



VarSITI Newsletter

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Project ROSMIC

Article 1:



Activity of ROSMIC WG3 “Trends in Mesosphere and Lower Thermosphere”

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Activities of WG3 ROSMIC are carried out in nine different but interrelated directions. Here we report some results reached in 2015 in five of them.

1. Long-term trends in winds and atmospheric waves

A homogeneous time series of winds over Collm (51N, 13E) in the MLT was constructed. Wind show long-term trends throughout the year, with a change of

trends in the 1990s. This tendency is also seen in other MLT wind time series at similar latitudes (Saskatoon, Obninsk). We were able to qualitatively reproduce the trend by a numerical model; the summer trends may be explained by CO₂ and ozone changes, while in winter the influence of the lower atmosphere (troposphere/stratosphere) circulation plays a decisive role. Some information is available in Jacobi et al. (2015).

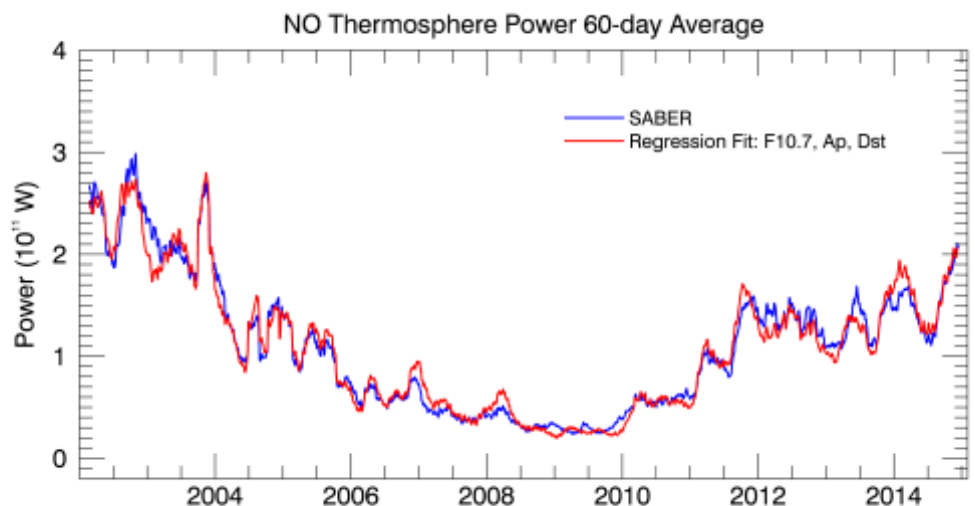


Figure 1. Multiple regression fit (red curve) using F10.7, Ap, and Dst to the observed time series of thermospheric radiative cooling by nitric oxide measured by the SABER instrument from 2002 to 2015 (blue curve). The multiple correlation coefficient is 0.985.

2. Long-term changes and trends in heat budget and composition

Mlynczak et al., (2015) developed the Thermosphere Climate Index (TCI), which is the 60-day running average of the rate of radiative cooling of the global thermosphere by nitric oxide (NO) infrared emission at 5.3 microns. The TCI is obtained by a multiple linear regression in which 13.5 years of observations of NO cooling between 100 and 250 km are accurately fit with corresponding time series of the F10.7, Ap, and Dst indexes. Figure 1 reveals very good agreement between fitted and observed NO 5.3 microns emission. With extant databases of these indexes it is possible to reconstruct the TCI, and hence, thermospheric cooling due to NO emission back to 1947 when F10.7 was first measured routinely (Figure 2).

The relationship of the peak in the solar cycle as given by the occurrence of sunspot maxima with the peak in radiative cooling by NO has been investigated. In solar cycles 19, 20, and 23, the sunspot maximum occurs after the maximum in NO cooling. In cycles 21, 22, and 24, the NO cooling maximum occurs after the sunspot maximum. The sunspot number is strongly correlated with F10.7 (and hence solar ultraviolet irradiance), but not with Ap (i.e., geomagnetic processes). The NO cooling is driven by both solar ultraviolet irradiance and geomagnetic processes, as shown in Mlynczak et al. (2015). On average, solar irradiance is responsible for approximately 70% of the cooling by NO, and geomagnetic processes are responsible for the remaining 30%. The fraction varies greatly over a solar cycle.

3. Vertical coupling of trends

Kozubek et al. (2015) disclosed the existence of the two-core longitudinal structure in meridional wind at 10 hPa in January. MERRA reanalysis data show that the two-

core structure covers the middle stratosphere (lower boundary ~50 hPa), upper stratosphere and lower mesosphere (up to at least 0.1 hPa). It is circulation response to the blocking Aleutian pressure high, which affects more or less also zonal wind, temperature and ozone fields. It occurs only in the winter half of the year (October-March) and only at the Northern Hemisphere.

4. Long-term trends in polar mesospheric clouds

Observations of polar mesospheric clouds (PMC) from the Solar Backscatter Ultraviolet (SBUV) from 1979 - 2014 and observations from Solar Occultation for Ice Experiment (SOFIE) indicate that PMC sensitivity to solar variability increases towards the poles, consistent with model results. Interpreting the SBUV PMC trends with SOFIE data indicates a cooling trend that increases towards the pole in the Northern Hemisphere, consistent with observations and model results.

Validation of modeled ice water content (IWC) reveals a nice agreement with IWC means taken from SBUV for the period 1979–2013.

Trends in the ice water content (IWC) depend on latitude. For the entire period 1961–2013, no trend exists at mid latitudes (50°–60°N) but increase poleward to highly significant values of 4.4 ± 0.9 g km⁻²/decade in the latitude band 74°–82°N. The analysis of trends in extreme PMC events (IWC > 300 g km⁻²) shows a 23 %/decade increase in occurrence frequency at 74°–82°N which is the largest trend of all PMC parameters. As a result the cooling of -0.58 ± 0.32 K/decade near 83 km height mainly determine trends in IWC, whereas cooling at stratospheric heights, induced by stratospheric ozone, controls to a large extent the long-term behavior of PMC altitudes (Berger and Lübken, 2015).

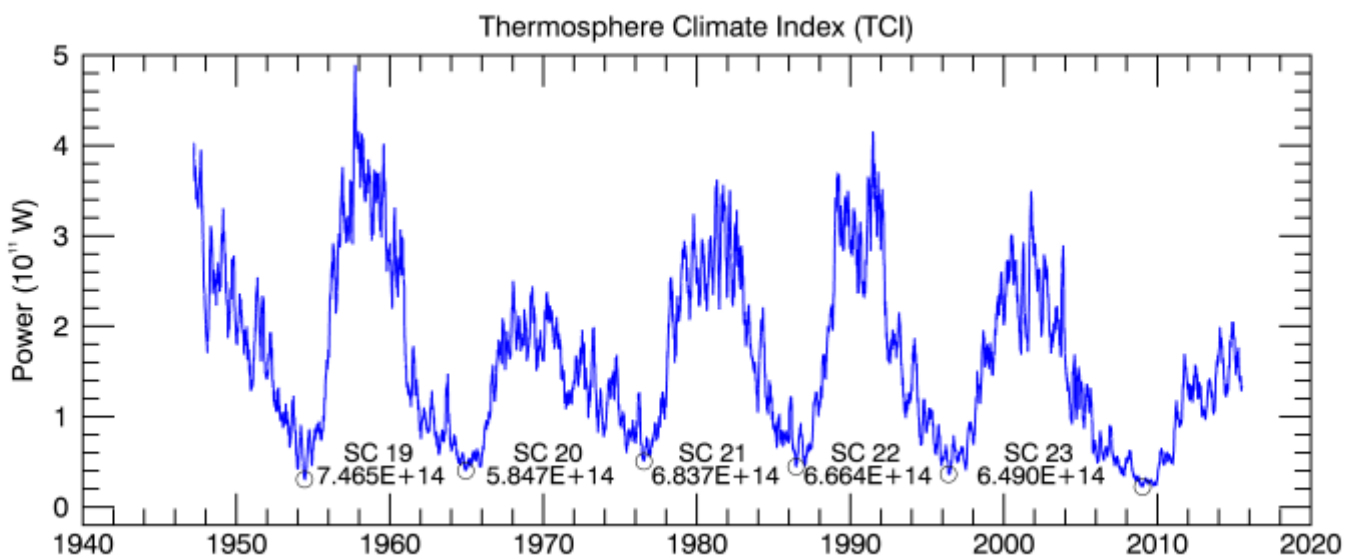


Figure 2. The TCI extended back to 1947, covering 5 full solar cycles. The numbers in the figure are the integrated power (W) radiated during each solar cycle. Of interest is that the difference in radiated power is at most 25% from the strongest to weakest solar cycles.

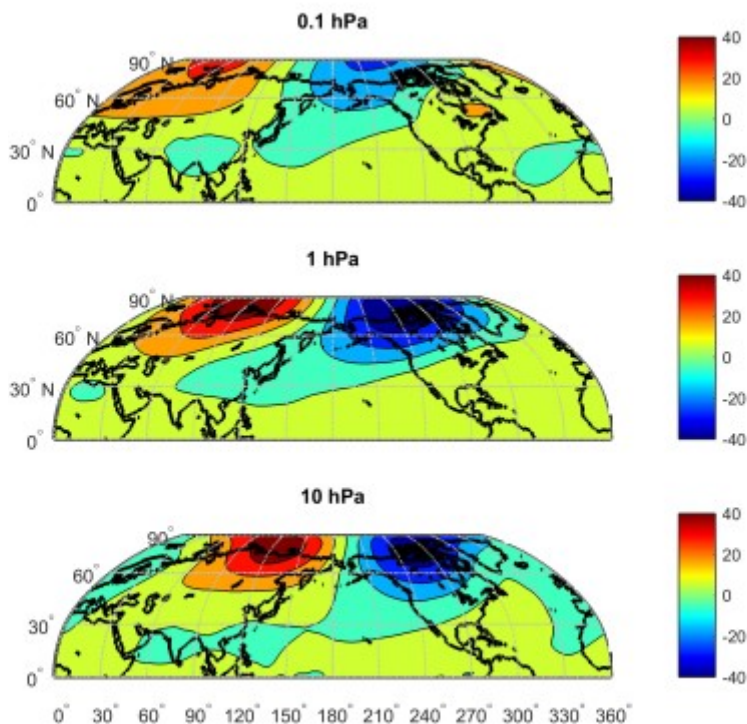


Figure 3. The MERRA climatology of meridional wind (scale in m/s) for January at 0.1 hPa (upper panel), 1hPa (middle panel) and 10 hPa (lower panel), 1979–2012. Positive values are for southerly wind (wind from south), negative values for northerly wind.

Long-term trend in the meridional wind at 10 hPa, 50–55°N, January is significant at the 99% level in the “core” areas but insignificant elsewhere. It is negative during the period of ozone depletion development (1970–1995) but positive after the ozone trend turnaround (1996–2012).

5. Long-term trends in CO₂ and O concentrations

Numerical models have so far failed to simulate in the mesosphere and lower thermosphere the differential CO₂ trends. A new analysis by sampling the WACCM model results on ACE-FTS sampling points was conducted. Figure 4 shows the trend profiles (~80 – 110 km) from our new analysis. It is clear that the modeled CO₂ trend is ~5%, about half of the ACE-FTS observed trends in this altitude range. It should be mentioned that ACE-FTS trends are supported by trends observed by SABER; thus model calculations of CO₂ trends differ from observations less than in the past but the difference is still significant.

Acknowledgement

We acknowledge activities of all partners who take part in WG3 of ROSMIC. This work was supported by GACR grant 15-03909S.

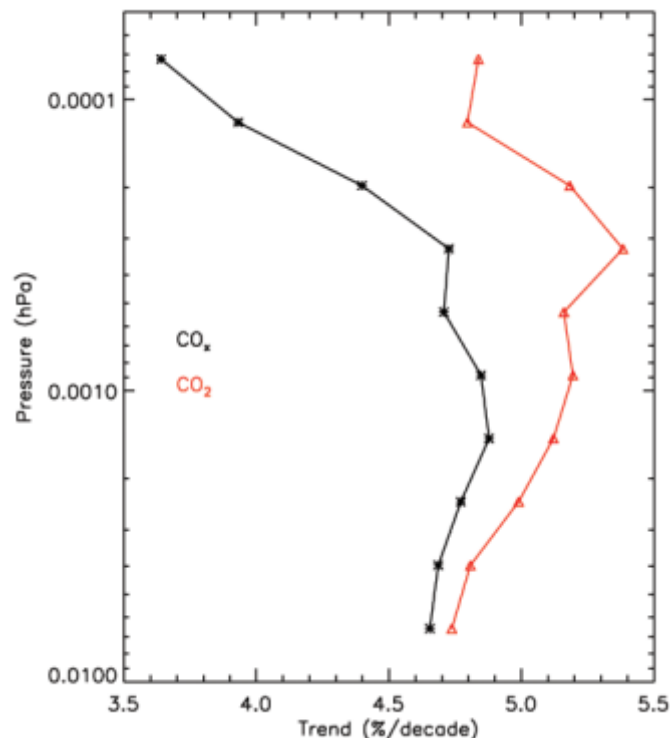


Figure 4. Trends of CO₂ and CO_x (CO₂+CO), in percent per decade, simulated by WACCM from 2004 – 2012, sampled at ACE-FTS sampling points.

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- Mlynczak, M. G., L. A. Hunt, B. T. Marshall, J. M. RussellIII, C. J. Mertens, R. E. Thompson, L. L. Gordley (2015), A combined solar and geomagnetic index for thermospheric climate. *Geophys. Res. Lett.*, 42, 3677–3682. doi:10.1002/2015GL064038.

Article 2:



Multi-Application Solar Telescope (MAST) at the Udaipur Solar Observatory, India

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Nandita Srivastava



Shibu K. Mathew

Multi Application Solar Telescope (MAST) is a 50-cm aperture off-axis Gregorian-Coude telescope installed on the island in the Lake Fatehsagar, Udaipur, by the Udaipur Solar Observatory (USO) of the Physical Research Laboratory. It sits on an alt-azimuth mount and has salient features like a field de-rotator to compensate the image rotation and a guider to track the Sun continuously with high precision (~ 0.01 arc-sec/min). It also has a wave front sensor for correcting optical misalignments caused due to temperature variations. In order to minimize the thermal related seeing, the temperature of the primary mirror is kept at ± 1 °C of the ambient by flushing air with a speed of 1.5 m/s. MAST is aimed at studying the solar activity including its magnetic field. Based on the results of measurements of the Fried's parameter at the island site, the diameter of the telescope aperture

was decided as 50 cm. MAST has a 3 arc-minute circular field of view, providing small field and high resolution images of solar active regions. The main telescope has been built by the Advanced Mechanical and Optical Systems (AMOS) of Belgium. The dome housing for the MAST telescope is a collapsible one, made of tensile fabric and has been manufactured by the Armatic Engineering of Bangalore, India.

MAST was installed in several stages by AMOS and tested by USO for onsite acceptance. The test observations were accumulated over a year, before the final acceptance of the telescope which took place on 16 June 2015. The telescope is now operational. Simultaneous images are recorded in H α (656.3 nm) and G-Band (430.5 nm) regularly.



Figure 1. The housing and the dome (left) for MAST on the island observatory in the lake Fatehsagar of Udaipur.

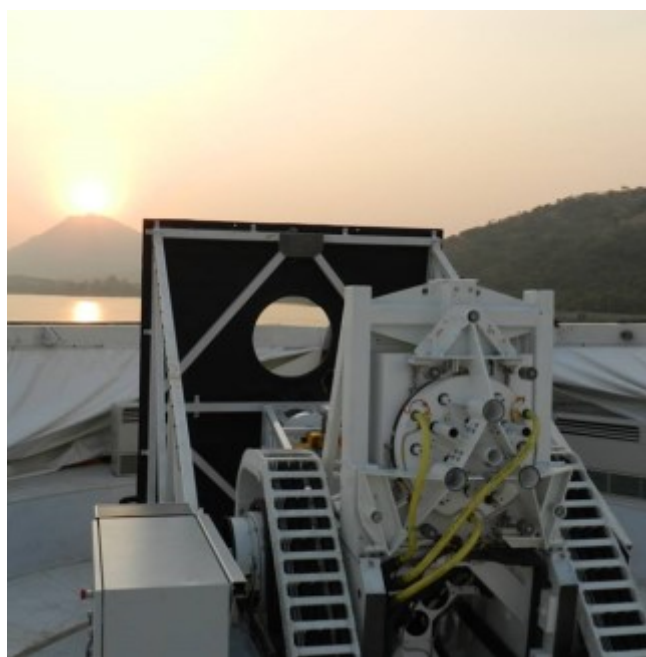


Figure 2. MAST pointing towards the Sun as the sun sets. The rear side of the primary mirror is seen here. The black plate with a circular opening is the sun-shield.

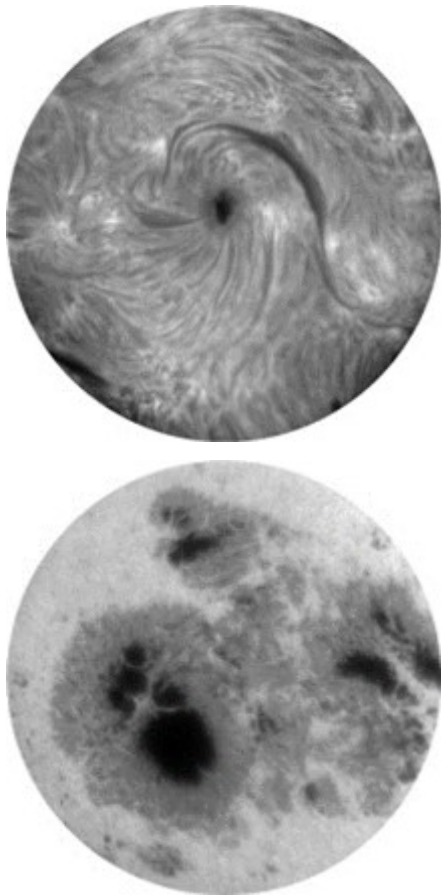


Figure 3. Typical images in chromosphere taken in H α (656.3 nm) (top) and in photosphere (bottom) in G-band (430.5 nm).

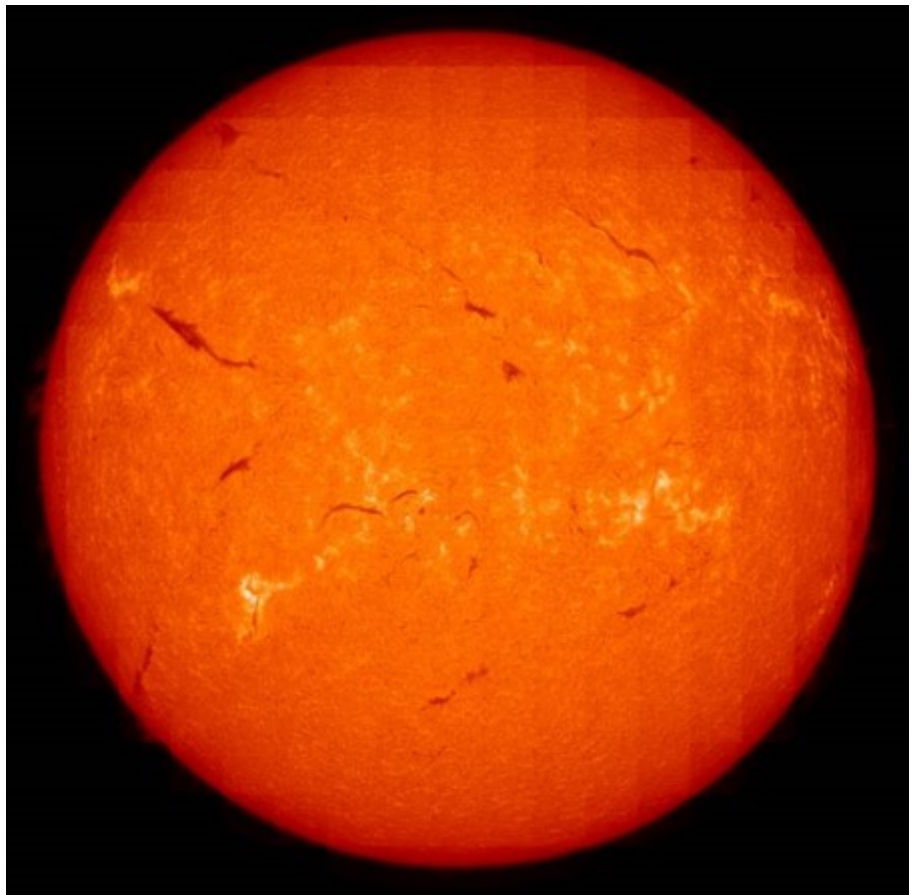


Figure 4. H α full disk image constructed from a sequential mosaic of 293 images taken by MAST on 19th May 2015.

Back-end instruments for MAST have been built in-house at USO and are being integrated with the telescope presently. These include a Narrow-band Imager which uses a tandem Fabry-Perot etalon pair to record simultaneous images of the photosphere (FeI 617.3 nm) and chromosphere (CaII 854.2 nm), a Liquid Crystal Variable Retarder (LCVR) based polarimeter to measure the magnetic field. An Adaptive Optics system for image stabi-

lisation to achieve the diffraction-limited performance is also being integrated. The integration of the back-end instruments is planned to be completed and regular observations are expected by the middle of this year.

Highlight on Young Scientists 1:



The causes and consequences of radiation belt electron precipitation

Lauren W. Blum

Space Sciences Laboratory (SSL), University of California Berkeley, USA



Lauren W. Blum

Particle precipitation into the atmosphere is a critical part of radiation belt electron loss, and quantified understanding of this mechanism is needed in order to understand and ultimately predict radiation belt dynamics. Electromagnetic ion cyclotron (EMIC) waves are thought to be a primary source of precipitation of radiation belt electrons, but a one-to-one relationship between the waves and precipitation is often not observed. My current research focuses on investigating the relationship between EMIC waves and precipitation events, their spatial scales, global distributions, and solar wind/magnetospheric drivers. Combining multipoint measurements from a variety of platforms, including balloons and CubeSats, I am exploring

the nature and extent of electron loss to the atmosphere and when and where EMIC waves may be driving it.

As a graduate student at the University of Colorado and now a postdoc at the Space Sciences Lab at UC Berkeley, my research has centered around the coupled nature of magnetospheric particle populations and the role of wave-particle interactions in radiation belt dynamics. In particular, I am interested in combining multipoint observations, particularly those from low-resource platforms such as CubeSats and balloons, to further understanding of the three-dimensional nature of magnetospheric dynamics.

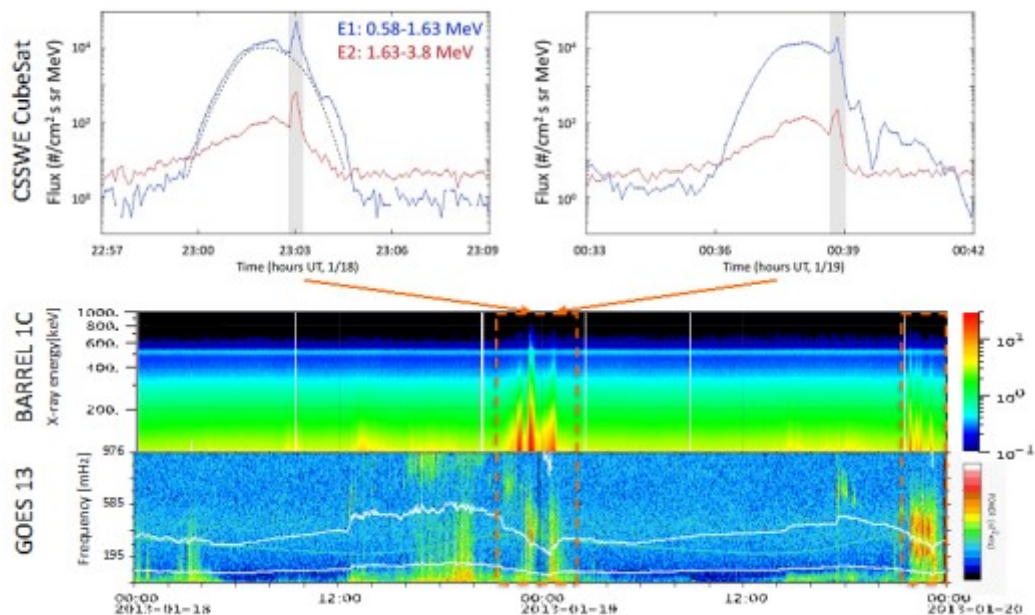


Figure 1. An example of an MeV electron precipitation event observed by a CubeSat and balloon concurrently with EMIC wave activity. (top panels) Measurements from the Colorado Student Space Weather Experiment (CSSWE) CubeSat and (second panel) BARREL balloon 1C during two periods of precipitation on 18–19 January 2013. During the same two day period, (third panel) GOES 13 observed EMIC wave activity at the same times, and with similar modulation, as the precipitation observed by the BARREL balloon (see orange dashed boxes). During these precipitation events, the balloon, CubeSat, and GOES 13 spacecraft were all in the dusk sector, on magnetic field lines mapping to a localized region near 18 MLT. Adapted from Blum et al. [2013, 2015].

Reference

- Blum, L. W., A. Halford, R. Millan, J. W. Bonnell, J. Goldstein, M. Usanova, M. Engebretson, M. Ohnsted, G. Reeves, H. Singer, M. Clilverd, and X. Li (2015), Observations of coincident EMIC wave activity and duskside energetic electron precipitation on 18-19 January 2013, *Geophys. Res. Lett.*, 42, doi:10.1002/2015GL065245.
- Blum, L. W., Q. Schiller, X. Li, R. Millan, A. Halford, and L. Woodger (2013), New conjunctive CubeSat and balloon measurements to quantify rapid energetic electron precipitation, *Geophys. Res. Lett.*, 40, doi:10.1002/2013GL058546.



About my research

Israel Silber

Department of Geosciences Tel Aviv University, Israel



Israel Silber

Very low frequencies (VLF – 3-30 kHz) electromagnetic signals are generated by various sources. The most dominant sources are lightning discharges and man-made transmitters, used for geolocation and communication with submarines. VLF waves are useful for these purposes as they are reflected off the ionospheric D-region (~60-95 km) and Earth's surface, while suffering from very low attenuation, thus allowing them to propagate thousands of kilometers from their source. As VLF transmitters broadcast at a constant power and frequency band, changes in the received signal's amplitude and phase give an indication of modifications in the reflection region.

I use these received narrowband signals to study various phenomena which affect the D-region's conductivity, composition, and electron density. These phenomena are of solar origin (solar flares, coronal mass ejections, etc.) and of terrestrial origin (thunderstorms, atmospheric tides, climate change effects, etc.). Throughout my studies, three papers were so far published, dealing with the MLT temperature - VLF amplitude connection (*Silber et al., JGR, 2013* – see attached figure), semiannual oscillation detected in midnight VLF amplitudes (driven by oscillatory molecule transport, and also affected by tides – *Silber et al., ACPD, 2015*), and the importance of vertical magnetic component in VLF measurements (*Silber et al., JGR, 2015*).

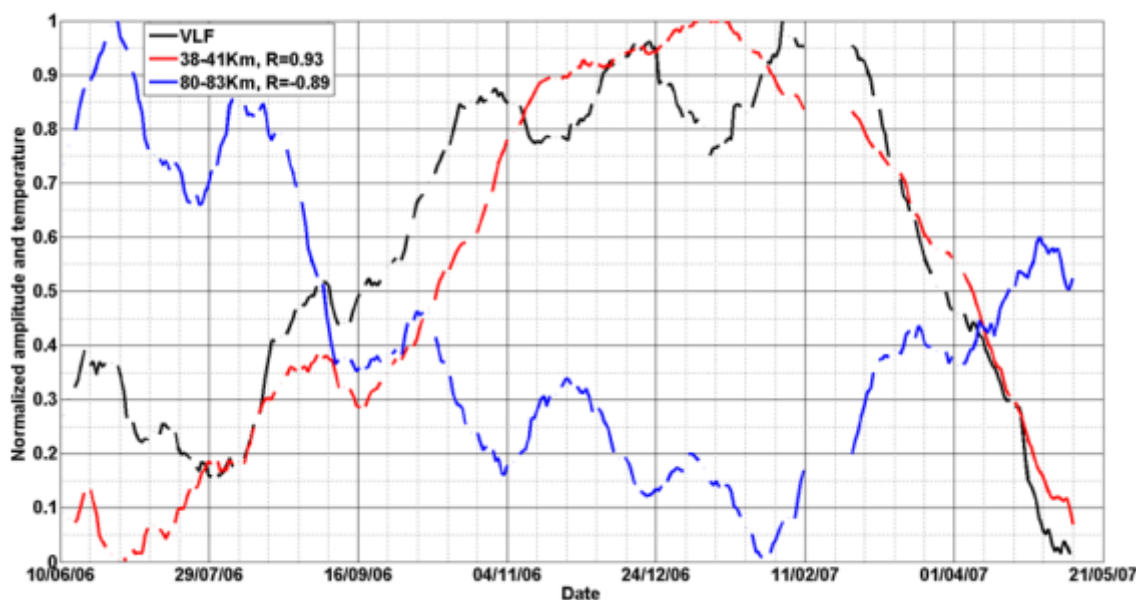


Figure 1. normalized VLF midday amplitudes (black) and normalized temperatures at 80-83 km (blue) and 38-41 km (red). Note the mirror-like similarity between the VLF and MLT temperatures. Correlation coefficients are given in the legend. Temperature data was acquired by the SABER instrument on-board the TIMED satellite.

Highlight on Young Scientists 3:



Features of OH dayglow emission observed by the TIMED/SABER satellite

Hong Gao

State Key Laboratory of Space Weather, Center for Space Science and Applied Research, Chinese Academy of Sciences, Beijing, China



Hong Gao

The airglow is influenced by the atmospheric photochemical and dynamical processes. Consequently the airglow can be regarded as a tracer of atmospheric variation. Earlier, studies mainly focused on the nightglow and our understanding of dayglow photochemistry and morphology was tenuous. To contribute to our understanding of the OH dayglow, I analyzed its global distribution and variation using the TIMED/SABER observations. We

found that the vertical distribution of the dayglow has a long-term stable double-layer structure with the upper layer situated in the mesopause region and the lower layer in the range of 70-85 km. It is mainly caused by photochemical processes involving ozone and modulated by atmospheric temperature and hydrogen. The double-layer structure changes with local time, season and latitude as shown in Figure 1.

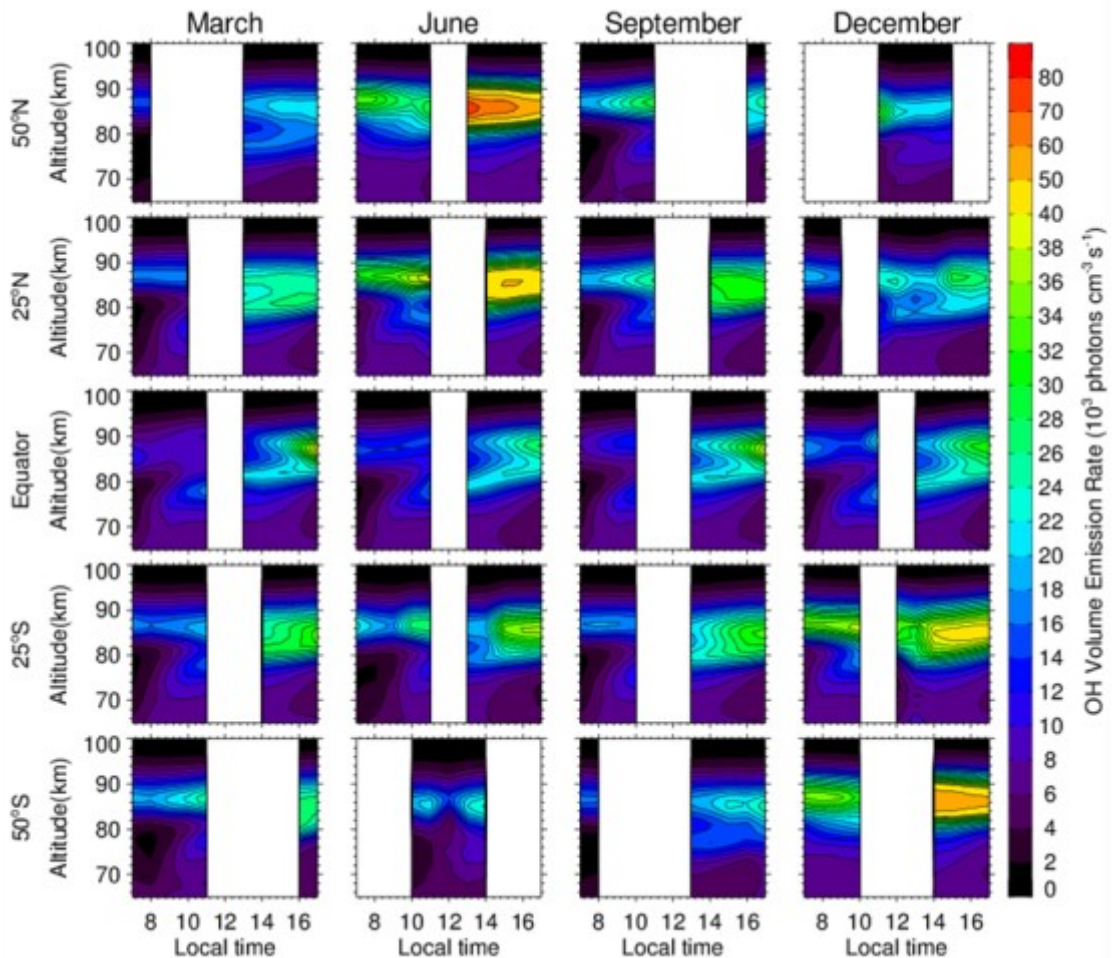


Figure 1. Adapted from Gao et al. [2015]. Altitude-local time distributions of 12-year monthly mean OH dayglow emission rate during equinoxes and solstices at five latitudes, 50°S/N, 25°S/N and the equator. An unequally spaced color bar is used with a spaced scale of 2×10^3 photons $\text{cm}^{-3} \text{s}^{-1}$ from 0 photons $\text{cm}^{-3} \text{s}^{-1}$ to 40×10^3 photons $\text{cm}^{-3} \text{s}^{-1}$ and a spaced scale of 5×10^3 photons $\text{cm}^{-3} \text{s}^{-1}$ from 40×10^3 photons $\text{cm}^{-3} \text{s}^{-1}$ to 85×10^3 photons $\text{cm}^{-3} \text{s}^{-1}$.

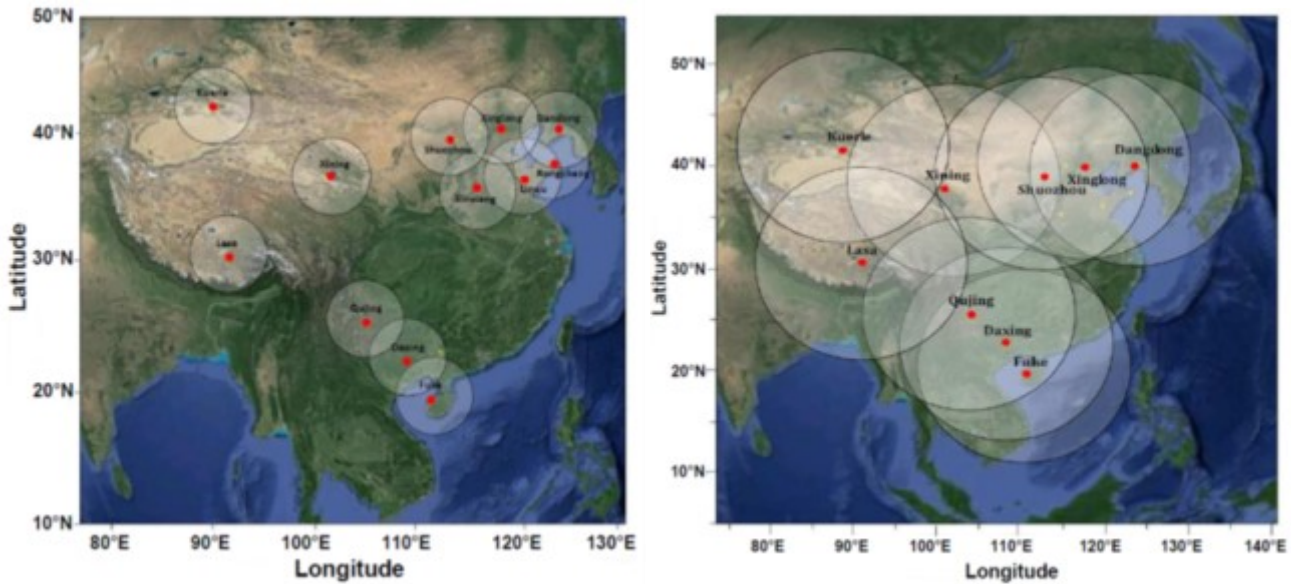


Figure 2. Airglow observation networks of China, AONC-OH (left) and AONC-Red Line (right).

I am now working in the Middle and Upper Atmosphere Research Group led by Prof. Jiyao Xu. This group established two airglow observation networks as shown in Figure 2, which observe OH and O(¹D) airglows respectively. In the networks, airglow is observed using multiple instruments including all-sky imagers, spectrometers, photome-

ters and Fabry-Perot interferometers. In this group, my current work involves the investigation of the vertical coupling between the lower and upper atmosphere, and the effect of solar activity on airglow using satellite and ground-based observations.

Reference

Hong Gao, Jiyao Xu, William Ward, Anne K. Smith, Guang-Ming Chen (2015), Double-layer structure of OH dayglow in the mesosphere, *JGR*, 120(7): 5778-5787.

Meeting Report 1:



The 14th International Symposium on Equatorial Aeronomy (ISEA-14)

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Institute for Scientific Research, Boston College, USA



Endawoke Yizengaw

The ISEA is held approximately every three to four years, and is a major gathering of scientists around the world to share their most recent results and to discuss possibilities for future campaigns and experiments. The 14th ISEA-14 conference had been held in Bahir Dar, Ethiopia from 19-23 October 2015, which was attended by excess of 125 participants represented from 27 nations. The scientific program of the conference had been organized into six main science themes: MIT coupling impact at low- and mid-latitude, Longitudinal dependence of equatorial electrodynamics and SED, Ionospheric



Figure 1. Group photo of the participants take outside the meeting hall, behind Lake Tana (the largest lake in Africa and is the source of Blue Nile).

irregularities and scintillations, New results from recently deployed instrumentation, Equatorial aeronomy related to atmosphere-ionosphere coupling, and Future opportunities using upcoming new mission and planned ground-based instrumentation. Very compelling and high standard 76 oral and about 40 poster presentations, focusing on both observation and modeling efforts for global and regional investigations with special emphasis on understanding space weather events in the African sector, were given at the conference. Detail information can be found at <http://www.bdu.edu.et/isea14/>.

Meeting Report 2:



ISEST (International Study of Earth-affecting Solar Transients) Workshop

Jie Zhang¹ and Alejandro Lara²

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²Instituto de Geofisica, Nacional Autonoma de Mexico, México City, México



Jie Zhang



Alejandro Lara

The annual ISEST International Workshop in 2015 was held in Universidad Nacional Autonoma de Mexico, México City, México, October 26 - 30, 2015. The ISEST, one of the four SCOSTEP/VarSITI projects, is aimed at bringing together scientists from different countries to interact and establish collaboration links that can effectively address the physical mechanisms of the



Figure 1. Group Picture of 2015 ISEST Workshop Participants.

origin, propagation, and Earth impact of solar transient events, including coronal mass ejections (CMEs), solar energetic particle events (SEPs) and corotating interaction regions (CIRs). About 40 experts and students from nine countries participated in this workshop, making seven invitation and 31 contributed talks. Leaders from all seven Working Groups (data-1, theory-2, simulation-3, campaign-4, Bs challenge-5, SEP-6 and MiniMax24-7) made progress reports in the beginning and summary reports in the end of the workshop. Rigorous and fruitful discussions were a trademark of the five-day-long workshop. All presentations and WG reports, along with data products, are archived and publicly available at the ISEST WIKI Website at "http://solar.gmu.edu/heliophysics/index.php/Main_Page".

Meeting Report 3:



International Conference on 'Solar Variability and Its Heliospheric Effects'

Olga Malandraki

Chair of the SOC and LOC,
IAASARS, National Observatory
of Athens, Athens, Greece



Olga Malandraki

This international conference took place in Athens from 2-6 November 2015. The conference was organized under the auspices of IAASARS of the National Observatory of Athens. 45 scientists attended the conference. In total 35 papers, with 31 Oral (Invited/Contributed) and 4 posters were presented. The meeting was co-sponsored by SCOSTEP/VarSITI. The conference was the 6th one organized in the frame of the Balkan, Black Sea and Caspian Sea Regional Network on Space Weather Studies comprising 11 countries. Many stimulating discussions took place for the various topics addressed.



Figure 1. Group photo of participants.

The presentations covered various aspects of Solar-Terrestrial Research and Space Weather relevant to the scientific goals of SEE and the other VarSITI projects: the Sun and solar activity, the solar wind and heliosphere, magnetospheric and ionospheric research advances, solar influences on the middle and lower atmosphere and the climate, space weather forecasting in frame of the d services. Many young scientists participated as well as targeted invited scientists from the international community (e.g. USA, Germany, Belgium). Presenting materials of the papers have been linked to the final programme: <http://www.space.noa.gr/bbc-sws/programme/>.

Meeting Report 4:



SCOSTEP/VarSITI Outreach Event during the Fall AGU in San Francisco

Kazuo Shiokawa

Center for International Collaborative Research (CICR),
Institute for Space-Earth Environmental Research (ISEE),
Nagoya University, Japan



Kazuo Shiokawa



Figure 1. VarSITI Reception at the AGU Fall Meeting 2015.

A SCOSTEP/VarSITI reception was held in San Francisco on 17 December 2015 as an associated event during the AGU Fall Meeting 2015. The goal of the event was to meet and greet members of the solar-terrestrial physics community attending the AGU meeting and introduce them to SCOSTEP's activities including the VarSITI program and some of the people involved in implementing them. Posters on VarSITI and its four Projects were shown together with a video clip on the program, also available on line at <http://www.varsiti.org/>.

A number of outreach materials like the VarSITI flyers, seven issues of the VarSITI newsletters, as well as flyers summarizing the SCOSTEP Visiting Scholar (SVS) program and SCOSTEP's Awards for Distinguished Science, Young Scientist and Service were also distributed. Participants enjoyed interdisciplinary discussion and communication on the sun-earth relationship related to SCOSTEP/VarSITI. About 50 participants (domestic and international) attended the reception, including VarSITI co-leaders and SCOSTEP's representatives in the USA.



Upcoming meetings related to VarSITI

Conference	Date	Location	Contact Information
2016 ILWSWorkshop "Science for Space Weather"	Jan. 24-29, 2016	Goa, India	http://www.cessi.in/ssw/
4th International Symposium	Mar. 20-24, 2016	Hurghada, Egypt	http://iaga.cu.edu.eg
Space Climate School	Mar. 30-Apr. 3, 2016	Levi, Finland	http://www.spaceclimate.fi
6th Space Climate Symposium	Apr. 4-7, 2016	Levi, Finland	http://www.spaceclimate.fi
ANtartic Gravity Wave Instruments Network (ANGWIN) 3rd workshop	Apr. 12-14, 2016	Cambridge, England	
EGU General Assembly 2016	Apr. 17-22, 2016	Vienna, Austria	http://meetingorganizer.copernicus.org/EGU2016/session/20495
Space Wether, Space Climate, and VarSITI Session at JpGU2016	May 22-26, 2016	Makuhari, Japan	http://www.jpgu.org/meeting_e2016/
The First VarSITI General Symposium	Jun. 6-10, 2016	Albena, Bulgaria	http://newserver.stil.bas.bg/VarSITI2016/
6th International HEPPA-SOLARIS Workshop	Jun. 13-17, 2016	Helsinki, Finland	http://heppa-solaris-2016.fmi.fi/
6th IAGA/ICMA/CAWSES Workshop on Vertical Coupling in the Atmosphere-Ionosphere System	Jul. 25-29, 2016	Tainan, Taiwan	
41st COSPAR Scientific Assembly	Jul. 30-Aug. 7, 2016	Istanbul, Turkey	http://www.cospar-assembly.org
AOGS 13th Annual Meeting	Jul. 31-Aug. 5, 2016	Beijing, China	http://www.asiaoceania.org/aogs2016/
International Symposium on Recent Observations and Simulations of the Sun-Earth System III	Sep. 11-16, 2016	Golden Sand, Bulgaria	http://www.isroses.lanl.gov/
ROSMIC/IAGA workshop on trends and long term variations	Sep. 19-23, 2016	Kühlungsborn, Germany	
International Symposium on the Whole Atmosphere (ISWA)	Sep. 14-16, 2016	Tokyo, Japan	http://pansy.eps.s.u-tokyo.ac.jp/iswa/
7th workshop of the VLF/ELF Remote Sensing of Ionospheres and Magnetospheres (VERSIM) working group	Sep. 19-23, 2016	Hermanus, South Arica	
14th Hvar Astrophysical Colloquium	Sep. 25-30, 2016	Zagreb, Croatia	



Obituary for Prof. Dr. Karin Labitzke

Prof. Dr. Karin Labitzke

Retired professor for Meteorology at the Freie Universität Berlin (FUB), passed away on 15th November 2015 at the age of 80 years.



Karin Labitzke
*19.7.1935
†15.11.2015

Karin Labitzke studied at the Institut of Meteorology at the Freie Universität Berlin. After completing her PhD in 1962 on *Contributions to the synoptic meteorology of the high stratosphere* (in German), she worked with her teacher and mentor, professor Richard Scherhag, who discovered the stratospheric warmings. She made her first international contacts at the groundbreaking international *Symposium on Stratospheric and Mesospheric Circulation* in Berlin in 1962. A number of extended research visits at the National Center for Atmospheric Research (NCAR) in Boulder/Colorado (USA) followed. In 1969, she completed her habilitation from the Freie Universität Berlin. After the early death of professor Scherhag in 1970 she took over leadership of the stratospheric research group in Berlin and established a successful and internationally renowned research group until her retirement in the year 2000.

Karin Labitzke's scientific interest was always focused on the stratosphere. For her investigations she used daily stratospheric analyses of the northern hemisphere, which meteorologists in her own research group have prepared since the mid-1950s from radiosonde soundings (later complemented with satellite data). These hand-analysed stratospheric maps have long served as a reference for computer analyses of weather centers and formed part of the first reference climatology of the middle atmosphere, the *Cospar International Reference Atmosphere* (CIRA). At workshops, Karin Labitzke used to emphasize that unexpected extreme temperatures in the winter stratosphere were not outliers of computer programs but the result of stratospheric warmings. Another important application of the stratospheric analyses was the production and distribution of STRATALERT messages, mandated by the WMO. These reports about the stratospheric dynamics during northern hemisphere winter were also used to advise measurement campaigns in the Arctic.

Since the 1960s, Karin Labitzke worked on a number of open issues that are still part of ongoing research, such as the interaction between the stratosphere and the troposphere. Through her methodological approach, i.e. to identify unknown phenomena and connections in the stratosphere with the help of observational data, she animated theoreticians and modelers to look for explanations.

She also established a modeling unit within her own research group. The motto was: "A model is only good if it reproduces the observations correctly".

An outstanding topic of Karin Labitzke's research were the sudden stratospheric warmings during Northern hemisphere winter. She showed for example that polar temperatures vary a lot in the winter stratosphere: in years with stratospheric warmings, the monthly mean temperature in January/ February at 30hPa at the Pole could reach -55°C, whereas during cold winters temperatures would be around -75°C.

A milestone of stratospheric dynamical research was Karin Labitzke's finding of a relation between the occurrence of stratospheric warmings, the QBO at the equator and the phase of the 11-year solar cycle. She published her discovery for the first time in 1987, together with her colleague and close friend Harry van Loon from NCAR. While they were initially criticized by a number of colleagues, this relationship has since been convincingly proven to be robust and is nowadays established. Altogether, the research activities of Karin Labitzke can be found in more than 250 publications, and her book *The Stratosphere* is a popular source of knowledge for PhD students.

Besides her own research, Karin Labitzke was always engaged in committees, among others she led the *Committee on Space Research*, was part of the *Scientific Committee of Solar and Terrestrial Physics* as well as member of the *German Advisory Council on Global Change*. Between 1991 and 1993, she was the first female chair of the German Meteorological Society. During her term she successfully reunified the two German societies.

By effective third-party fundraising Karin Labitzke attracted many young scientists whom she supported with a great deal of enthusiasm. She served as a role-model for female scientists which resulted in a constant high proportion of women in her group.

Many people knew and appreciated Karin Labitzke as a colleague, teacher, mentor, and friend. We will always cherish our memories of her.

Author: Ulrike Langematz and Katja Matthes

The purpose of the VarSITI newsletter is to promote communication among scientists related to the four VarSITI Projects (SEE, ISEST/MiniMax24, SPeCIMEN, and ROSMIC).

The editors would like to ask you to submit the following articles to the VarSITI newsletter.

Our newsletter has five categories of the articles:

1. Articles— Each article has a maximum of 500 words length and four figures/photos (at least two figures/photos).
With the writer's approval, the small face photo will be also added.
On campaign, ground observations, satellite observations, modeling, etc.
2. Meeting reports—Each meeting report has a maximum of 150 words length and one photo from the meeting.
With the writer's approval, the small face photo will be also added.
On workshop/conference/ symposium report related to VarSITI
3. Highlights on young scientists— Each highlight has a maximum of 200 words length and two figures.
With the writer's approval, the small face photo will be also added.
On the young scientist's own work related to VarSITI
4. Short news— Each short news has a maximum of 100 words length.
Announcements of campaign, workshop, etc.
5. Meeting schedule

Category 3 (Highlights on young scientists) helps both young scientists and VarSITI members to know each other. Please contact the editors if you know any recommended young scientists who are willing to write an article on this category.

TO SUBMIT AN ARTICLE

Articles/figures/photos can be emailed to the Newsletter Secretary, Ms. Miwa Fukuichi (fukuichi_at_stelab.nagoya-u.ac.jp). If you have any questions or problem, please do not hesitate to ask us.

SUBSCRIPTION - VarSITI MAILING LIST

The PDF version of the VarSITI Newsletter is distributed through the VarSITI mailing list. The mailing list is created for each of the four Projects with an integrated list for all Projects. If you want to be included in the mailing list to receive future information of VarSITI, please send e-mail to "fukuichi_at_stelab.nagoya-u.ac.jp" (replace "_at_" by "@") with your full name, country, e-mail address to be included, and the name of the Project you are interested.

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Mai Asakura has been taking a maternity/childcare leave since December 2015, Miwa Fukuichi is taking over Mai's task as the newsletter secretary from this issue.

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