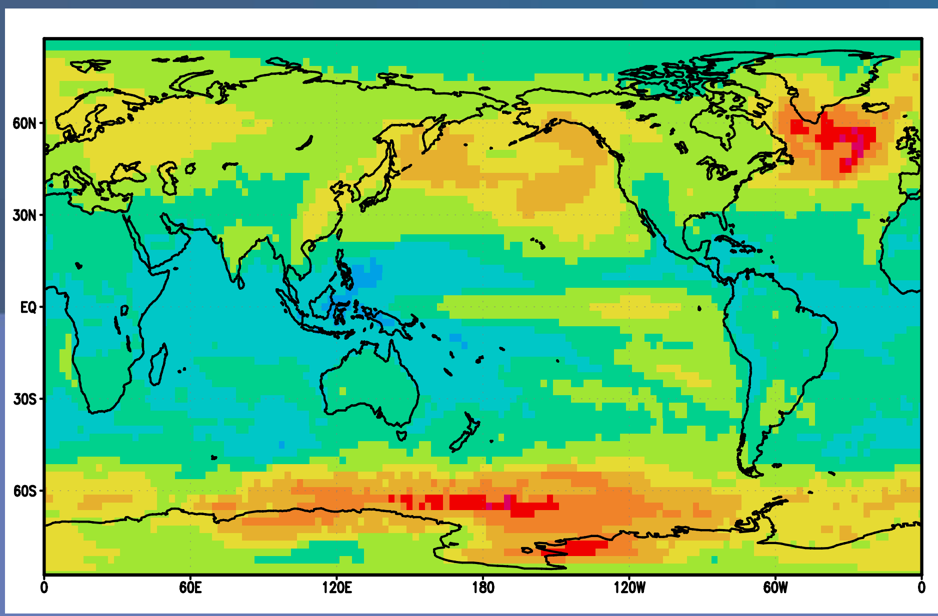
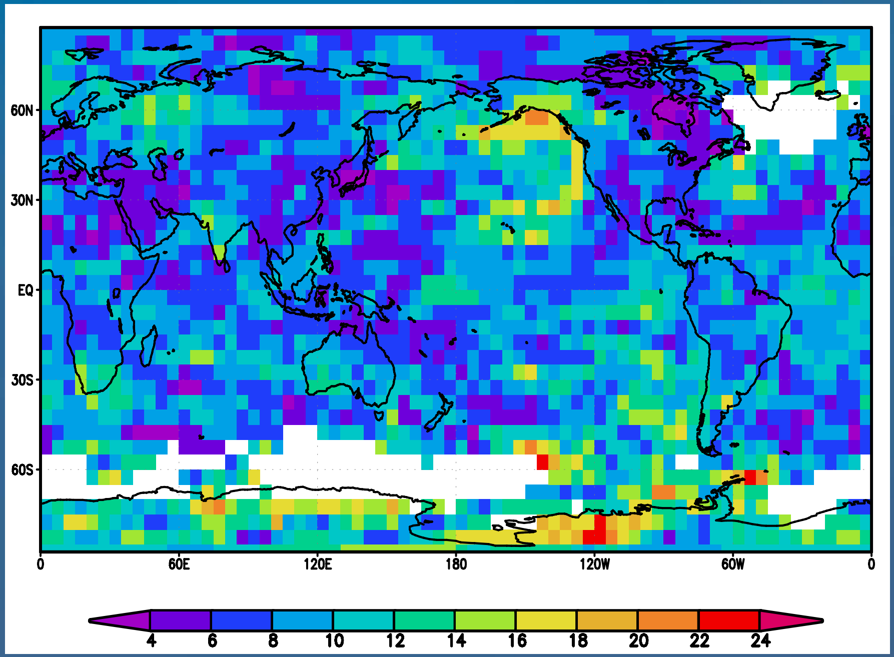
Resolution 5x5



Resolution 2.5x2.5



Running averaging: 11yr → 21yr



Timing of SAT stable change (A2): a model in northern North Atlantic

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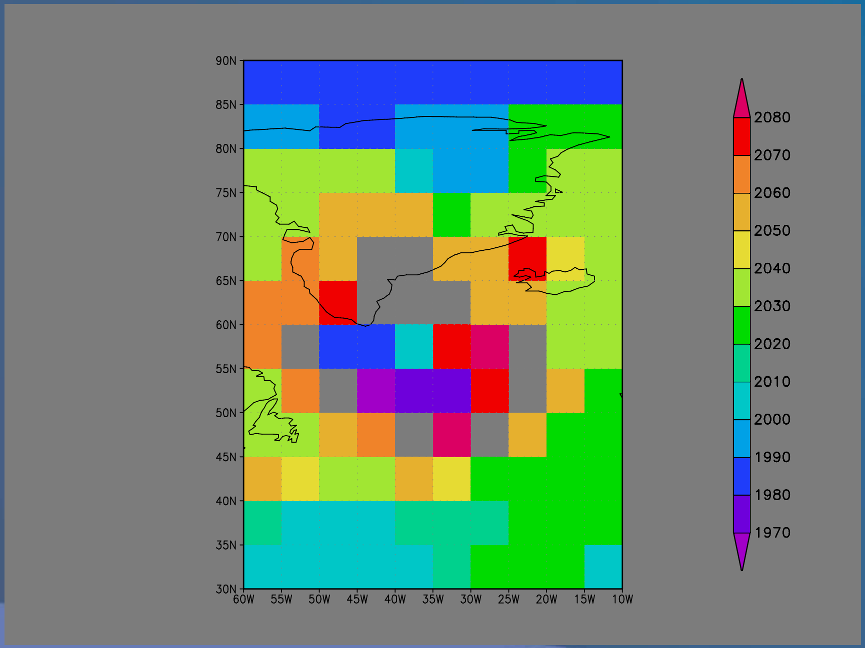

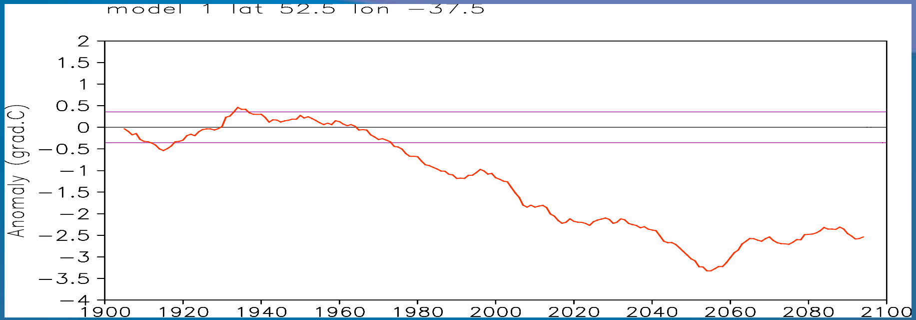

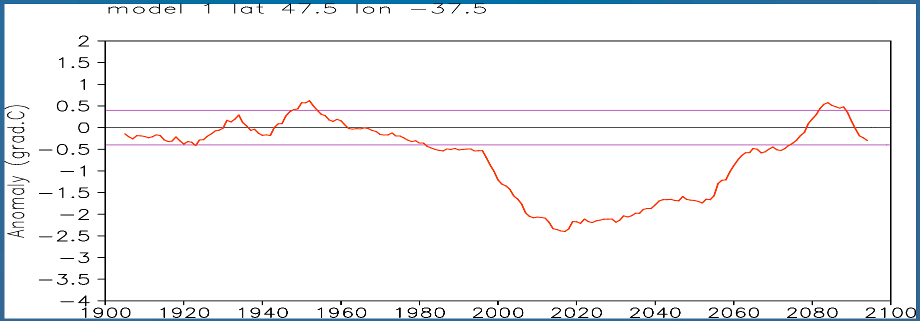

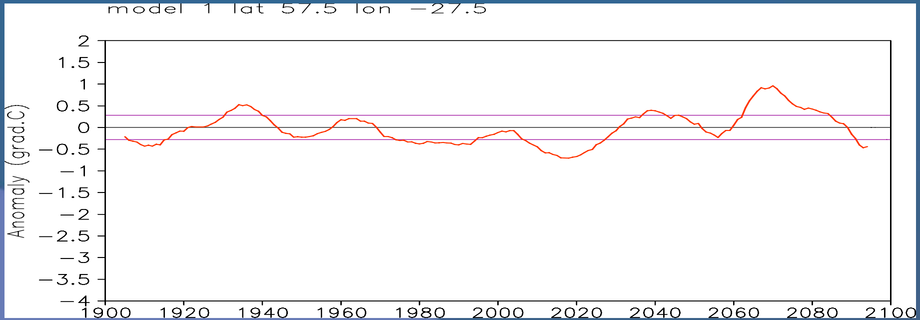

Kattsov and Sporyshev (2006)

Stable change of SAT (SCSAT)

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$$t = \frac{\widehat{\mu}_X - \widehat{\mu}_Y}{S_p\sqrt{\frac{1}{n_X} + \frac{1}{n_Y}}},$$

$$S_p^2 = \frac{\sum_{i=1}^{n_X} (\mathbf{x}_i - \widehat{\mu}_X)^2 + \sum_{i=1}^{n_Y} (\mathbf{y}_i - \widehat{\mu}_Y)^2}{n_X + n_Y - 2}$$

Kattsov and Sporyshev (2006)