The Sub-seasonal to Seasonal (S2S) Prediction Project
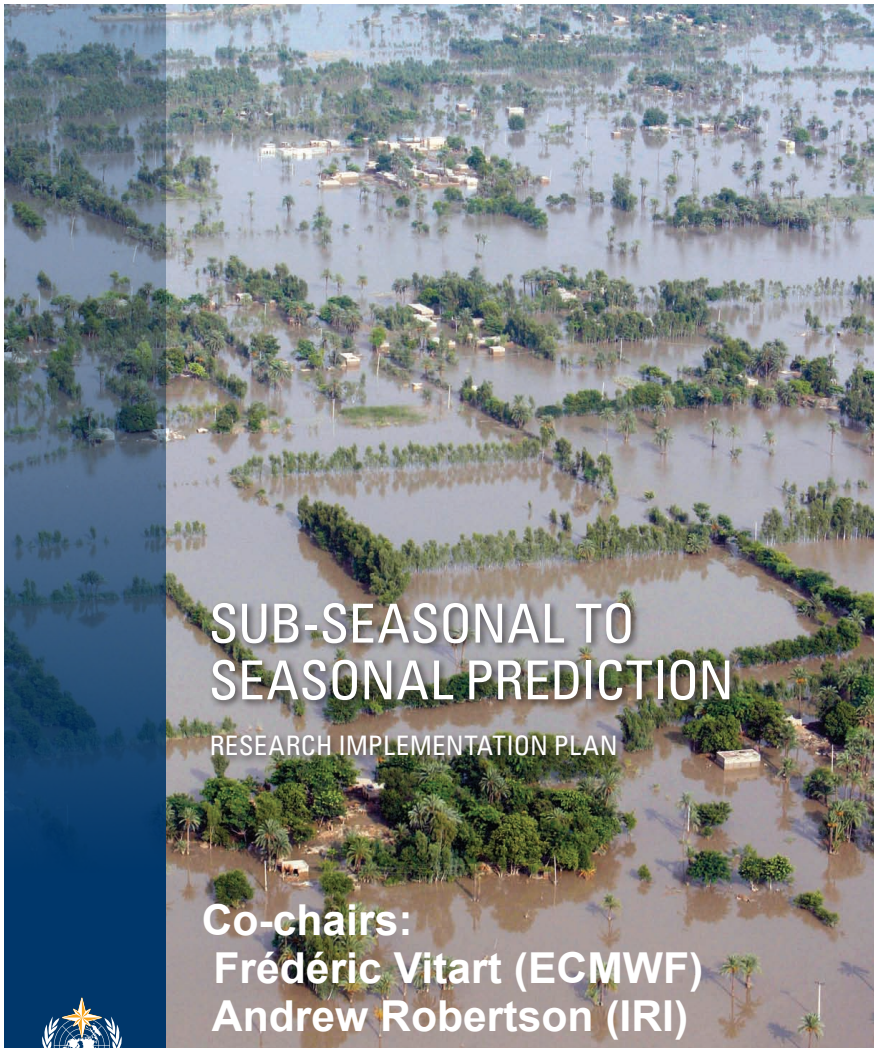
"Bridging the gap between weather and climate"

**Co-chairs:
Frédéric Vitart (ECMWF)
Andrew Robertson (IRI)**

SUB-SEASONAL TO
SEASONAL PREDICTION

RESEARCH IMPLEMENTATION PLAN

**Co-chairs:
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Andrew Robertson (IRI)**

World
Meteorological
Organization
Weather·Climate·Water

- Improve forecast skill and understanding on the sub-seasonal to seasonal timescale (2 weeks to 2 months) with special emphasis on high-impact weather events

- Promote the initiative's uptake by operational centres and exploitation by the applications community

- Capitalize on the expertise of the weather and climate research communities to address issues of importance to the Global Framework for Climate Services

5 year project, started in Nov 2013

The S2S Database, hosted by ECMWF and CMA, went online in May 2015. International Coordination Office hosted by KMA.

Key highlights in the last year

- Development of the S2S database:
    - 10 models available
    - CMA data portal opened
    - Subset of S2S data opened from IRI data library
    - Extension of w to all pressure levels
    - BAMS paper on S2S database (to appear in Jan 2017)
    - Usage: more than 600 registered users at ECMWF, 150 at CMA

- Side event for S2S at the WMO executive council in June 2016 to raise community awareness of the value of S2S to WMO member countries (introductory talk by F. Rabier followed by three exemplars of use of S2S forecasts for applications)

- Started assessment of S2S models (sub-project activities, MAPP research projects, other WWRP/WCRP groups e.g. SPARC/SNAP)

- S2S near real product websites

- 2-week training school on S2S (23 Nov. 2015 – 4 Dec. 2015, Trieste Italy) for 45 research scientists from developing countries

- S2S sessions at AGU, EMS, RMetSoc Conferences + Workshop on Maritime Continent with WGNE/MJO TF (Singapore, April 2016)

Contributing Centres to S2S database

● **Data provider (11)**   O **Archiving centre (2)**
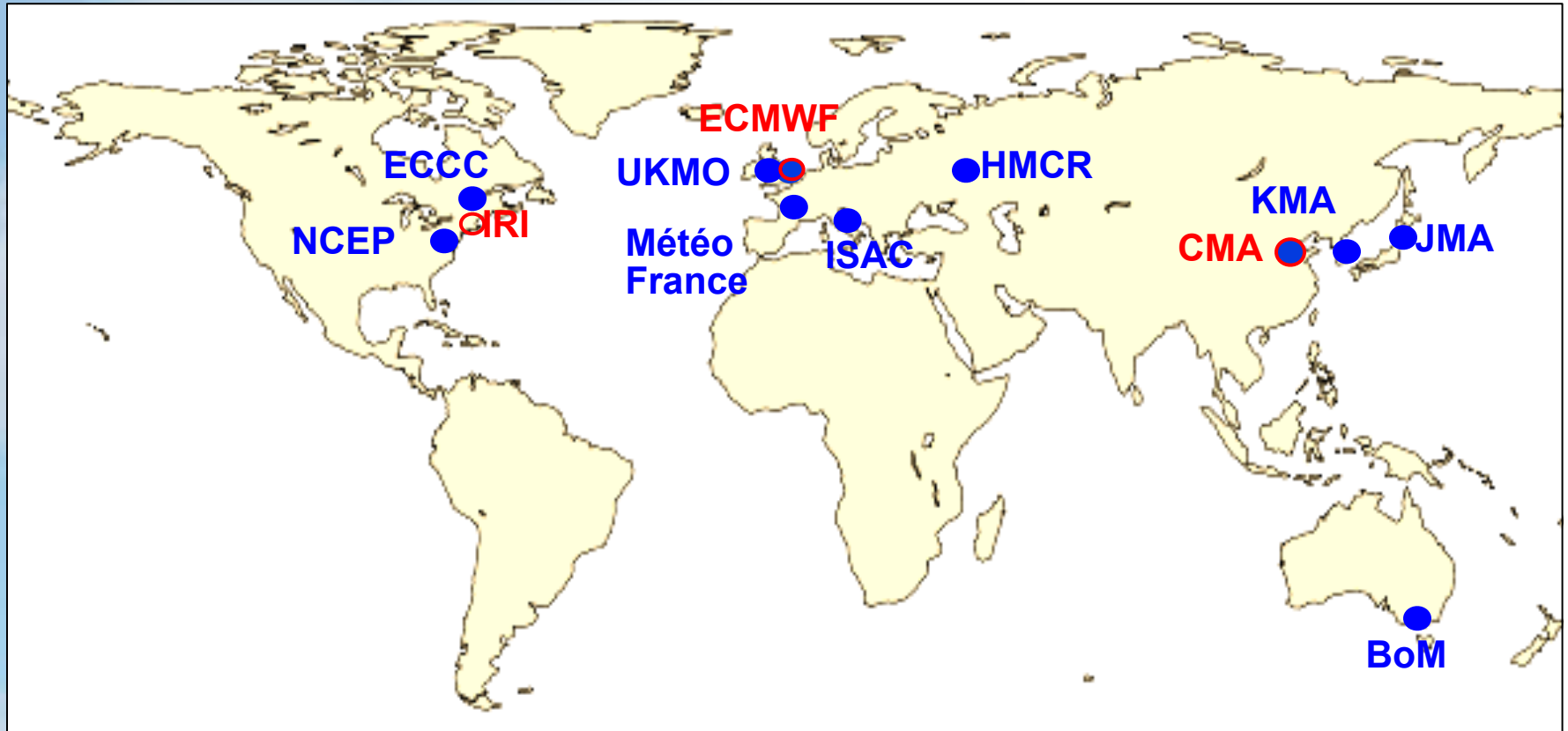
S2S Models

	Time-range	Resol.	Ens. Size	Freq.	Hcsts	Hcst length	Hcst Freq	Hcst Size
ECMWF	D 0-46	T639/319L91	51	2/week	On the fly	Past 20y	2/weekly	11
UKMO	D 0-60	N216L85	4	daily	On the fly	1993-2015	4/month	3
NCEP	D 0-44	N126L64	4	4/daily	Fix	1999-2010	4/daily	1
ECCC	D 0-32	0.45x0.45 L40	21	weekly	On the fly	1995-2014	weekly	4
BoM	D 0-60	T47L17	33	weekly	Fix	1981-2013	6/month	33
JMA	D 0-34	T319L60	25	2/weekly	Fix	1981-2010	3/month	5
KMA	D 0-60	N216L85	4	daily	On the fly	1996-2009	4/month	3
CMA	D 0-45	T106L40	4	daily	Fix	1886-2014	daily	4
CNRM	D 0-32	T255L91	51	weekly	Fix	1993-2014	2/monthly	15
CNR-ISAC	D 0-32	0.75x0.56 L54	40	weekly	Fix	1981-2010	6/month	1
HMCR	D 0-63	1.1x1.4 L28	20	weekly	Fix	1981-2010	weekly	10

S2S database models

Models	Ocean coupling	Active Sea Ice
ECMWF	YES	Planned
UKMO	YES	YES
NCEP	YES	YES
ECCC	NO	NO
BoM	YES	Planned
JMA	NO	NO
KMA	YES	YES
CMA	YES	YES
CNRM	YES	YES
ISA-CNR	YES	NO
HMCR	NO	NO

S2S Database current status

- Open access to researchers since May 2015 from ECMWF and Nov. 2015 from CMA. Subset of the database also available in netcdf from IRI data library.
- Currently, data from all centres except KMA (will become available soon) are available.
- Total size of the database so far: 43 Tbytes (real-time 7Tbs, re-forecasts 36 Tbs)
- Usage: 600 registered users from 65 countries at ECMWF, 140 at CMA

Active users
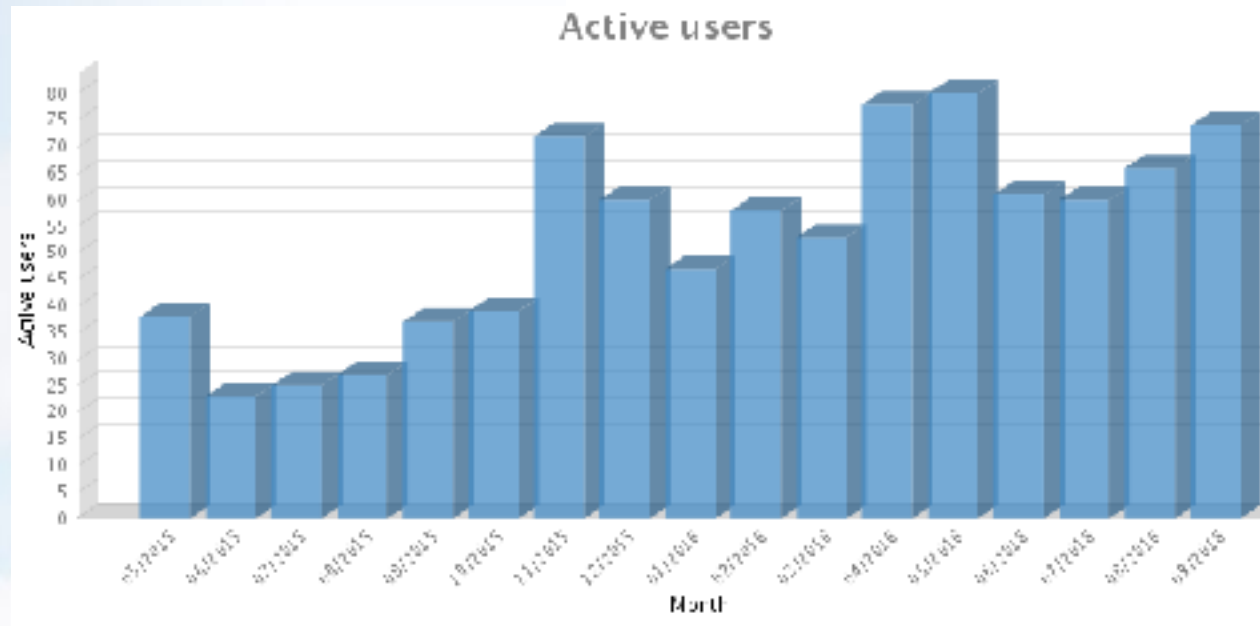
- Plans
  - End of 2016: all 11 Data Providers
  - Add new ocean sub-surface and sea-ice variables
  - **Compute and archive indices such as MJO RMMs, SSW index, Weather regimes, Tropical storm tracks, Monsoon indices to be available for the research community from ECMWF and IRI servers.**

New variables to be added

Atmosphere:

Vertical Velocity (currently archived at 500 hPa only) to be archived in all pressure levels: from 1st January 2017 in some S2S models

Ocean/sea-ice variables:

- Sea surface salinity
- Depth of 20 deg isoth
- Mixed layer depth
- Heat content at top 300m
- Salinity in top 300m
- U surface current
- V surface current
- Sea surface height
- Sea ice thickness

These new variables will be archived in **netcdf** in MARS**.** Work is ongoing to archive ocean data in the MARS system (project for ERA-CLIM2).

New variables will not be ready for all the S2S models straight away. For models with fixed climatology, we may need to wait the next version of these model.

🔓 The Sub-seasonal to Seasonal Prediction (S2S) Project Database

F. Vitart[1], C. Ardilouze[2], A. Bonet[1], A. Brookshaw[1,8], M. Chen[3], C. Codorean[1], M. Déqué[2], L. Ferranti[1], E. Fucile[1], M. Fuentes[1], H. Hendon[4], J. Hodgson[9], H.S. Kang[5], A. Kumar[3], H. Lin[6], G. Liu[4], X. Liu[7], P. Malguzzi[8], I. Mallas[1], M. Manoussakis[1], D. Mastrangelo[8], C. MacLachlan[9], P. McLean[9], A. Minami[10], R. Mladek[1], T. Nakazawa[5], S. Najm[1], Y. Nie[7], M. Rixen[16], A. W. Robertson[11], P. Ruti[16], C. Sun[7], Y. Takaya[10], M. Tolstykh[13], F. Venuti[1], D. Waliser[14], S. Woolnough[15], T. Wu[7], D.-J. Won[5], H. Xiao[7], R. Zaripov[12], and L. Zhang[7]

[1] ECMWF, Reading, UK
[2] Météo-France/CNRM, Toulouse, France
[3] NCEP, College Park, USA
[4] BoM, Melbourne, Australia
[5] KMA, Republic of Korea
[6] Environment and Climate Change Canada, Montreal, Canada
[7] CMA, Beijing, China
[8] CNR ISAC, Bologna, Italy
[9] Met-Office Hadley Centre, Exeter, UK
[10] JMA, Tokyo, Japan
[11] IRI, New York, USA
[12] HMCR, Moscow, Russia
[13] Inst. Of Numerical Mathematics RAS, Moscow, Russia
[14] Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA, USA
[15] National Centre for Atmospheric Science, Department of Meteorology, U. Reading, UK
[16] World Meteorological Organization, Geneva, Switzerland

S2S Product Websites (3 weeks behind real-time)

- S2S product website at ECMWF: Contains near real-time products (2mtm precip, Z500 anomaly maps, MJO forecasts, EFI…) from S2S models from 1st January 2016. http://www.ecmwf.int/en/research/projects/s2s/charts/s2s/

- "S2S museum" at university of Tsukuba, Japan: Contains near real time indices (MJO, AO, NAO. SSW…)
  http://gpvjma.ccs.hpcc.jp/S2S/S2S_SICmap.html

S2S NAO index forecasts (initial: 2016.03.24, Thu)
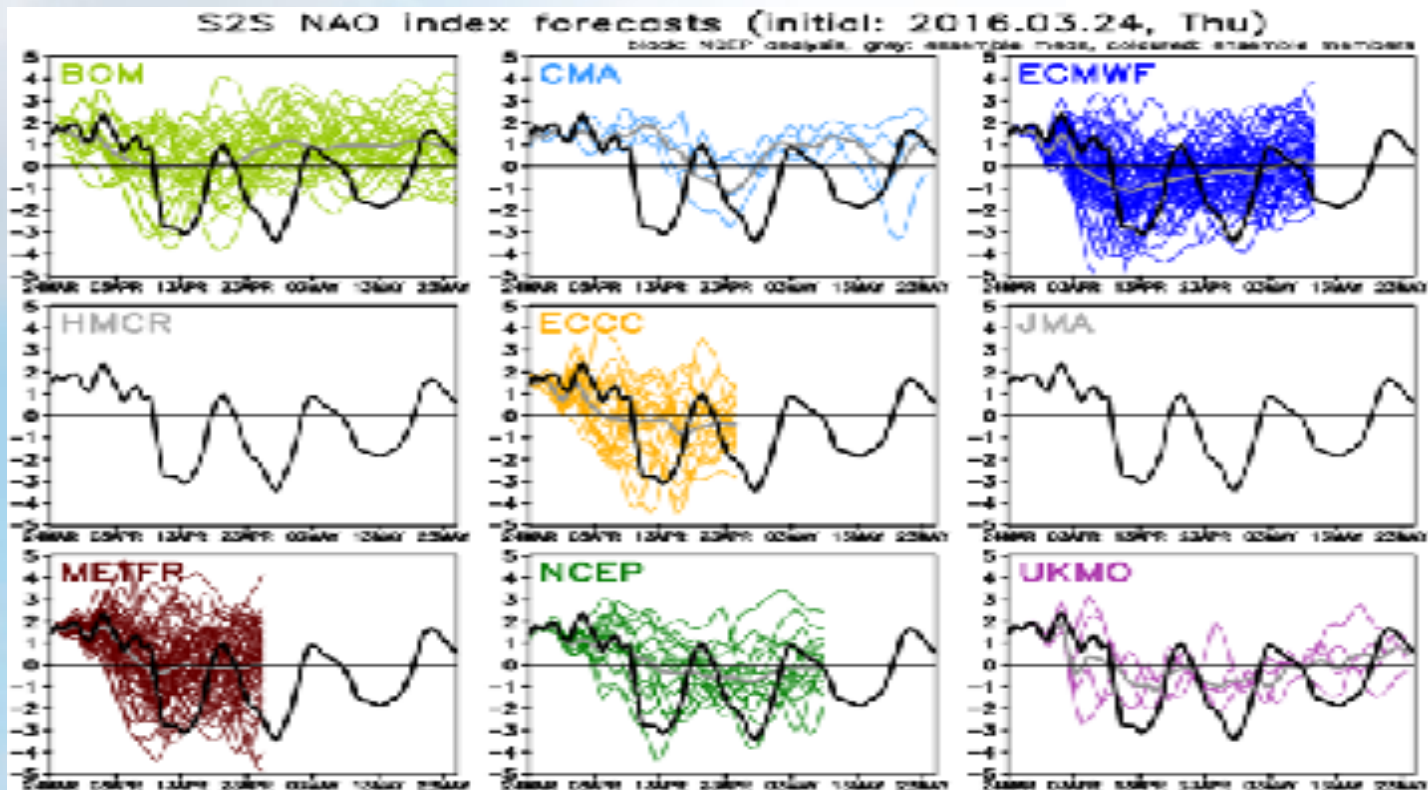
S2S Side Event at WMO Executive Council - June 2016

Goal: to raise community awareness of the value of S2S to WMO member countries and stimulate contributions to S2S trust fund.

Introductory talk by F. Rabier (Director of ECMWF) followed by three exemplars of use of S2S forecasts for application.

Follow up: Submission of two regional pilots to the GFCS:

- Advancing Flood Early Warning on sub-seasonal to seasonal time scale over India with coupled hydrologic and atmospheric modelling

- Reservoir management for optimization of energy production in South America

US National Academy of Science book on Sub-seasonal to seasonal prediction

http://www.nap.edu/catalog/21873
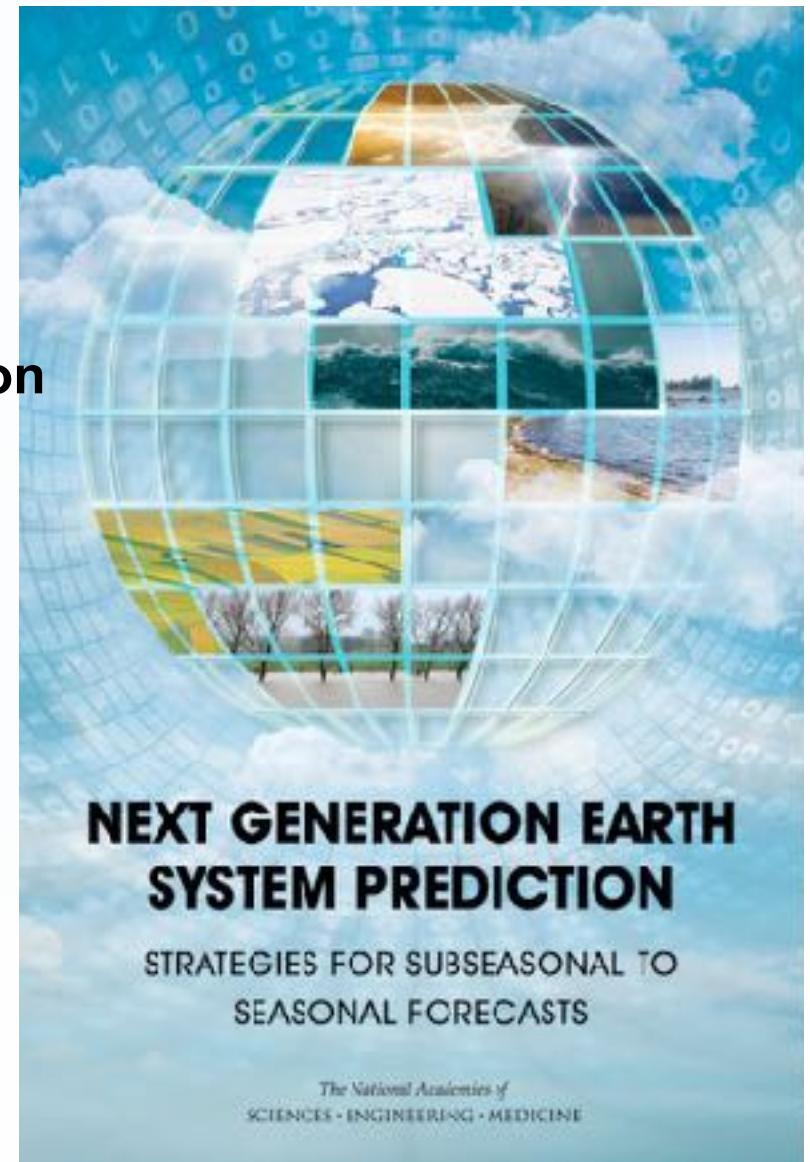
Conferences/Education outreach

- *Nov/Dec, 2015: 2 week training course at ICTP (Trieste, Italy) for young scientists from developing countries*
- *Dec 2015: S2S session at AGU conference*
- *11-14 April 2016: S2S/MJO-TF Maritime Continent workshop – Singapore*
- *July 2016: S2S workshop at Royal Meterorological Society Conference - Manchester*
- *Sept 2016 S2S session at EMS conference*
- **6-7 Dec 2016: Workshop on Sub-Seasonal to Seasonal Predictability of Extreme Weather and Climate (IRI)**
- **12-16 Dec: S2S session at AGU conference**
- **May 2017: S2S verification session at the 7th International Verification Methods Workshop (IVMW in coordination with JWGFVR, Berlin,8-11 May 2017**
- **June 2017: S2S teleconnection session at WGNE meeting (Montreal)**
- **August 2017: S2S session at IAMAS meeting (Cape Town)**
- **Oct 2017: 2 week training course on S2S teleconnections and workshop**

+ the Asean Specialized Meteorological Centre in Singapore is proposing a 4-5 year program (SEA-S2S) of workshops/training course aimed at ASEAN national meteorological services. Proposal for a South American training course in 2017 to be held in Paraguay or Columbia

Next year planning

- Continue development of S2S database (KMA, new variables)

- Make available pre-computed weather indices to the research community

- Continue evaluation of S2S database and potential benefit of S2S multi-model forecasts through the S2S sub-project activities, links with other groups/projects (e.g. SPARC/SNAP, PDE…) and through funded projects (e.g. MAPP)

- Workshops/training courses

- Book on S2S

- Special issue on S2S in FRONTIER (online publication)

Analysis of S2S Database

MJO Bivariate Correlation
S2S REFORECASTS 1999-2010
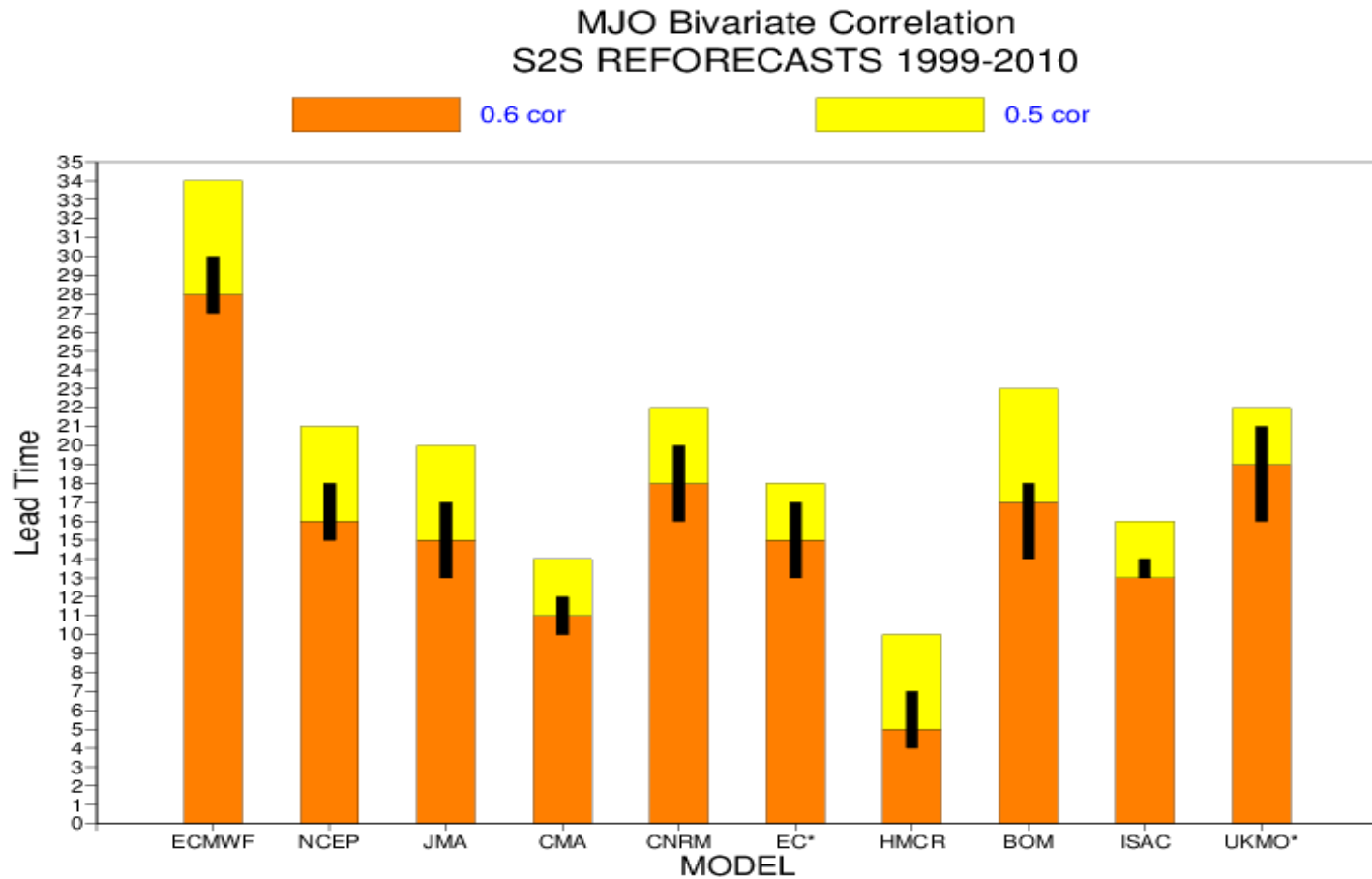
from Frederic Vitart

S2S Prediction Task Force (US)

The OAR Climate Program Office's Modeling, Analysis, Predictions and Projections (MAPP) Program has organized the Subseasonal to Seasonal (S2S) Prediction Task Force to advance NOAA's and the Nation's capability to model and predict sources of S2S predictability. The ultimate goal of this initiative is to help close the gap in prediction skill and products between traditional weather and seasonal lead times.

Elizabeth Barnes (Lead), Colorado State University
Edmund Chang (Co-Lead), Stony Brook University
Paul Dirmeyer (Co-Lead), George Mason University/COLA
Andrea Lang (Co-Lead), University at Albany

- 14 research projects have been awarded

- SubX project (NASA, the National Weather Service, and the Department of Defense's Office of Naval Research) : a new interagency prediction system experiment to test sub-seasonal ensemble prediction systems for possible operational use by the National Weather Service.

- Important contribution to S2S research activities

Sub-projects

Sub-seasonal to Seasonal (S2S) Prediction Project

Sub-Projects

Teleconnections *(C. Stan and H. Lin)*

Madden-Julian Oscillation *(D. Waliser and S. Woolnough)*

Monsoons *(H. Hendon)*

Africa *(A. Robertson and R. Graham)*

Extremes *(F. Vitart)*

Verification and Products *(C. Coelho)*

Research Issues

- Predictability
- Teleconnection
- O-A Coupling
- Scale interactions
- Physical processes

Modelling Issues

- Initialisation
- Ensemble generation
- Resolution
- O-A Coupling
- Systematic errors
- Multi-model combination

Needs & Applications

Liaison with SERA
(Working Group on
Societal and Economic
Research Applications)

S2S Database

S2S sub-project on verification (and products)

Website: http://s2sprediction.net/xwiki/bin/view/Main/Verification

Science plan developed with inputs from JWGFVR, SERA and S2S: http://www.s2sprediction.net/resources/documents/sub-projects/Verification.pdf

Activities: ← **Science plan: Guidance document to stimulate scientific community to address S2S verification problems**

- **Literature survey** on S2S verification posted on the sub-project wiki page

- **Collaboration bwt S2S and WMO:** Questionnaire on subseasonal verification practices in operational centers (GPC) prepared, with the purpose of **sharing current practices** used to verify subseasonal forecasts (both for operations and research) and also help **identify gaps and guide novel developments. Summary of responses discussed with WMO CBS/CCl ET-OPSLS** and posted on the sub-project wiki page

- **Development of pilot real-time sub-seasonal MME predictions:** WMO LCLRFMME developed a pilot system for real-time multi-model subseasonal forecasts using real-time forecasts (and hindcasts) from a subset of models contributing to the S2S project accessible via ECMWF data archive. **The S2S wiki page provides a link for the S2S research community to see the initial developments and provide feedback for future developments and improvements in this pilot under development system.**

- **Comprehensive collection of links to available datasets for S2S verification** posted on the sub-project wiki page

- **Links and instructions on how to access S2S project model datasets** posted on wiki

- **Links to S2S forecast products webpages** developed by ECMWF and S2S Museum (University of Tsukuba/Oxford) posted on wiki

- S2S is included in the JWGFVR **user-oriented verification challenge** https://www.wmo.int/pages/prog/arep/wwrp/new/FcstVerChallenge.html

- **Organizing S2S verification session** at the **7th International Verification Methods Workshop (IVMW)** in coordination with JWGFVR, Berlin,8-11 May 2017, preceded by verification tutorial, 3-6 May 2017 (website and first announcement for abstract submission will soon be available)

- **Preparing forecast verification chapter for S2S book** co-edited by S2S co-chairs

Main.WebHome / Documents on this Wiki / Teleconnections (Interactions and teleconnections between midlatitudes and tropics)

Teleconnections (Interactions and teleconnections between midlatitudes and tropics)

⚙ More actions ▾

Last modified by Administrator on 2016/04/11 06:42

Broad Objectives

Better understand sub-seasonal tropical-extratropical interaction pathways

Identify periods and regions of increased predictability ("forecasts of opportunity")

Improve subseasonal-to-seasonal forecasts of weather and climate for applications

Research Priorities

Understand physical mechanisms of tropical-extratropical interaction

Assess the physical mechanisms and robustness of mid-latitude circulation and weather responses to the spectrum of three-dimensional tropical diabatic heating on all subseasonal time scales, from tropical cyclones to the boreal winter and summer ISO. Identify mechanisms of extra-tropical forcing of tropical convection and circulation on all subseasonal time scales.

Develop new comprehensive estimates of tropical heating

Synthesize available satellite radiance and radar measurements with modern reanalysis products to produce four-dimensional estimates of tropical heating.

Mechanistic numerical experiments to assess mechanisms and potential predictability

Carry out a broad array of numerical experiments with tropical diabatic heating estimates to further refine understanding of mechanisms. Use state-of-the art models with the (observed) tropical heating embedded to assess potential predictability of mid-latitude weather and circulation.

Development of down-scaling and error correction methods for applications.

Identify the main errors associated with teleconnections, especially those associated with extratropical response to tropical forcing. Develop postprocessing techniques to correct systematic teleconnection related model errors.

Implementation

The objectives of the science plan will be implemented on two time scales. On a shorter time scale they will benefit from being executed within the framework of a coordinated program, and on longer time-scale they will evolve independently and interweave as progress in research reaches the stage of transfer to applications.

An intense international program of one year, the Year of Tropics-Midlatitude Interactions and Teleconnections (YTMIT), should be implemented. This program is designed to foster relationships between research, forecasting, and stakeholder communities, and will facilitate the sharing of common interests to explore the links between the tropics and midlatitudes. The international program will include an integrated observations component (using existing products of Global Observing System, reanalyses), an operational forecast and reforecast component (using the S2S and NMME databases), an applications component, and a research component aligned with the research priorities of this science plan and WCRP mission. The research component will consist of a combination of theoretical, diagnostic, and modeling studies and will be focused on understanding the physical nature of the tropics-midlatitude interactions and teleconnections and their potential as sources of predictability.

Collaboration with other WMO projects, and S2S subprojects such as WCRP Working Group on Seasonal to Interannual Prediction (WGSIP), MJOTF-S2S Joint Project on MJO and Maritime Continent Interactions, S2S sub-project on extreme weather, and the S2S sub-project on verification.

For more information about the YTMIT project, please contact Cristiana Stan.

Linkage with WMO Operational Activities

A major goal of S2S is to support CBS operational sub-seasonal activities

- Research into sub-seasonal predictability under S2S will be conducted in close liaison with developing infrastructure and procedure for operational sub-seasonal prediction as they develop under CBS.]

- It has been proposed to use the S2S database to exchange real-time data for CBS activities.

Near rt data + rfcsts

S2S database

lead centre

WMO users

Subset in near real-time

S2S data portal (3-weeks behind RT)

S2S producing centres

Research and application community