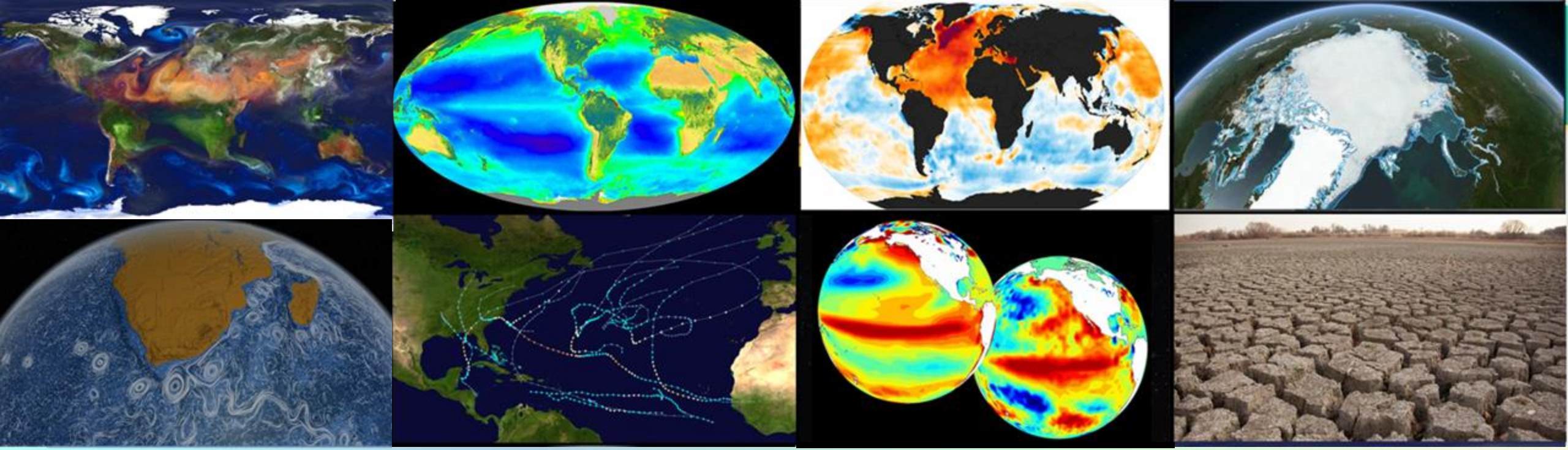


Discussion on future of the CHFP

Jin Ho Yoo and Bill Merryfield

WGSIP 25/WGNE 39

4-8 November 2024

Toulouse, France

ESMO Earth System Modelling and Observations

WCRP World Climate Research Programme

Origin of the Climate-System Historical Forecast Project (CHFP)

ca. 2007:

- Mandate of WCRP Task Force on Seasonal Prediction transferred to WGSIP (then under CLIVAR)
- CHFP proposed in conjunction with WCRP position paper on seasonal prediction →
- CHFP launched at the 2007 WCRP Workshop on Seasonal Prediction in Barcelona
- https://www.wcrp-climate.org/images/modelling/WGSIP/CHFP/CHFP.pdf
- Early days for application of coupled climate models to seasonal prediction

B. Kirtman and A. Pirani, 2009: The State of the Art of Seasonal Prediction Outcomes and Recommendations from the First World Climate Research Program (WCRP) Workshop on Seasonal Prediction, BAMS, DOI: 10.1175/2008BAMS2707.1

→ CHFP archive established at CIMA, merged with DEMETER and ENSEMBLES archives

→ Seasonal hindcasts from >20 systems

http://chfps.cima.fcen.uba.ar

Publications using CHFP data

- Hindcast data continues to be used, despite getting “old”:

Jain S., and A. A Scaife, 2022: How extreme could the near term evolution of the Indian Summer Monsoon rainfall be? *Environ. Res. Lett.*, **17** 034009. https://doi.org/10.1088/1748-9326/ac4655

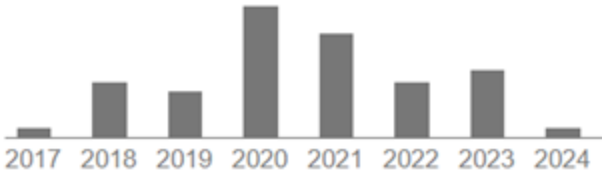
Pillai, P. A., S. A. Rao, A. Srivastava, D. A. Ramu, M. Pradhan, and R. S. Das, 2021: Impact of the tropical Pacific SST biases on the simulation and prediction of Indian summer monsoon rainfall in CFSv2, ECMWF-System4, and NMME models. *Climate Dyn.*, 56, 1699–1715, https://doi.org/10.1007/s00382-020-05555-1.

Saurral RI, Merryfield WJ, Tolstykh MA, Lee W-S, Doblas-Reyes FJ, García-Serrano J, Massonnet F, Meehl GA, Teng H (2021) A dataset for intercomparing the transient behavior of dynamical model-based subseasonal to decadal climate predictions. *J Adv Model Earth Syst*. https://doi.org/10.1029/2021MS002570

Nikolaev, A.; Richter, I.; and Sadowski, P. 2020. Deep learning for climate models of the Atlantic ocean. In Proceedings of the AAAI Spring Symposium - Combining Artificial Intelligence and Machine Learning with Physical Sciences: Palo Alto, CA, USA: MLPS https://par.nsf.gov/servlets/purl/10273992

+ 13 earlier publications

- 51 citations of Tompkins et al. (2017) →



- However, there are multiple **barriers to keeping CHFP relevant**:
  - Difficult to persuade centres to provide tailored data with every system update
  - Emergence of other hindcast data sources (e.g. NMME, C3S)
  - Systems in database getting old
  - Sustainability at CIMA

→ is there a way forward for CHFP?

A possible way forward

Background

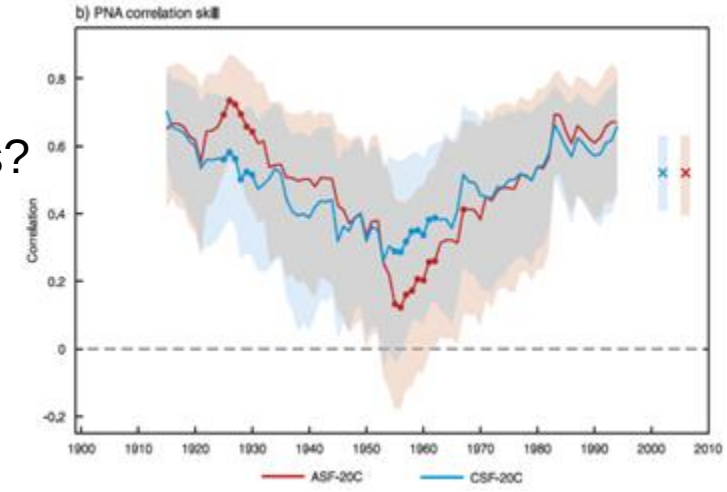
Recognizing the need to reduce model biases, a TPOS 2020 recommendation was for development of a community effort to document model biases and to quantify how S2IP prediction systems may be improving with time - TPOS 2020 Final Report

Proposal

- **Archive WMO LC-LRFMME hindcast data from retired (and current?) systems** in the CHFP database
- New systems from consenting GPCs could continuously be added

Analysis

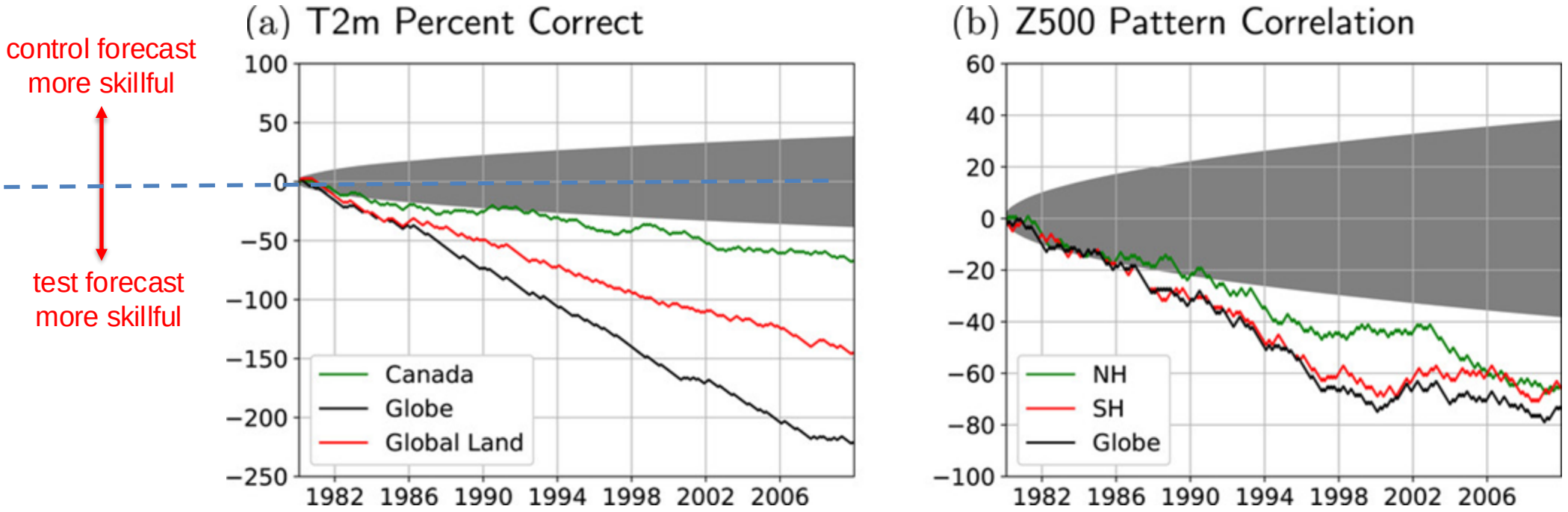
- How to compare skill for systems having different hindcast epochs and lengths?
- Need to control for variations in predictability, different hindcast lengths, etc.
- Possible benchmark: ECMWF CSF-20C*, verification acainst ERA-20C →



*Weisheimer et al. BAMS 2020

A possible way forward (2)

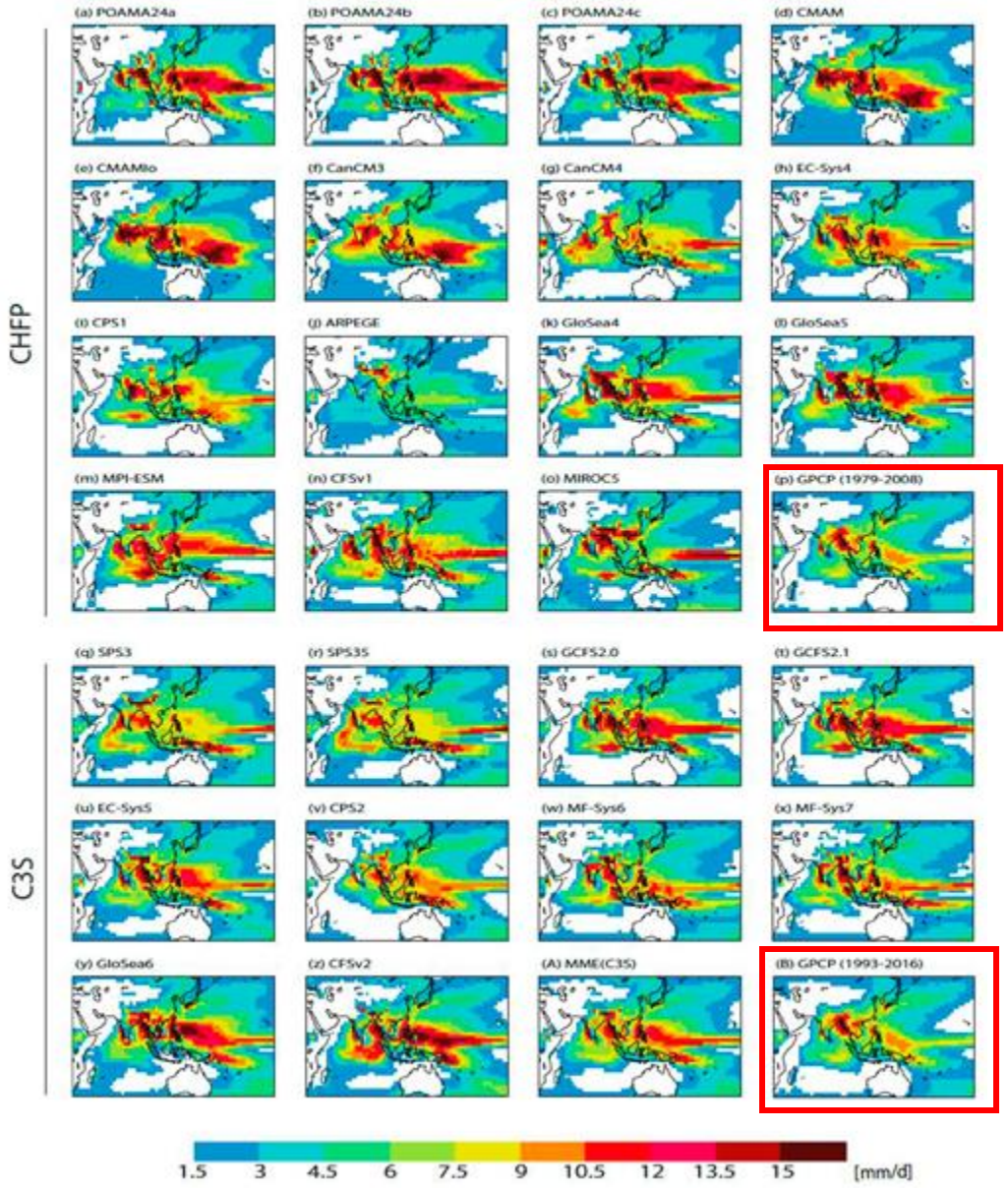
- Possible approach for assessing relative skill of two systems: method of DelSole and Tippett, “Forecast Comparison Based on Random Walks”, *MWR* 2016, https://doi.org/10.1175/MWR-D-15-0218.1



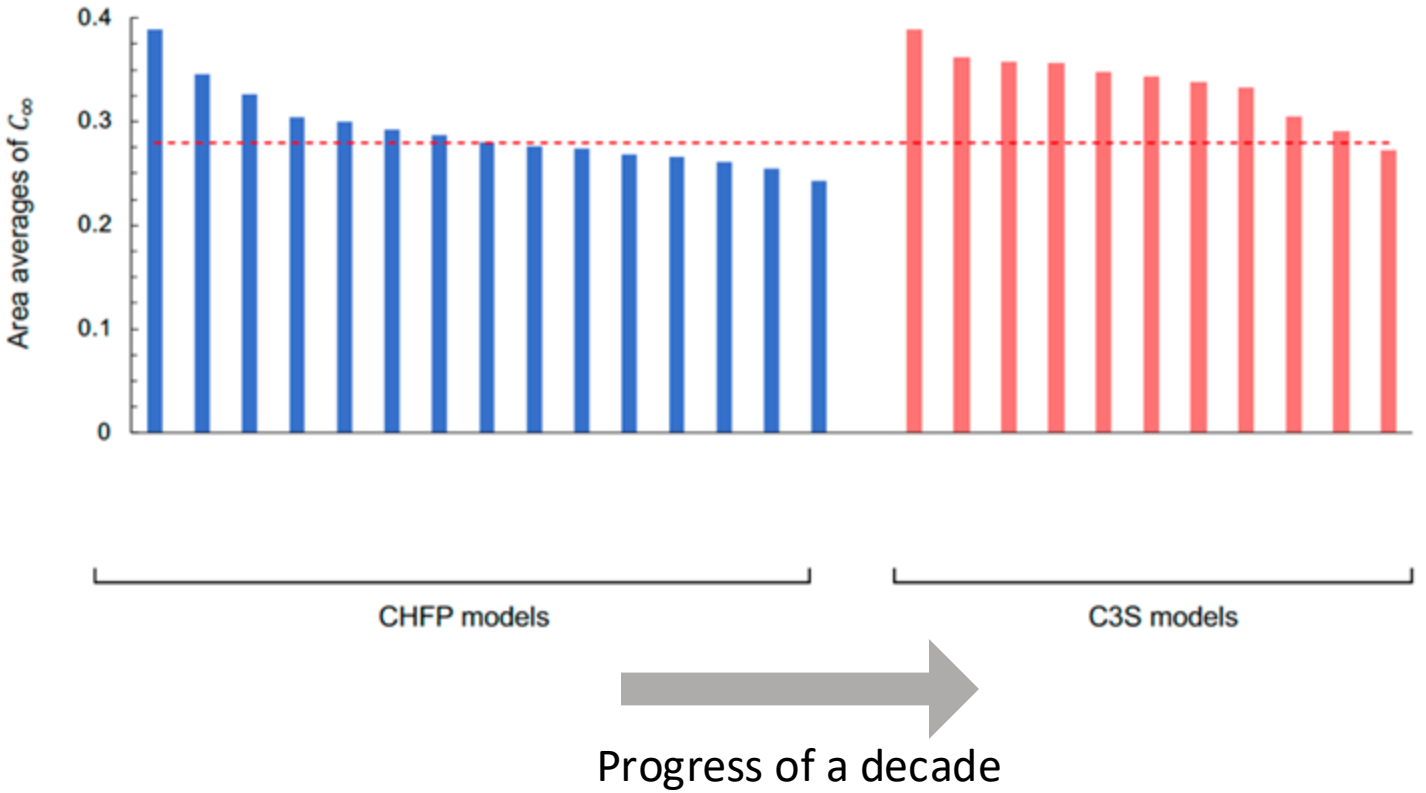
Lin et al., WAF (2020): control=CanSIPSv1, test=CanSIPSv2

- TPOS-type assessment would have control=CSF-20C, test=GPC hindcast
- Could compare Random Walk Skill Scores of Risby et al. *Nature Comm.* (2021) against common benchmark
- (However, CSF-20C ends in 2010, no prospect for updating)

Example: Skill assessment of seasonal prediction systems (Looking back the progress in the last decade)



Area average of temporal correlation scores for Jun.-Aug. precipitation over ASM region



Yuhei Takaya slide

Takaya et al. (2023) Mausam, IWM-7 special issue
DOI: 10.54302/mausam.v74i2.5925

Current situation

- APCC is interested and willing to take over (WGSIP contact: Jin Ho Yoo)
- WMO ET-OPCS is making LC-LRFMME seasonal prediction data open, has endorsed this plan

	GPC	Institute	System Name	Applied in WMOLC		
1	Beijing	BCC	CSM1.1m		1991	2015
2	CMCC	CMCC	CMCC-SPS3.5		1993	2016
3	CPTEC	CPTEC			1979	2010
				2020JAS	1981	2010
4	ECMWF	ECMWF	SEAS4		1981	2005
			SEAS5	2018AMJ	1993	2016
5	Exeter	UKMO	Glosea5		1993	2016
			GloSea6-GC3.2	2021MAM	1993	2016
6	Melbourne	BoM	POAMA2.4		1980	2010
			ACCESS-S1	2020ASO	1990	2012
			ACCESS-S2	2021DJF	1981	2018
7	Montreal	MSC	CanSIPSv1		1981	2010
			CanSIPSv2	2019SON	1981	2010
			CanSIPSv2.1	2022JFM	1980	2020
8	Moscow	HMC	SL-AV		1981	2010
			SL-AV	2022DJF	1991	2015
9	Offenbach	DWD	GCFS 1.0	2017OND	1981	2015
			GCFS 2.0	2018NDJ	1990	2017
			GCFS 2.1	2020DJF	1993	2019
10	Pretoria	SAWS			1982	2009
11	Pune	IMD			2003	2017
12	Seoul	KMA	GloSea5GC2		1991	2016
			GloSea6-GC3.2	2022AMJ	1993	2016
13	Tokyo	JMA	JMA/MRI-CPS2		1979	2010
			JMA/MRI-CPS3	2022MAM	1991	2020
14	Toulouse	Met France	System6		1993	2016
			System7	2019NDJ	1993	2016
			System8	2021ASO	1993	2018
15	Washington	NCEP/CPC	CFSv2		1982	2010

WMOLC-LRFMME

'79 '80 '81 '82 '83 '84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17 '18 '19 '20

'93 '09