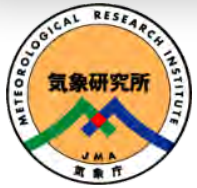# Sub-seasonal to Seasonal Prediction Project (S2S)

Yuhei Takaya and **Laura Ferranti**

Meteorological Research Institute, Japan Meteorological Agency

S2S Phase 2 (2018 Nov. - 2023 Dec.)

WWRP 2018 - 4
WCRP Report No. 11/2018

WWRP/WCRP Sub-seasonal to
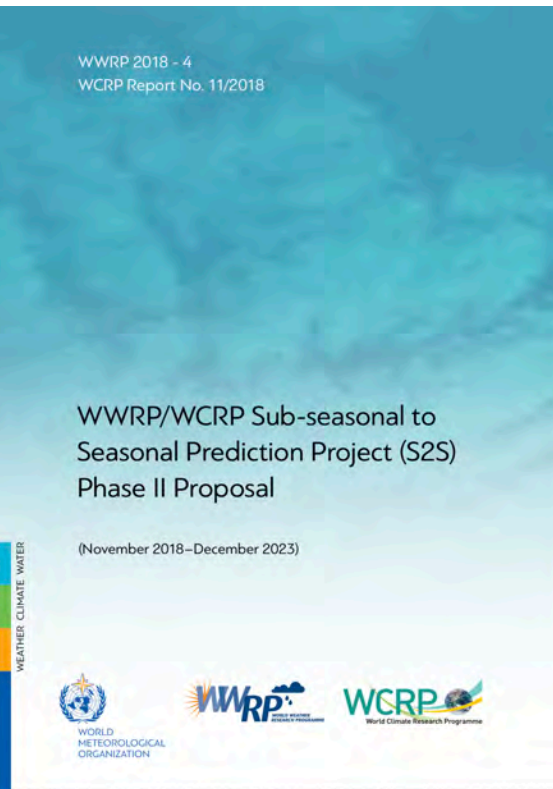Seasonal Prediction Project (S2S)
Phase II Proposal

(November 2018–December 2023)

WORLD
METEOROLOGICAL
ORGANIZATION

WWRP — World Weather Research Programme

WCRP — World Climate Research Programme

Science

New research foci MJO prediction and teleconnections; roles of Ocean and sea ice, Land surface, Stratosphere, Atmospheric composition and Ensemble generation.
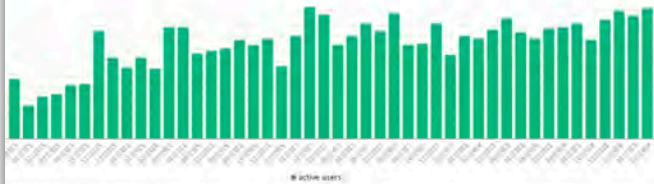
Research-Operations Applications Dev.

Enhancing operational infrastructure, user applications & real-time pilot experiment
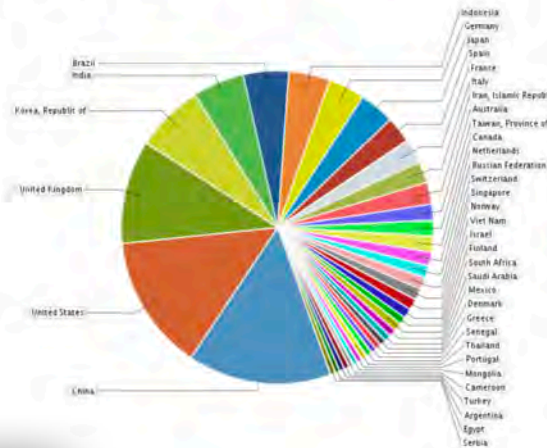
Data Infrastructure

S2S Database enhancement – ocean variables, more surface variables 4xdaily, additional models (eg IMD)
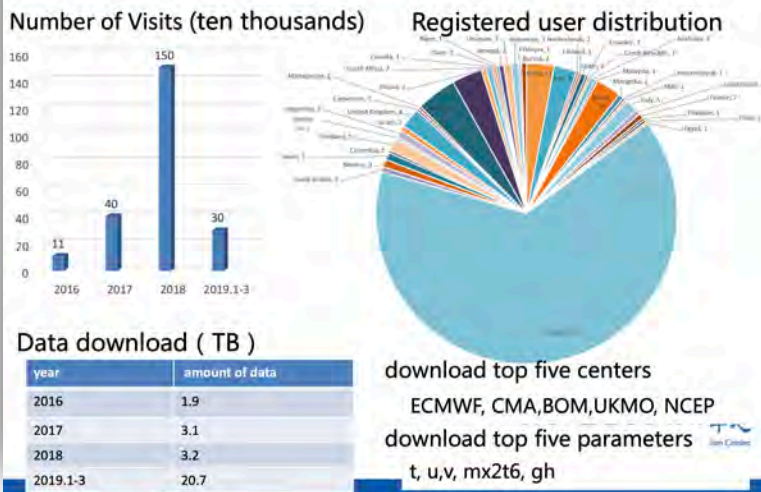
2

S2S Database

Use of the S2S database

Over 1000 active users of ECMWF archive
With ~500TB retrieved since 2015.

61 papers
using S2S DB
(as of May 2019)

CMA S2S Data Server

Number of Visits (ten thousands)

Registered user distribution

Data download (TB)

year	amount of data
2016	1.9
2017	3.1
2018	3.2
2019.1-3	20.7

download top five centers
ECMWF, CMA,BOM,UKMO, NCEP
download top five parameters
t, u,v, mx2t6, gh

S2S Database in IRI Data Library

- Over 2/3 of the S2S database is archived at IRI, including MJO indices

- Kept up to date

- Allows server-side and "lazy" computation to analyze the data according to user requests (eg weekly averaged anomalies of ensemble means, EOFs …)

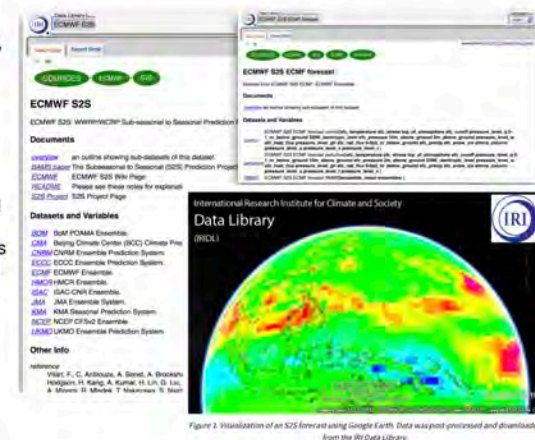- Good for low-bandwidth situations

- OpenDAP

- Includes RMM indices

Phase 2 sub-projects

Land-atmosphere coupling & initialization
MIPS: LS4P, LFMIP-OBS, GLACE-ESM SnowGLACE.
GEWEX-GASS WGSIP

Ocean coordinated case studies of ocean extreme events & air-sea interaction. Sea ice prediction assessment.

Aerosols
S2S/WGNE coord expt with/without interactive aerosols. 4-6 modeling centers

MJO Teleconnections
Systematic errors Relationships w/extremes

Impact of the ocean obs system
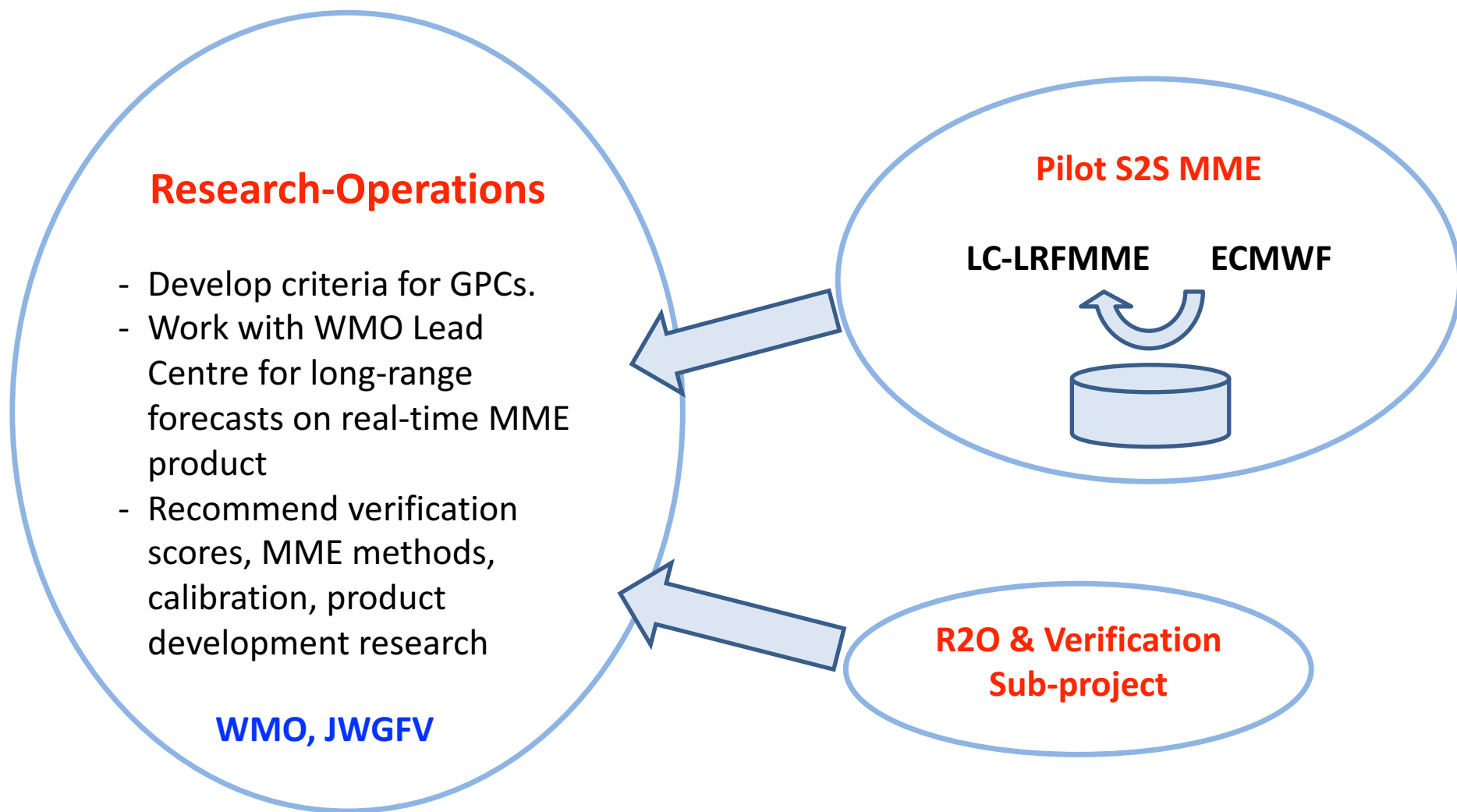on S2S forecasts: data denial expts (eg XBT, ARGO T/S profiles) ECMWF, JMA

Stratosphere
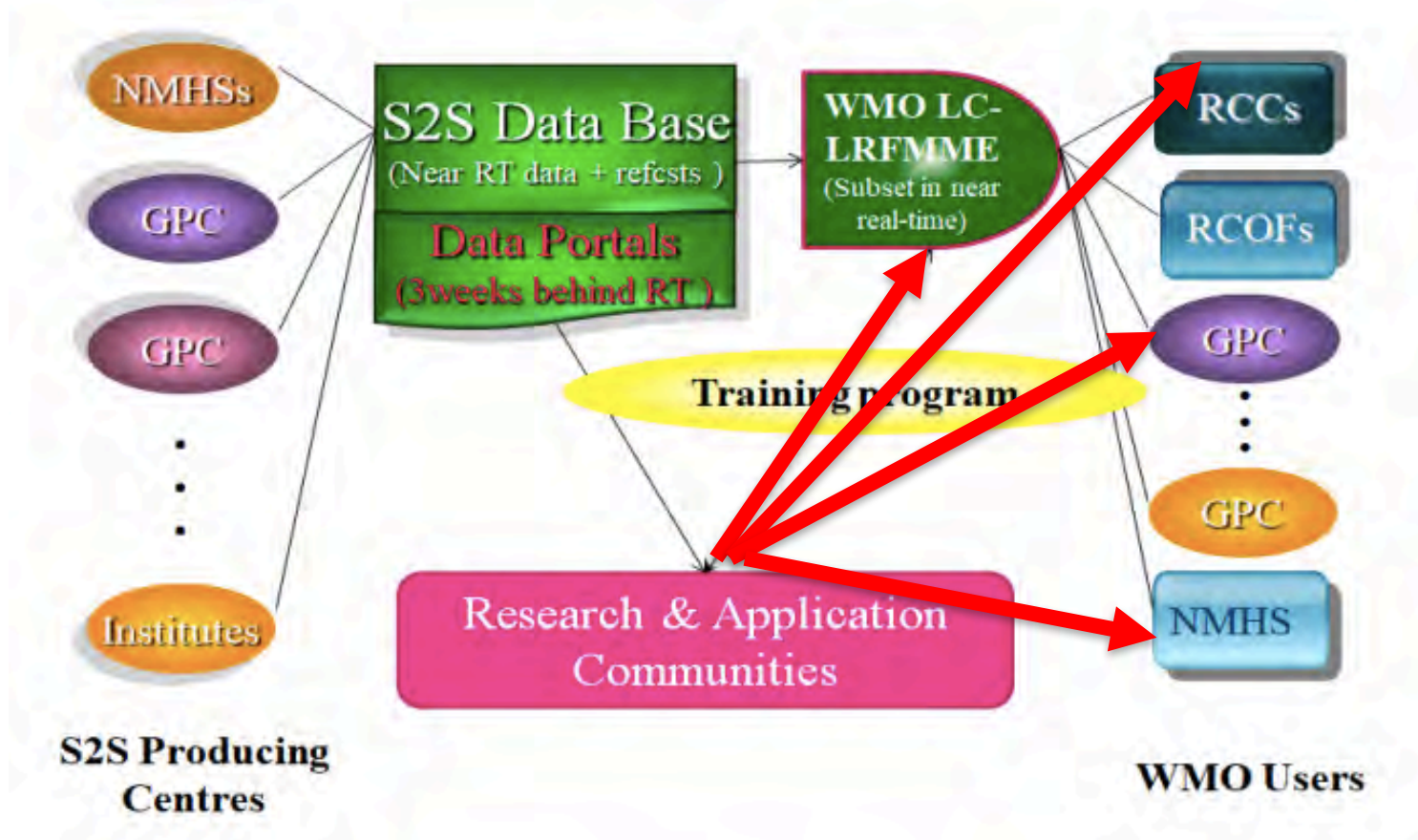Nudging expts to better understand impact of SSWs. Also impact of QBO on the MJO.

Ensembles
Stochastic physics sensitivity expt.

4

IPET-OPSLS pilot S2S MME

Research-Operations

- Develop criteria for GPCs.
- Work with WMO Lead Centre for long-range forecasts on real-time MME product
- Recommend verification scores, MME methods, calibration, product development research

WMO, JWGFV

Pilot S2S MME

LC-LRFMME   **ECMWF**

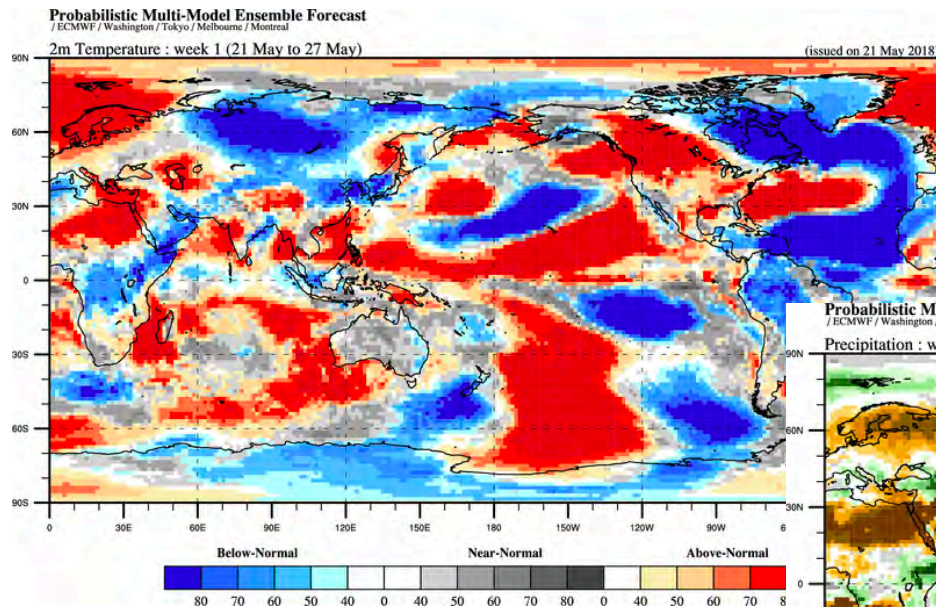**R2O & Verification Sub-project**

S2S linkage with WMO operational activities

We need to make sure to establish a WMO operational mechanism to support S2S forecast activity in the future.
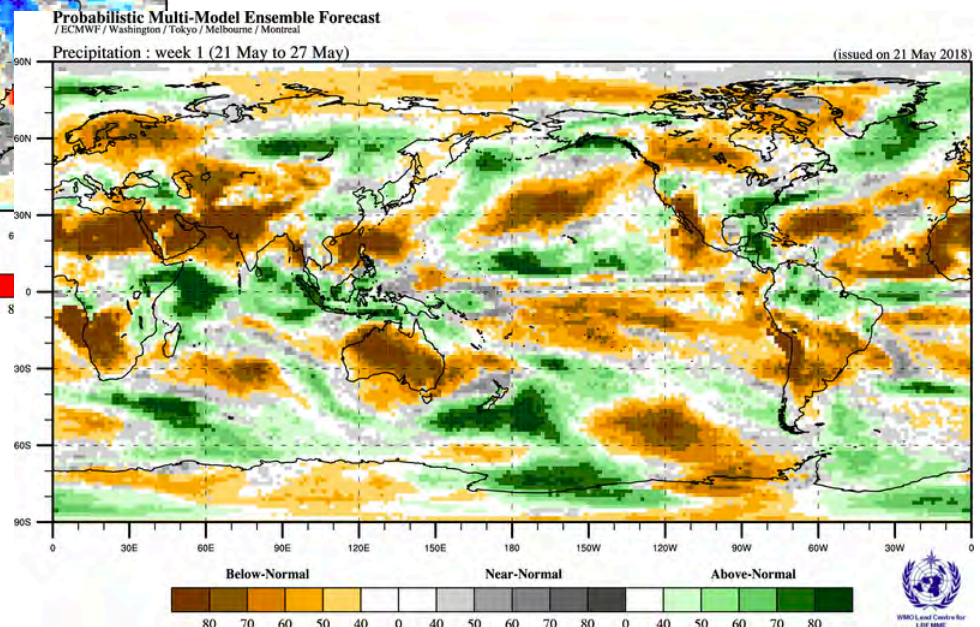
Source: S2S Newsletter No.8
http://www.s2sprediction.net/file/newsletter/Newsletter_No8.pdf

Probabilistic prediction map of 2m air temperature and precipitation produced by LC-MMELRF

2-m temperature:
Tercile probabilistic forecast
   using parametric method
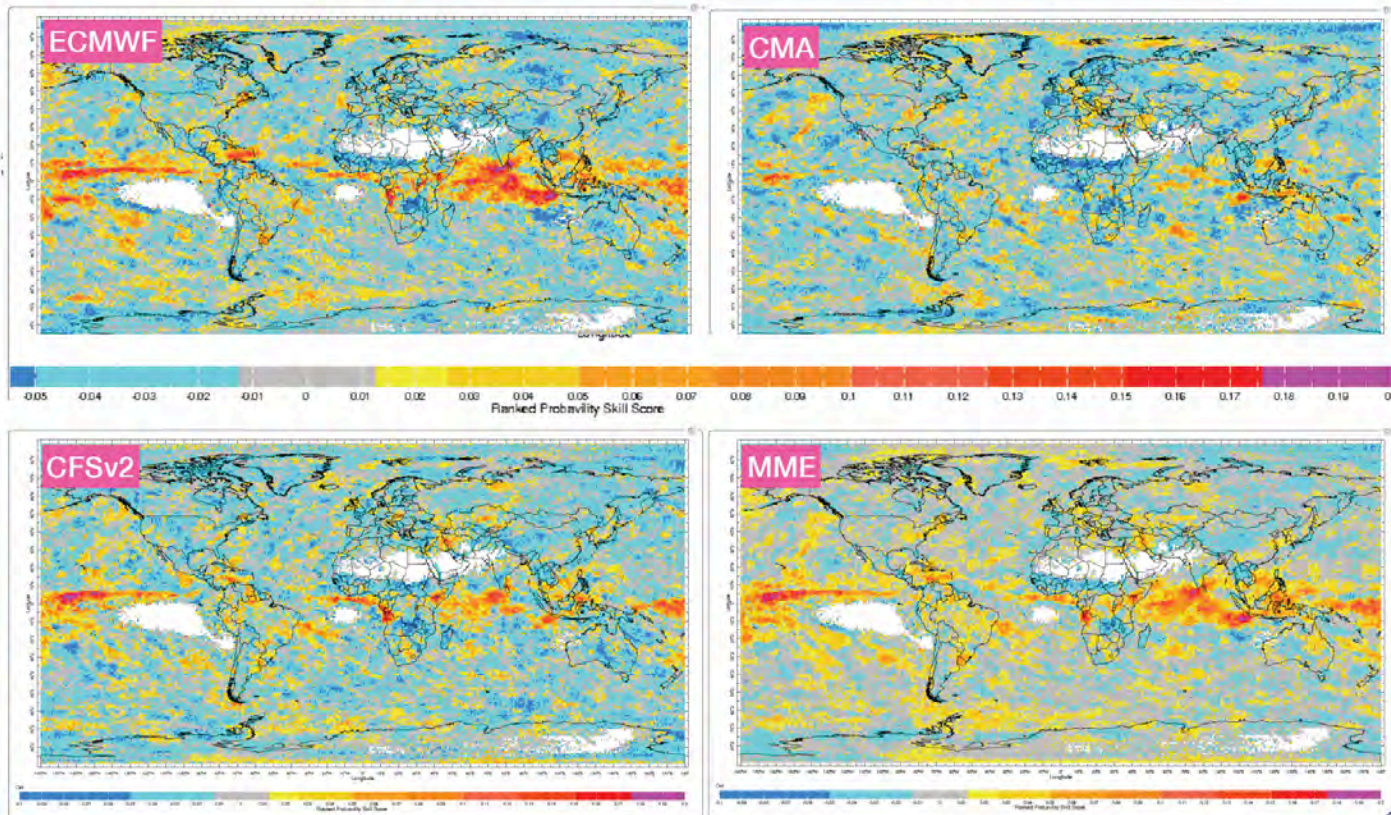   (Gaussian fitting)

Precipitation:
   Tercile probabilistic forecast
   using parametric method
   (Gamma fitting)

Courtesy LC-MMELRF   7

October start, MME of S2S

Rank Probability Skill Score, Week 3–4 by model

- ECMWF & MME are comparable in high-skill areas

- MME helps remove negative areas

- Highest skill is over Indian Ocean/West Pacific.

- Skill appears mostly MJO/ENSO related

Source: Andrew Robertson (2018), S2D conference, Boulder, USA

8
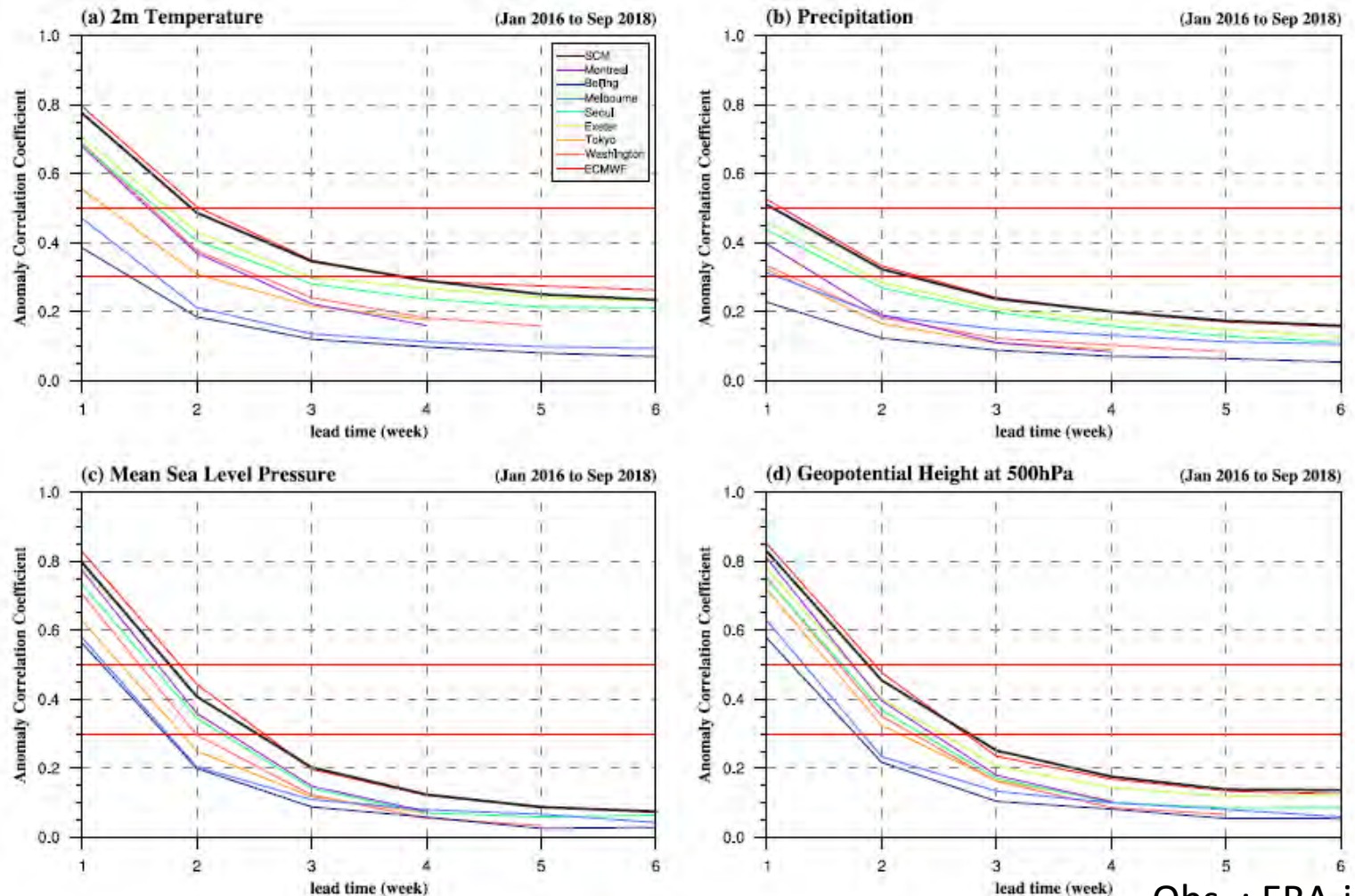
Realtime MME evaluation (LC-LRFMME) (1)

S2S partners

	Center	Time Range	Resolution	Forecast Ens. Size	Forecast Frequency	Hindcast	Hindcast Length	Hindcast Frequency	Hindcast Ens. Size
Beijing	CMA	d 0-60	T106L40	4	daily	fix	1994-2014	daily	4
ECMWF	ECMWF	d 0-46	Tco639/319 L91	51	2/week	on the fly	past 20 years	2/week	11
Exeter	UKMO	d 0-60	N216L85	4	daily	on the fly	1993-2016	4/month	7
Melbourne	BoM	d 0-62	T47L17	33	2/week	fix	1981-2013	6/month	33
Montreal	MSC	d 0-32	0.45x0.45 L40	21	weekly	on the fly	1998-2017	Weekly	4
Seoul	KMA	d 0-60	N216L85	4	daily	on the fly	1991-2010	4/month	3
Tokyo	JMA	d 0-33	T479/T319L100	50	weekly	fix	1981-2012	3/month	5
Washington	NCEP	d 0-44	T126L64	16	daily	fix	1999-2010	daily	4

※ https://software.ecmwf.int/wiki/display/S2S/Models (2019.04.29 기준)

Anomaly correlation coefficient – Ensemble Mean
Real time forecast Verification(Jan. 2016 to Sep. 2018)

A nominal initial date is Monday.
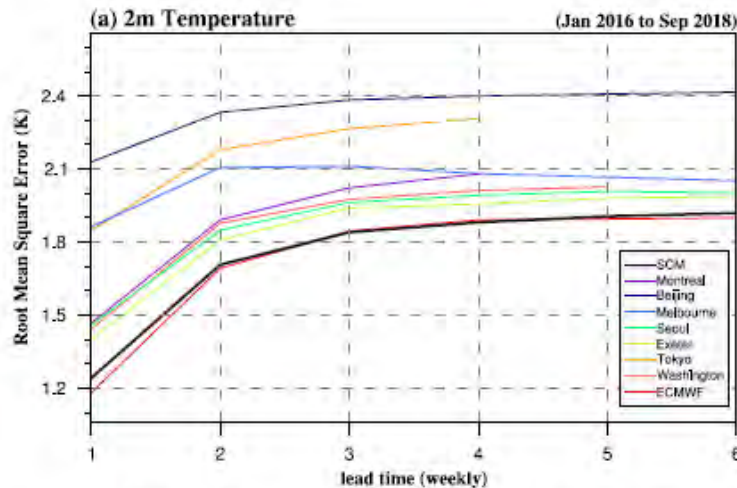
Obs. : ERA-interim

10

Root Mean Square Error
Real time forecast Verification (Jan. 2016 to Sep. 2018)
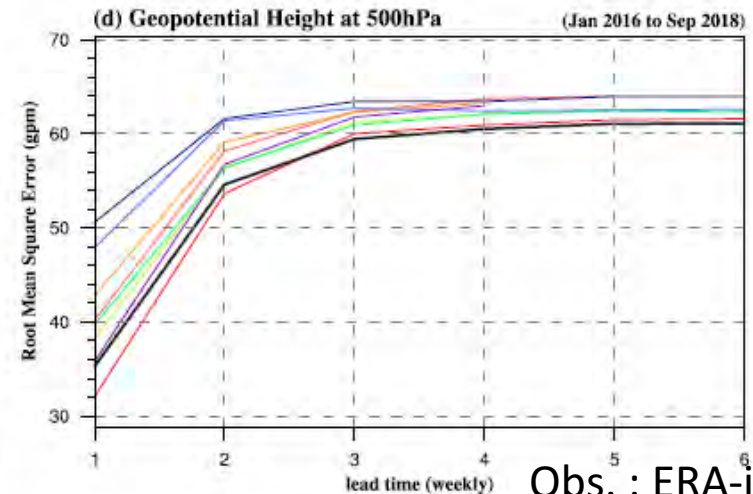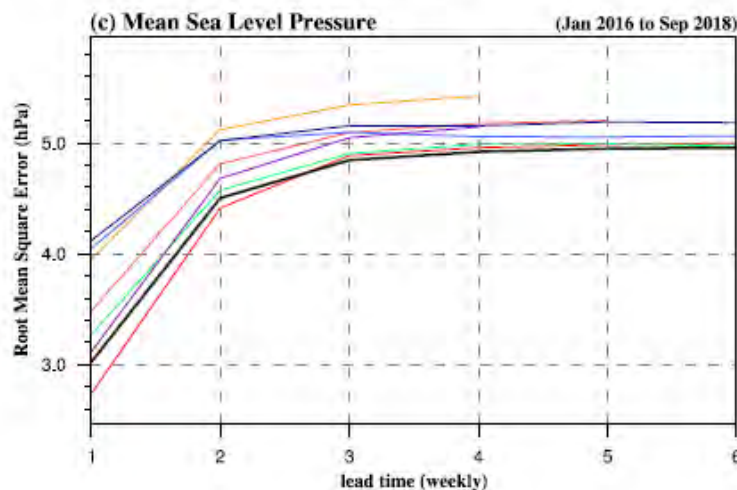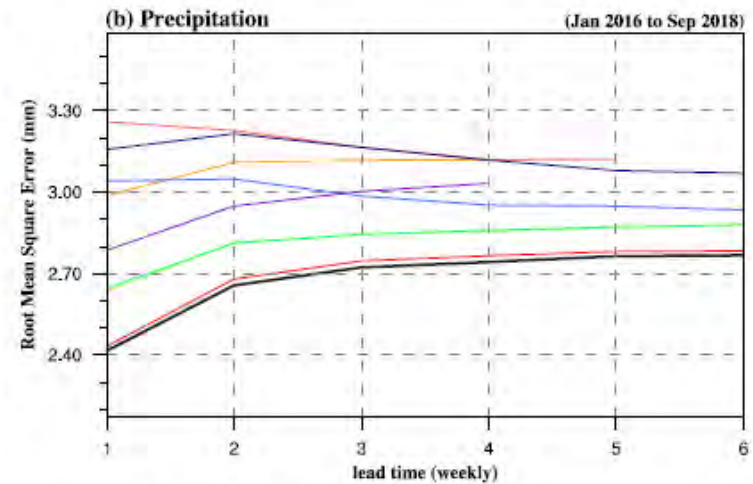
(a) 2m Temperature (Jan 2016 to Sep 2018)

(b) Precipitation (Jan 2016 to Sep 2018)

(c) Mean Sea Level Pressure (Jan 2016 to Sep 2018)

(d) Geopotential Height at 500hPa (Jan 2016 to Sep 2018)

A nominal initial date is Monday.

Obs. : ERA-interim

11

WGSIP-S2S link

Outcome from Reading S2S SG meeting (Apr. 2019)

- Ocean sub-project (Lead: Harry Hendon)
  It was suggested to collaborate with WGSIP on an aspect of ocean biases (time-evolution) in S2S time scale.