WMO OMM
World Meteorological Organization
Organisation météorologique mondiale
Organización Meteorológica Mundial
Всемирная метеорологическая организация
المنظمة العالمية للأرصاد الجوية
世界气象组织

WEATHER CLIMATE WATER
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Réf.: 08601/2023-L.6 WIGOS

Nuestra ref.: 08601/2023/I/WIGOS/ONM/NWP-8 25 de abril de 2023

Anexo: 1 (disponible en inglés solamente)

Asunto: Anuncio del Octavo Taller de la Organización Meteorológica Mundial sobre los Efectos de los Diversos Sistemas de Observación en la Predicción Numérica del Tiempo y la Predicción del Sistema Tierra

Finalidad: Difundir el presente anuncio entre las partes interesadas

Estimado señor/Estimada señora:

La Organización Meteorológica Mundial (OMM) está organizando el Octavo Taller de la OMM sobre los Efectos de los Diversos Sistemas de Observación en la Predicción Numérica del Tiempo y la Predicción del Sistema Tierra. El Instituto Meteorológico e Hidrológico Sueco (SMHI) acogerá este evento en su sede de Norrköping (Suecia) del 27 al 30 de mayo de 2024. El taller se impartirá en inglés.

Esta serie de talleres constituye un importante foro cuatrienal en donde se aportan pruebas científicas sobre los efectos que los sistemas de observación espaciales y en superficie tienen en diferentes ámbitos, entre otros, la predicción numérica del tiempo (PNT) y las aplicaciones del sistema Tierra, como aquellas relacionadas con el clima. Las conclusiones de los talleres brindarán orientaciones para optimizar el despliegue de los actuales sistemas mundiales de observación y guiar su futuro diseño y evolución.

La participación en el taller está abierta a todos los expertos que trabajen en el ámbito de los estudios de impacto de los sistemas de observación, tanto de centros de PNT como de cualquier otro instituto o comunidad implicado en la predicción del sistema Tierra.

Un Comité Científico de Organización, copresidido por el señor Sid Boukabara y la señora Seiyoung Park, supervisará el taller y se encargará de las cuestiones de organización general, incluida la selección de ponencias para las presentaciones orales o de carteles y la redacción de las recomendaciones del taller.

El propósito de la presente carta es anunciar el taller, proporcionar la lista de las cuestiones científicas que se abordarán durante su transcurso (que figura en el anexo a la presente carta), animar a los expertos a realizar los experimentos y estudios necesarios, y preparar la presentación de resúmenes. Sírvase tener en cuenta que el período para la presentación de resúmenes en línea comenzará en junio de 2023 y concluirá a finales de año.

Se ruega a quienes deseen participar en el taller consulten el anexo a la presente carta y, además, visiten periódicamente el sitio web del taller.

A los Representantes Permanentes de los Miembros ante la OMM

Copias: Asesores Hidrológicos
presidentes y vicepresidentes de las comisiones técnicas
presidentes de las asociaciones regionales
presidenta y vicepresidente de la Junta de Investigación
miembros del Grupo de Gestión de la INFCOM

Se proporcionará más información al respecto a su debido tiempo. Si tiene más preguntas sobre este evento, no dude en ponerse en contacto con nosotros a través de la dirección de correo electrónico del taller (nwp8@wmo.int).

Le agradecería que diera la mayor difusión posible a este anuncio, tanto en su Servicio como en otros ámbitos.

Le saluda atentamente.

Dr. Wenjian Zhang
por el Secretario General

World Meteorological Organization (WMO)
Organisation météorologique mondiale (OMM)

The 8th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction and Earth System Prediction

Sweden, Norrköping
27–30 May 2024

First Announcement

Overview

The 8th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction (NWP) and Earth System Prediction (ESP) will be organized by WMO and will be hosted by the Swedish Meteorological and Hydrological Institute (SMHI) in Sweden, at the SMHI main office in Norrköping, on 27–30 May 2024. Participation from all the major NWP centres and communities active in the field of impact studies about the observing systems is anticipated. The exact format of the workshop (in-person, or hybrid) will be decided closer to the meeting date and will depend on the pandemic situation. The meeting will be conducted in English.

Background and History

WMO's impact workshop series is an important quadrennial venue for providing science evidence on the impacts of surface- and space-based observing systems, on short- to medium- and longer-range forecasting including climate monitoring. Conclusions from the workshop provide guidance on how to optimize the use of the current global observing system as well as help guide its future evolution.

This workshop is held under the auspices of the WMO INFCOM/SC-ON Joint Expert Team on Earth Observing System Design and Evolution (JET-EOSDE).

The previous seven workshops in this series took place successively in Geneva (April 1997), Toulouse (March 2000), Alpbach (March 2004), Geneva (May 2008), Sedona (May 2012), Shanghai (May 2016) and most recently in a virtual format, in December 2020. Results from a multitude of observing system experiments, with both global and regional aspects, were presented each time and conclusions were drawn concerning the contributions of the various components of the observing systems to forecast skill at short and medium range.

Since then, both the global observing systems and the NWP systems that utilize them have undergone significant changes. Many space missions have been launched and ground observation systems networks have been enhanced. NWP systems are being coupled with models and data assimilation systems for the ocean, land, cryosphere and atmospheric composition, in pursuit of a whole ESP capability. There has also been a continued trend toward using techniques other than Observing System Experiments (OSEs) and Observing System Simulations Experiments (OSSEs) to document data impact, such as adjoint- and Ensemble-based Forecast Sensitivity Observation Impact (FSOI and EFSOI) and other quantitative assessment techniques, and estimates of analysis uncertainty.

As a result, in this upcoming 8th workshop, we will continue to focus on assessing the impacts of various observing systems in all Earth system domains on NWP, but we will extend the scope to also encompass the impact assessment of the various observing systems to other Earth system applications. This is done in order to achieve a comprehensive understanding of the value of the observations and to support the strategic goals of the WMO.

Who should attend and what is expected

Experts who have results of impact assessment of various observing systems, especially those responding to the science questions listed below, are invited to submit a short abstract. Contributions to the workshop may fall within general topics that will frame the workshop sessions (to be determined at a later stage), or they may simply address one or several of the specific studies and science questions listed in the appendix to this annex. Note that to increase the chances of being responsive to this call, abstracts should clearly articulate what type of impact assessment(s) will be presented.

During the workshop, the results presented will be reviewed in plenary discussion sessions or relevant breakout sessions and a consensus view will be formed where possible. Conclusions to help guide the design and evolution of components of the WMO Integrated Global Observing System (WIGOS[1]) for NWP and ESP in general, will be drawn.

Participation

Abstract Submission

- Subject matter experts who want to present their results should submit one or multiple abstracts through the workshop website. These will be reviewed by the scientific organizing committee.
- See the corresponding abstract submission deadline below.

Registration

- The authors who have been accepted to present at the workshop should register through the workshop website.
- Non-authors (without presentation) who want to participate in the workshop should seek approval from WMO. This should be done through the workshop website.
- See the corresponding registration deadline below.

Financial Support Request

- WMO expects to have limited financial resources available to support participation. An early indication of the need for financial support should be submitted to the WMO secretariat via email to Krunoslav Premec (kpremec@wmo.int). These requests will be considered by WMO. Priority will be given to support participants from developing countries who will present their abstracts at the workshop.
- See the corresponding financial support request deadline below.

[1] WIGOS is the overarching framework for all WMO observing systems and for WMO contributions to co-sponsored observing systems in support of all WMO Programmes and activities. Currently the component systems are the Global Observing System (GOS), the WMO Hydrological Observing System (WHOS) and the observing components of the Global Atmosphere Watch (GAW) and the Global Cryosphere Watch (GCW).

Important Dates

Start of the abstract submission period (through website)	15 June 2023
Deadline for abstract submission	15 December 2023
Deadline for requesting financial assistance	15 December 2023
Acceptance of abstract and decision on financial assistance	1 February, 2024
Deadline for requesting an invite to workshop (without abstract)	15 February 2024
Notifications on acceptance of participation (for non-authors)	1 March 2024
Deadline for registration (authors)	1 March 2024
Deadline for registration (non-authors)	1 April 2024
Workshop date	27–30 May 2024

Publications

Workshop proceedings for the first four workshops were published as WMO World Weather Watch Technical Reports TD Nos. 868, 1034, 1228, 1450 and are available from the WMO library. The report on the 5th workshop was published as WIGOS Technical Report No. 2012-1 and is available on the WMO website[2]. The final reports with presentations on the 6th and 7th Workshops were also published on the WMO website[3,4]. Similar to the previous seven workshops, it is planned to produce a workshop report, which will be published as a WMO technical publication and will include the presentations submitted by the participants.

Organizers

Scientific Organizing Committee (SOC)

Sid Boukabara	NASA, JET-EOSDE, SOC Chair
Seiyoung Park	KMA, JET-EOSDE, SOC Co-Chair
Irfan Azeem	NOAA
Mariana Barrucand	FCEN-UBA/CONICET
Emmanuel Brocard	BAFU, SC-HYD
Yosuke Fujii	JMA/MRI
Ron Gelaro	NASA
Marilaure Gregoire	University of Liege, JET-EOSDE
Susanna Hagelin	SMHI, LOC Chair
Sean Healy	ECMWF, DAOS
Kazuyuki Miyazaki	NASA
Magnus Lindskog	SMHI, a representative for the LOC
Lars Peter Riishojgaard	WMO

[2] https://old.wmo.int/extranet/pages/prog/www/OSY/Meetings/NWP5_Sedona2012/Final_Report.pdf

[3] https://old.wmo.int/extranet/pages/prog/www/WIGOS-WIS/reports/6NWP_Shanghai2016/WMO6-Impact-workshop_Shanghai-May2016.html

[4] https://community.wmo.int/meetings/NWP-7

Patricia de Rosnay	ECMWF, JET-EOSDE and GCW

WMO and JET-EOSDE Liaisons

Albert Fischer	WMO Secretariat
Krunoslav Premec	WMO Secretariat
Alexander Scheid	WMO Secretariat
Etienne Charpentier	WMO Secretariat
Erik Andersson	INFOCM/SC-ON/JET-EOSDE Chair

Local Organizing Committee (LOC)

Susanna Hagelin	SMHI, LOC Chair
Magnus Lindskog	SMHI, HIRLAM Project leader of Data Assimilation

Workshop website

Information about the workshop including abstract submission, registration, relevant news, updates and the workshop programme can be found under:

WMO Workshop on Impact of Various Observing Systems on NWP and Earth System Prediction

APPENDIX

SCIENCE QUESTIONS

The following table represents the list of scientific questions that the workshop will attempt to address. These proposed topics are for NWP and ESP impact studies relevant to the evolution of Earth system observing systems.

These science questions are stratified into three categories:

- S1: Those relevant to surface-based observing systems
- S2: Those relevant to space-based observing systems
- S3: Those that are general in nature: that might apply to both surface and space observation systems, or to model handling of observing systems, etc.

Type of Observing Systems	Sub-Type	Questions
Questions Related to Surface-Based Observing Systems (S1)	Radar	S1.1: What are the impacts of current radar observations, particularly radar polarization, but also wind profiles, radial winds and reflectivity on multiple Earth System Applications including NWP?
	Radiosondes	S1.2: What is the impact of high-altitude ascent and descent data of radiosondes on forecast skills (weather, climate, etc.)? Is there a seasonal variation of that impact? S1.3: Does it help to increase the frequency of radiosondes launched in winter and reduce it in summer (especially, in the high latitude regions e.g. to allow capturing sudden stratospheric warming)?
	Airborne Observations	S1.4: What are the impacts of Airborne-based Observations (ABO) on NWP and ESP models (including tropical regional, convective weather)? - These ABO measurements could include FLYHT TAMDAR and AFIRS temperature, wind and humidity, EUMETNET/EMADDC temperature and wind data, etc. Impacts could be global or regional (such as mountain regions) and special attention should be given to ABO in data-sparse regions. S1.5: Compare the impacts of various ABO measurements and assess them with regard to other measurements (such as radiosondes). - For example, can AMDAR data be replaced by EMADDC/MODE-S data, i.e. deliver similar or better impact on the model forecast? S1.6: What impacts do horizontal and temporal coverages of ABO water vapour measurement, vertical (airport) locations, have on global and regional NWP?

Type of Observing Systems	Sub-Type	Questions
		S1.7: MODE-S can provide a huge amount of data, but we cannot send it all on GTS. What is the optimum volume/density of data required from ABO?
	Uncrewed Aircraft Systems	S1.8: What are the impacts of Uncrewed Aircraft Systems (UAS) measurements (e.g. drones) on NWP and other ESP applications? S1.9: What is the impact of replacing radiosondes with drone-based observing systems that go up to 6 km only?
	Ground-based Sensors (including sensors looking at space weather)	S1.10: What are the impacts on NWP and other ESP applications of the new and emerging environmental data sources (e.g. crowd-sourced observations, mobile phones, Netatmo and wind farms)? S1.11: Are column observations or vertically resolved (with how much vertical resolution) observations of atmospheric composition required to improve NWP?
	Ocean-Based in-situ observing systems	S1.12: What is the impact of eulerian (e.g. moorings like the tropical mooring arrays, tidal gauges) and lagrangian (e.g. Argos, gliders, drifters) ocean observing platforms on NWP, and the forecast of the blue (physics, wave), green (biogeochemistry, ecosystem) and white (polar) ocean? S1.13: What is the impact of Argo (including deep Argo) on the assessment of climate change on the ocean (including the deep ocean)? - For instance, what is the impact of BGC Argo on the assessment of ocean deoxygenation, acidification, and air-sea fluxes of CO_2 and O_2? What is the impact of Core Argo on the assessment and prediction of the ocean heat budget, water mass formation, heat waves, etc.? S1.14: What are the impacts of assimilating non-traditional marine-based observing systems on marine forecasting? - For example, radiometric/hyperspectral ARGO, Underwater Vision Profilers (UVP), underway systems (e.g. Ship Of Opportunity Programme (SOOP)), sensors of marine animals (e.g. Animal Borne Ocean Sensors (AniBOS))
	General	S1.15. What are the impacts of the various temporal and spatial atmospheric composition observations on NWP? - For example, day/night coverages, high temporal resolution, over different regions, and on ships added to the land. S1.16: What is the impact of the representativeness of the GB observing networks on the different ESP models' skills?

Type of Observing Systems	Sub-Type	Questions
Questions Related to Space-based Observing Systems (S2)	Wind Measurements	S2.1: What is the relative impact on global (and regional) NWP of different technologies measuring the wind from space (active lidar, passive sounders, Geo-based trackers, etc.)?
	Microwave Sensors	S2.2: What is the impact of microwave (MW) sensors (sounders and imagers, including surface-sensitive channels) on the different ESP applications including NWP and high-resolution data assimilation systems? - S2.3: What is the impact on NWP and other ESP applications (especially, precipitation related) of multiple orbits of MW sounder data? For example, what is the impact of hourly MW sounding? S2.4: What threshold of Radio-Frequency Interference (RFI) contamination in MW observations could be considered tolerable for NWP and other MW-dependent applications? (i.e. what RFI levels are deemed to not impact the analyses, monitoring and forecast skills?) S2.5 What is the impact of satellite Sea Surface Salinity on the prediction of ocean convection, plume pattern, air-sea fluxes, and circulation?
	Visible and Infrared Sensors	S2.6: What is the impact of Infrared (IR) sensors on the different ESP applications including NWP? S2.7: What is the impact of various combinations of GEO and LEO hyperspectral IR sounders on NWP and other applications? S2.8: What is the impact of assimilating reconstructed radiances or principal components instead of radiances on NWP? S2.9: What is the impact of hyperspectral sensors on the quality of oceanic biogeochemical predictions (e.g. primary, export production, plankton functional groups)?
	Altimetry and Scatterometry	S2.10: What is the impact of Surface Water parameters and Ocean Topography (SWOT) measurements on oceanographic and Earth system applications (e.g. open and coastal ocean forecasting, sea level rise estimation, etc.)? S2.11: What are the impacts of varying combinations of scatterometers with increased coverage and temporal refresh globally?
	Space Weather	S2.12: What are the impacts of measurements from space weather missions at L4, L5, or some other orbits?

Type of Observing Systems	Sub-Type	Questions
		S2.13: What are the impacts of high latitude convection on space weather model responses? S2.14: What is the impact of satellite data (for example, through assimilation) in improving the fidelity of the whole atmosphere model results of the thermosphere and ionosphere?
	Radio Occultation	S2.15: How does GNSS-RO impact scale with the number of profiles? - For example, how many are needed for an optimal NWP skill? How many anchor measurements are needed? S2.16: How effective are radio occultation measurements in providing ionospheric scintillation nowcasting and forecasting?
	New Satellites/ Sensors	S2.17: What are the impacts of various SmallSats and CubeSats on NWP and ESP? S2.18: What are the impacts of the new MTG satellite data? - In particular, (1) the impact of Hyperspectral IR sounder on NWP, (2) the impact of lower-tropospheric channels such as MTG FCI 0.9μm on forecasting boundary layer moisture, instability, and convective initiation, (3) the impact of assimilating MTG LI basic and accumulated products in NWP models S2.19: What will be the impact of the future MW sounder constellation programme over the polar regions?
	General	S2.20: What are the impacts of various products derived from satellites on NWP and other ESP applications? - For example, the impacts of snow products on NWP and Hydrology, the impacts of sea-ice (concentration and thickness) on NWP and Cryospheric applications, the impact of SST accuracy, resolution, frequency, etc.) on NWP and ESP, the impact of Sea Surface Salinity (quality and resolution) on the prediction of the blue ocean and in particular, convection assessment, plume monitoring, mesoscale tracking, and trend assessment S2.21: What is the relative impact (and ranking) of space-based observing systems and their characteristics on NWP and ESP (including commercial data)?. For example, the impact of IR/MW limb sounders, the impact of the early morning orbit on NWP, the impacts of data from Observing satellite missions in a highly elliptical orbit, the impact of reduced timeliness (e.g. from DBNet data). S2.22: What are the impacts of additional Arctic-sensing satellite observations (especially, MW and altimetry data or

Type of Observing Systems	Sub-Type	Questions
		Vis/IR data from HEO orbits providing GEO-like temporal frequency over the Arctic) on NWP and other ESP applications? S2.23: What is the impact of directional and polarization information from 3MI on NWP? S2.24: What is the relative impact of various levels of quality and quantity of satellites and orbital configurations? (For example, fewer data with higher accuracy and spectral coverage, vs. more data but with reduced accuracy/quality, etc.). S2.25: What is the impact of using the wind lidar plus MW constellations? For example, the impact of a wind lidar on one satellite, and the impact of a constellation of MW sounders, and the impact of both together (relative to a baseline with none of them) S2.26: What is the additional impact of geostationary measurements on global and regional atmospheric composition and radiative forcing analysis? S2.27: What is the impact and value of having several mixtures of orbits (e.g. the satellites in polar and the low latitude inclinations in addition to Sun-Synchronous Orbit (SSO))? S2.28: What is the impact of having MW and IR sounding on the same platform (vs. in separate platforms) for NWP and other ESP applications?
General Questions (S3)	Complementarity of Observing Systems	S3.1: What is the impact of surface-based observing systems in the presence of space-based observing systems? - For example, what is the changing impact of radiosonde data in the presence of satellite data? How does the assimilation of combined satellite and in-situ observation improve the quality of marine forecasting in general compared to the assimilation of only satellite or in-situ? How can a weather-focused satellite observing system benefit from ground-based atmospheric observations? S3.2: What would be the impact of satellite surface-sensitive observations over land and sea-ice with a reduced influence of conventional observations? S3.3: What is the impact of PBL variables and space-time resolution on regional and global NWP? S3.4: What is the impact of integrating observations (across different platforms/domains) for mitigating, adapting and providing solutions to climate monitoring? S3.5: How should co-located ocean and atmospheric variables be balanced with independent ocean and atmospheric fields, which may have a better resolution? What is the optimal

Type of Observing Systems	Sub-Type	Questions
		observing system design for maximizing the performance of coupled ocean-atmosphere predictions?
	Impact of new observing systems on NWP	S3.6: What are the impacts on NWP of measurements not previously assimilated? These could include land surface measurements sensitive to soil moisture and vegetation activity (e.g. hydroGNSS, SIF), hydrology measurements (e.g. runoff, river discharge) including those in high mountain areas, and cryosphere observations (e.g. permafrost data, meltwater from glaciers). S3.7: What are the most impactful oceanographic (met-ocean) variables (i.e. prioritized list and their impacts) to improve global NWP and ESP? S3.8: What are the potential impacts on NWP and ESP of emerging/future observing systems (e.g. IoT, future satellite systems)? S3.9: What are the impacts of ocean observations for predicting marine extremes (i.e. Tropical Cyclones, severe mid-latitude storms, and polar lows)? S3.10: What are the impacts of observing the lower atmosphere, ocean surface, and sub-surface pre-condition for sub-seasonal and seasonal prediction, and monsoon onset? S3.11: What lower atmosphere and ocean surface observations would be the most impactful in the polar regions for predicting weather and climate?
	Impact on Oceanography	S3.12: What are the impacts of atmosphere, ocean (including surface and subsurface), and sea-ice observations on oceanography applications? S3.13: What ocean observations are directly needed in support of emergency response and sustainable development in the most vulnerable areas to sea level rise and flooding, such as low-lying islands and coasts? S3.14: What is the suitable temporal and spatial resolution for the observation of glacier and ice sheets to support glacier and ice sheet modeling and predictions (and links to sea level rise)? S3.15: What Ocean observations would be the most impactful for better wave and storm surge predictions? What observations are required to optimize the performance of these ocean wave models especially for high impact (storm) events?
	Impact on Hydrology	S3.16: What are the impacts of observations on hydrology applications?

Type of Observing Systems	Sub-Type	Questions
		S3.17: What is the impact of using the snow observations (e.g. satellite derived snow cover) in different models on simulating river discharge? S3.18: What is the impact of detailed permafrost observations on hydrological and ESP models? These include the assessment of timely and frequent (e.g. hourly) observations of catchment-scale glacial runoff, daily meltwater runoff from glaciers, and multi-layer permafrost.
	Impact on Cryospheric applications	S3.19: What are the impacts of spatial/vertical/temporal resolutions of observations on model prediction of extreme cryospheric events and risk assessment of cryo-hazards? S3.20: What are the impacts of a denser network of high-quality sea-ice drifters, Voluntary Observing Ships (VOS), sea-ice ship-based observations, and citizen science initiatives?
	Basic Observing Network (a) GBON - Implementation and extension (b) RBON	S3.21: What is the impact of GBON data (and its potential extension) on NWP and other ESP? S3.22: What are the impacts on NWP and other ESP applications of GBON network stations, especially those in data-sparse regions (remote stations, high-altitudes, etc.)?
		S3.23: What are the suitable spatial/vertical/ temporal resolutions of observation to improve convective scale forecasting (especially, over areas like land, oceans, and complex terrain)? S3.24: What are the impacts of the regional observing system in each area on the key regional challenges in RBON (e.g. heavy rain, flood, coastal inundation, high mountain weather, fog)?
	Data Exploitation Techniques and Methodology	S3.25: What are the impacts on forecasting systems of using new data assimilation systems? These could include the coupled DA techniques, AI/ML methods combined with very high-resolution limited area models, etc. How are these techniques improving our use of existing measurements? S3.26: What are the new metrics for measuring the skill of the NWP and ESP model(s) and the impacts of observing systems? (To allow us to be inclusive of all phenomenology). S3.27: How are the observation impacts assessed using different methods compared to each other (OSEs, OSSEs, FSOI, EFSOI, etc.)? What are the potential roles (and pros and cons) of those techniques in designing the future GOS?

Type of Observing Systems	Sub-Type	Questions
	General	S3.28: What is the impact of observations assimilated in different thinning distances over sea and over land? Does that impact vary? S3.29: What is the impact of low-cost sensors on the forecast in support of urban applications? S3.30: What is the optimum synergy between various observing systems for humidity profiles (e.g. radiosonde, AMDAR, Raman, DIAL lidar, ZTD from GNSS, weather radar refractivity, microwave radiometer, etc.) to deliver a cost-effective network for various applications? S3.31: What are the relative impacts of the observations when used for severe weather prediction (regional and local scales)? S3.32: Can we achieve the same NWP performance with fewer surface stations of a higher tier quality vs. quantity i.e. for a given geographic region (or globally), how does NWP performance vary if there is greater spatial coverage of observations with higher uncertainty vs. reduced spatial coverage of observations with lower uncertainty? S3.33: What are the impacts of various observations on monitoring and predicting atmospheric turbulence, particularly observations and reports of Eddy Dissipation Rate (EDR)? S3.34: What is the impact of stratosphere measurements in seasonal forecasting? S3.35: How do we quantify improvements in prediction skills over time due to changing investments in the ocean observing system?

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