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Newsletter of the

DIVECHA CENTRE FOR CLIMATE CHANGE

Climate change and health training programme

Open Day 2024

The 11th meet of the mountain states

Eco-friendly Agro-Technology and field research



Indian Institute of Science
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FROM THE CHAIR

Greetings!



The year 2023 was the hottest year during the past 150 years. The global mean temperature was 1.5 degrees C above the values during 1890-1900. The Paris agreement signed in 2015 was supposed to limit the global warming to 1.5 degrees C. The high temperature we had in 2023 is on account of increasing greenhouses gases as well as the natural climate oscillations known as the El-Nino. The decrease in aerosols on account of enforcement of air pollution laws in many countries have played a role too. In addition, the international maritime organization has implemented new rules to reduce emissions of aerosols by ships. All these factors have contributed to higher global temperature and large episodes of heat waves in the tropics. The heat waves that occur in the pre-monsoon season are “dry heat waves” that cause temperatures to exceed 40 degrees C but relative humidity is low. Most people in the tropics have found ways to adapt to these heat waves by proper hydration and avoiding outdoor work during the afternoon. After the onset of the monsoon there are “humid heat waves” when temperatures exceed 35 degrees C and relative humidities are above 50%. One cannot adapt to these heat waves unless the buildings have air conditioners. In India less than 5% of the households have air conditioners. In the last decade the demand for air conditioners has increased dramatically. In the last decade, the large increase in demand for power during hot days in New Delhi has caused large-scale disruption in power supply. The Rocky Mountain Institute in Colorado is working with the Indian government to develop more efficient air-conditioners. Human beings may be able to tackle humid heat waves through innovations, but this is not possible for other mammals. In India, Leopards and Tigers hunt in the dusk but they do so at different times to avoid conflicts. As the temperature rises the optimum time that is available to both will decline and thus may lead to new confrontations. In south India, the number of encounters between human beings and elephants has increased both on account of global warming and encroachment of human beings into national forests. This will demand creative solutions.

S. K. Satheesh

CLIMATE CHANGE AND HEALTH TRAINING PROGRAMME



Training programme on “Climate change and health” held on 15-16 March 2024.

The Divecha Centre on Climate Change, IISc organised the third edition of the comprehensive two-day training programme for health professionals entitled “HEALTH IN A CHANGING CLIMATE: EMPOWERING HEALTH PROFESSIONALS” on 15th and 16th March 2024. This certificate-based programme was designed to equip health professionals and educators with the knowledge and skills necessary to make a positive impact on their communities in the face of climate change.

The first day of the programme was dedicated to lectures on four critical themes related to the impact of climate change on health: air quality, water contaminants, soil and plastic contaminants, and the impact of natural disasters. Scientists and doctors delivered presentations on each topic, providing participants with a solid understanding of the scientific background and reasoning behind each theme. The lectures covered the facts and figures related to each topic, and the doctors discussed the associated health risks and their impact on communities.

The second day of the programme was dedicated to lightning talks and workshops, where participants had the opportunity to delve deeper into

specific areas of interest. Ten-minute lightning talks were given on topics such as innovative solutions to air pollution, the impact of climate change on indigenous health and oral health, a note on Planetary Health, soil and health, heatwaves impact on health and the importance of effective communication for health professionals. This was followed by workshops focused on the four themes covered on day one. Participants were divided into groups based on their areas of interest, and each group was given a case-based activity to complete, which they presented at the end of the workshop.

Overall, this training programme was a highly enriching and interactive experience for all participants, providing them with a comprehensive understanding of the critical issues related to health and climate change and empowering them to act.



Participants of the training programme conducted on 15-16 March 2024.

OPEN DAY 2024



Quiz programme being conducted at the DCCC auditorium during Open Day event on 24 February 2024.

The annual event called “Open Day” was organised on 24 Feb 2024 at the Indian Institute of Science campus to showcase its ongoing research activities to the public. On this day, students, science and technology enthusiasts, and the public had an opportunity to visit the Institute and go around the campus to explore the exciting science and technology initiatives and activities of the Institute.

The Open Day featured popular lectures, experimental demonstrations, poster presentations, quiz contests, scientific competitions, and exhibitions hosted at various departments and Centers. Divecha Centre for Climate Change also showcased a number of experiments, posters and quiz programmes for the visitors.



Students and staff of DCCC showcasing their experiments at the Open Day event.





Dr. H. Paramesh giving a climate and health talk to school students at the event.



Visitors viewing the posters put up by DCCC staff and students.

WHY SHOULD ARCHITECTS WORRY ABOUT CLIMATE CHANGE?

Prof. J. Srinivasan was invited to give a talk at The School of Architecture, Ramaiah Institute of Technology, Bengaluru during their Faculty Development program on “Energy efficient buildings: Advance in Practices” from 11th to 15th March 2024. Prof. Srinivasan gave a talk on “Why should architects worry about climate change?” He argued that architects design building that last 50 to 100 years and hence need to be concerned about the impact of climate change on the comfort of the occupants. Moreover, buildings contribute about 40% to the global carbon dioxide emissions. Cities occupy less than 1% of the earth’s surface area but contribute 60% of global carbon dioxide emissions. Architects designing building in coastal areas have to account for sea level rise during the next 50 years. Architects in developing countries cannot afford to repeat the mistakes made by developed countries. They need to adopt novel approaches to break the nexus between development and CO₂ emissions. He concluded by declaring that architects can play a major role to help us to adapt to climate change and reduce the carbon footprint of buildings and urban landscape.



Prof. J. Srinivasan, Distinguished Scientist, DCCC, delivering his talk at Ramaiah Institute of Technology, Bengaluru during 11-15 March 2024.

THE 11TH MEET OF THE MOUNTAIN STATES



A group discussion on water resources in the Himalayas.

The 11th Meet of the Mountain States (MoMS) was organised by Integrated Mountain Initiative on 22nd March, 2024, coinciding with World Water Day on the theme of “Water Resources in the Himalaya – Disaster Resilience and Reduction”. MoMS is an annual event of IMI that brings together policymakers, elected representatives, partners of IMI, and other relevant agencies to jointly work on priority actions related to key mountain issues.

In his opening address, Mr. Ramesh Negi, President IMI, outlined the objectives of MoMS 2024 to inform policymakers about the need for greater mountain sensitivity of policies on disaster and the allocation of appropriate financial resources to mitigate the collateral and multi-sectoral long-term damage. Mr. Roshan Rai, Secretary IMI set the context for the meet highlighting how disasters impact people in the mountains, with very little national focus. This year, the meet was supported by the Govt of Arunachal Pradesh, Uttarakhand Council for Science and Technology (UCOST) and Sustainable Development Forum of Uttarakhand (SDFU).

The Chief Guest for the inaugural session focusing on Geo Hydrology of the Himalaya and Disasters was Smt. Rita Khanduri, Hon’ble Speaker of Uttarakhand. The keynote address was delivered by Padmashree Dr.



Dr. Smriti Basnett from DCCC, participating in the 11th Meet of the Mountain States (MoMS) event held in New Delhi on 22 March 2024.

Eklabya Sharma who is currently the Strategic Advisor & Distinguished Fellow, ATREE. He highlighted how mountains face the brunt of climate change, and with a 1.5 degree C rise in temperature, Himalayan glaciers would lose 1/3rd of their volume by 2100. Evidence of this was also being witnessed by mountain states, he warned, remembering the recent Himachal and Sikkim and Darjeeling Kalimpong Disasters. Speaking on solutions, Dr. Sharma recommended the need for high altitude monitoring, early warning systems for disasters, river basin planning with zonal action, and an integrated approach for sustainability.

In her Chief Guest address, Smt. Khanduri spoke on the urgent need of bridging research with policy and practice, and there was a need to fall back on good traditional practices with strong community engagement. She highlighted that tourism pressures were also having a major impact in the Himalaya and talked about the issue of limiting numbers in ecologically fragile areas. Himalayan communities were important stakeholders, and must be included in the policy spaces, she stated.

Technical session-I on “Linkage between Himalayan geology, river system disaster and disaster response” was chaired by Dr. Durgesh Pant, DG - UCOST. In his address, he highlighted the Dehradun Declaration on Disasters coming out of the World Congress on Disasters organised in Dehradun in 2023. Dr. Ashim Sattar- IIT Bhubaneswar shared his research

experience from Sikkim of monitoring the glacial lakes. Dr. Smriti Basnett from Divecha Center for Climate Change, and Mr. Stanzin Chosphel, Exec Councillor from Ladakh Hill Council participated in the session.

The second session that focused on evidence based DRR and way forward was chaired by Mr. Arvind Mehta, Ex Member Secretary - 15th Finance Commission. Panelists in this session highlighted the need to embed disaster risk reduction in planning processes. Mr. Anil Raj Rai, Secretary- Land Revenue and Disaster Management Department, Sikkim Government, Mr. PK Joshi from JNU and Dr. Nanda Kishore from ICIMOD were part of the session. In his remarks, Mr. Mehta spoke on the importance of having a river basin approach, with stringent mitigation measures with community participation put in place in all development interventions.

Presenting the summary of the meet, Mr. Sushil Ramola spoke on the need for having focused actions through common platforms engaging all stakeholders and investing in capacity building. He emphasised also on acknowledging the socio ecological fragility of the mountains that should reflect in devolution of funds in the 16th FC to mountains states. Elected representatives of the Indian Himalayan Region (IHR), key policymakers, government department representatives, academia, researchers, funding agencies and IMI members from the mountain states participated in the workshop. A photography exhibition on the recent Teesta Disaster was also put up on the sidelines of the meeting.



Participants of the Integrated Mountain Initiative meet.

ECO-FRIENDLY AGRO-TECHNOLOGY AND FIELD RESEARCH



Participants of the Future Earth webinar held on 22 Feb 2024.

Future Earth Global-Hub South Asia, Divecha Centre for Climate Change, Indian Institute of Science, organised a webinar on “Eco-friendly Agro-Technology and field research” on 22 Feb 2024. The first speaker Dr. Madhukar Swayambhu, research head at Vaidic Srijan Iip., spoke on “Cownomics Technology: Transforming industrial wastewater into agricultural gold” which was about transformative approach to address water stress in the country by turning industrial wastewater into an asset for agriculture. He contemplated a technology called Cownomics Technology, which he and his team have designed to transform any waterbody into a blue carbon sink, irrespective of the kind of inlet water coming in. Primarily, the technology was developed for ecological resuscitation of soil, water, and air Ecology, without any use of mechanics, physics, chemistry, biology, or micro-biology. It harnesses the free energy from nature for rejuvenation of life cycles of Ecology.

Basically, nature had designed all waterbodies as carbon sinks doing photosynthesis, absorbing carbon from atmosphere and releasing oxygen to maintain high dissolved oxygen levels in water and emitting the surplus oxygen in air and attracting all the particulate matter (PM) in air to the

water surface to perform the air pollution mitigation. Humans through anthropogenic activities of sewage production and effluent creation, have spoilt this ecosystem, resulting in global warming, climate change, air pollutions, drinking water scarcity and so on. Cownomics Technology is to restore this back to the natural conditions, transforming polluted waterbodies back into carbon sinks. Dr. Madhukar presented some of the projects undertaken to restore waterbodies in different states of India. He showcased an experiment that took place in Chhattisgarh, utilizing a pond to treat toxic industrial wastewater from a rice mill alongside organic waste from a nearby gaushala. The Cownomics Technology successfully converted this mixture within 45 days, resulting in Water enriched as a neuro-immune booster for plants and animals. This innovative solution not only mitigates water stress but also demonstrates its potential to enhance agricultural productivity and contribute to the rural economy.

The next speaker, Dr. Rohini Mattoo, Researcher at DCCC, spoke on “How to increase crop yields without synthetic fertilizer”. All life on Earth continues to be seriously threatened by environmental pollution. While synthetic fertilizers have aided in maximizing crop productivity, their protracted use has harmed soil microorganisms, diminished soil health, and contaminated soil, water, and air. Dr. Mattoo weighed on the criticality to reconsider expansion in food production through sustainable means, so that crop losses caused by climate change and the growing usage of synthetic chemicals, do not worsen our ecosystems. Environmentally friendly and diversified farming practices have the potential to transform agricultural productivity and promote beneficial microbial consortia that support plants and ecosystem services. Natural, organic, regenerative, zero-budget natural farming advocate agroecological principles and aim to increase crop yield without synthetic inputs. She accentuated the importance of focusing on enhancing agricultural crop yields, infrastructure, and cropping practices in a sustainable and eco-friendly manner to build and fortify our agricultural system for future food security.

GLOBAL WARMING AND CHILD HEALTH



Dr. H. Paramesh, Visiting Professor, DCCC, giving his talk at the National conference of Indian Academy of Pediatrics event held at Kochi, Kerala from 24-28 January 2024.

PEDICON 2024, the 61st National Conference of the Indian Academy of Paediatrics (IAP), recently convened in the vibrant city of Kochi, Kerala. This annual scientific conclave serves as a premier platform, drawing paediatricians not only from across India but also from various corners of the globe. The five-day event, held from January 24th to 28th at the Lulu Bolgatty International Convention Center, showcased a meticulously crafted academic programme aimed at enriching our understanding of child healthcare.

At the heart of this year's conference was the poignant theme, 'Global warming and Child Health.' As the world grapples with the escalating impacts of environmental change, it becomes increasingly imperative to unravel its intricate implications, particularly on the vulnerable paediatric population.

Dr. H. Paramesh delivered two insightful lectures at PEDICON-2024. The

first lecture, he delved into the often-overlooked aspect of “light pollution” and its profound ramifications on child health. He elucidated how excessive exposure to artificial light, especially at night, disrupts circadian rhythms and adversely affects the overall well-being. His second lecture was on “Environmental Impact on Nasal Health in India”. Dr. H. Paramesh delved into the intricate nexus between environmental factors and nasal health in India.

In addition to Dr. Paramesh’s illuminating discourse, Dr. Joshitha Sankam was part of a panel discussion titled “Climate Change Impacting Children Around the World.” This engaging dialogue, moderated by Dr. H. Paramesh himself, provided a platform for experts to dissect the multifaceted repercussions of climate change on child health globally including panelists from UNICEF. The panellists elucidated the myriad ways in which climate change poses a grave threat to the health and well-being of children worldwide. Moreover, the discussion underscored the urgent need for concerted action at both local and global levels to mitigate the adverse impacts of environmental degradation on the paediatric population.



Participants of the national conference of Indian Academy of Pediatrics event held at Kochi, Kerala from 24-28 January 2024.

RESEARCH HIGHLIGHTS

WIND-SOLAR-STORAGE TRADE-OFFS IN A DECARBONIZING ELECTRICITY SYSTEM

Exploring cost-effective wind-solar-storage combinations to replace traditional fossil-fuelled power generation without compromising grid stability becomes crucial in a decarbonizing electricity system. We use Pareto frontiers to systematically evaluate the trade-offs between the annualised cost and reliability of different wind-solar-storage energy combinations to meet future electricity demand of a renewable rich state, Karnataka in Southern India. Pareto frontiers can characterize efficient solutions to multi-objective problems where it is not possible to improve one objective without worsening the other. Depending on the priorities, points on the Pareto frontier can be chosen.

The simulated scenarios consider an estimated increase in the demand for electricity, as well as varying base generation (Figure 1) and supply-side flexibility from hydropower and fossil fuels. We use hourly demand data, estimate the impact of battery charging and discharging on battery lives, and simulate generation based on hourly weather reanalysis data. In the context of declining base generation and limited flexibility in the state electricity grid, the reliability of meeting demand is limited by the allowed generation curtailment. We show that adding battery storage capacity without concomitant expansion of renewable generation capacity is inefficient.

Even with sufficient battery storage, a fully decarbonized grid with limited flexibility can achieve roughly 63% reliability by maintaining wind-solar installations within the officially recognized renewable potential. It would be costly and necessitate big wind-solar projects that surpass officially assessed potential (constrained by land allocation) in order to achieve 99% grid reliability. A completely decarbonized grid (in the absence of any base generation) with 6 GW of flexible generation and allowing for 30% annual curtailment of renewables would result in grid reliability of around 93%. The results emphasize how critical it is to do a fresh examination of curtailment thresholds, renewable energy potential, and demand-side management opportunities that rely on customers' willingness to alter hourly consumption patterns.

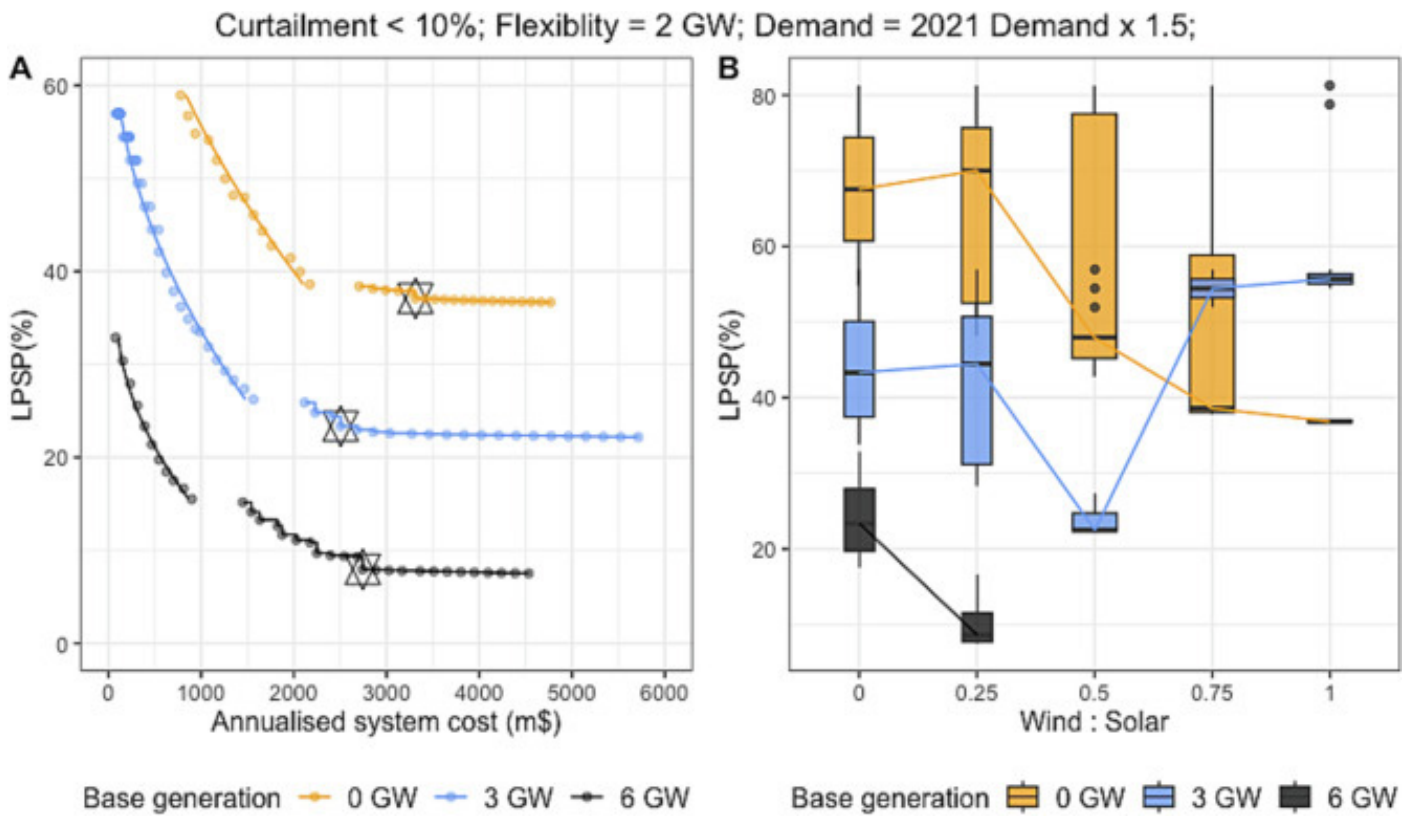


Figure 1. A) Minimum achievable Loss of Power supply Probability (LPSP) for a given system cost (Pareto frontier), and effects of different levels of base generation capacity. Reliability can be expressed as $(1-LPSP)$. Wind and solar capacity are limited to 55 GW and 24 GW respectively, following officially assessed capacity; and curtailment is limited in these simulations to a maximum value of 10%; highest wind-solar installation on the Pareto Frontiers is shown with black star; B) Boxplot distributions of achievable LPSP against wind-solar ratio along the Pareto frontier for different base generation capacities; The bold lines in the middle of each box indicate the median.

Reference: Gangopadhyay, A and Seshadri, AK and Patil, B (2024) Wind-solar-storage trade-offs in a decarbonizing electricity system. In: Applied Energy, 353

A RAPID INCREASE IN EXTREME HUMID STRESS IN INDIA

Extreme humid stress occurs when the ambient temperature exceeds 35 °C and the relative humidity exceeds 50%. Extreme humid heat stress poses distinct challenges to human health and productivity that cannot be mitigated solely by heat action plans designed for dry heat stress. Jency and Srinivasan (2024) examined the trends in extreme humid heat stress in India from 1943 to 2022 using the high-resolution hourly European reanalysis data. They found that certain eastern coastal regions in peninsular India experienced extreme humid heat stress from May to June due to persistent high humidity levels. In northwest and northcentral India extreme dry heat stress is encountered in the pre-monsoon season, followed by a transition to humid heat stress immediately after the onset of the monsoon. The results also show that number of hours of extreme humid heat stress hours per grid has seen a sixfold increase over the past 80 years compared to a threefold increase in dry heat stress. The approach adopted to deal with extreme humid heat stress cannot be same as that adopted to deal with dry heat stress. The use of air conditioners is essential to deal with extreme humid heat stress but 95% of the households in India do not have air conditioners.

Reference: Jency Maria Sojan and Jayaraman Srinivasan, Environmental Research Communications. 6, 021002,2024

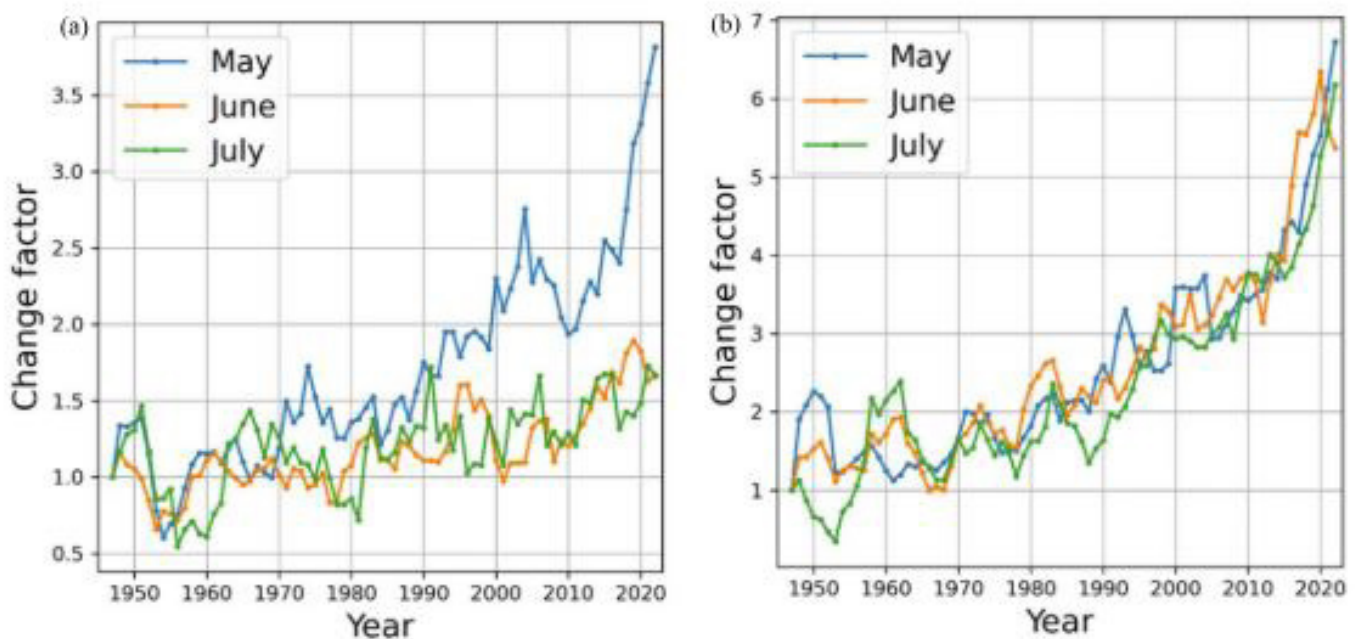


Figure: The variation in the number of hours of dry heat stress(left) and humid heat stress in India during May to July from 1943 to 2022. Change is defined with respect to 1943.

