The Sub-seasonal to Seasonal (S2S) Prediction Project

"Bridging the gap between weather and climate"

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

Mission Statement

- “To improve forecast skill and understanding on the sub-seasonal to seasonal timescale with special emphasis on high-impact weather events”

- “To promote the initiative’s uptake by operational centres and exploitation by the applications community”

- “To capitalize on the expertise of the weather and climate research communities to address issues of importance to the Global Framework for Climate Services”

The project will focus on the forecast range between 2 weeks and a season

Timeline

Month	Milestones
Nov 2009	*CAS recommends WCRP, WWRP and THORPEX to set up S2S*
Dec 2010	*WWRP-WCRP-THORPEX workshop in Exeter*
Sept. 2011	*Formation of the S2S planning group*
Dec. 2011	*First S2S planning group meeting in Geneva*
June 2012	*Approval of S2S though WMO EC*
Feb. 2013	*Second S2S planning group meeting in Exeter*
March 2013	*Final version of implementation plan*
Nov. 2013	*Opening ceremony of the ICO and S2S launch workshop in Jeju Island*
Feb. 2014	*S2S workshop at NCEP* *First S2S steering group meeting*

The S2S Steering Group

- Frederic Vitart (co-chair)
- Andrew Robertson (co-chair)
- Arun Kumar
- Harry Hendon
- Duane Waliser
- Yuhei Takaya
- Hai Lin
- Alberto Arribas
- June-Yi Lee
- Ben Kirtman

- In-Sik Kang (WCRP_JSC)
- Richard Graham (CBS)
- Jean-Pierre Ceron (CCL)
- Caio Coelho (JWGFV)
- Steve Woolnough (GEWEX/GASS)
- Bart van den Hurk (GEWEX/GLASS)
- Joanne Robbins (SERA)

International Coordination Office: NIMR, Republic of Korea

Research areas

Service-oriented research

Societal and economic research applications (SERA)

Verification

Underpinning research

Sources of predictability

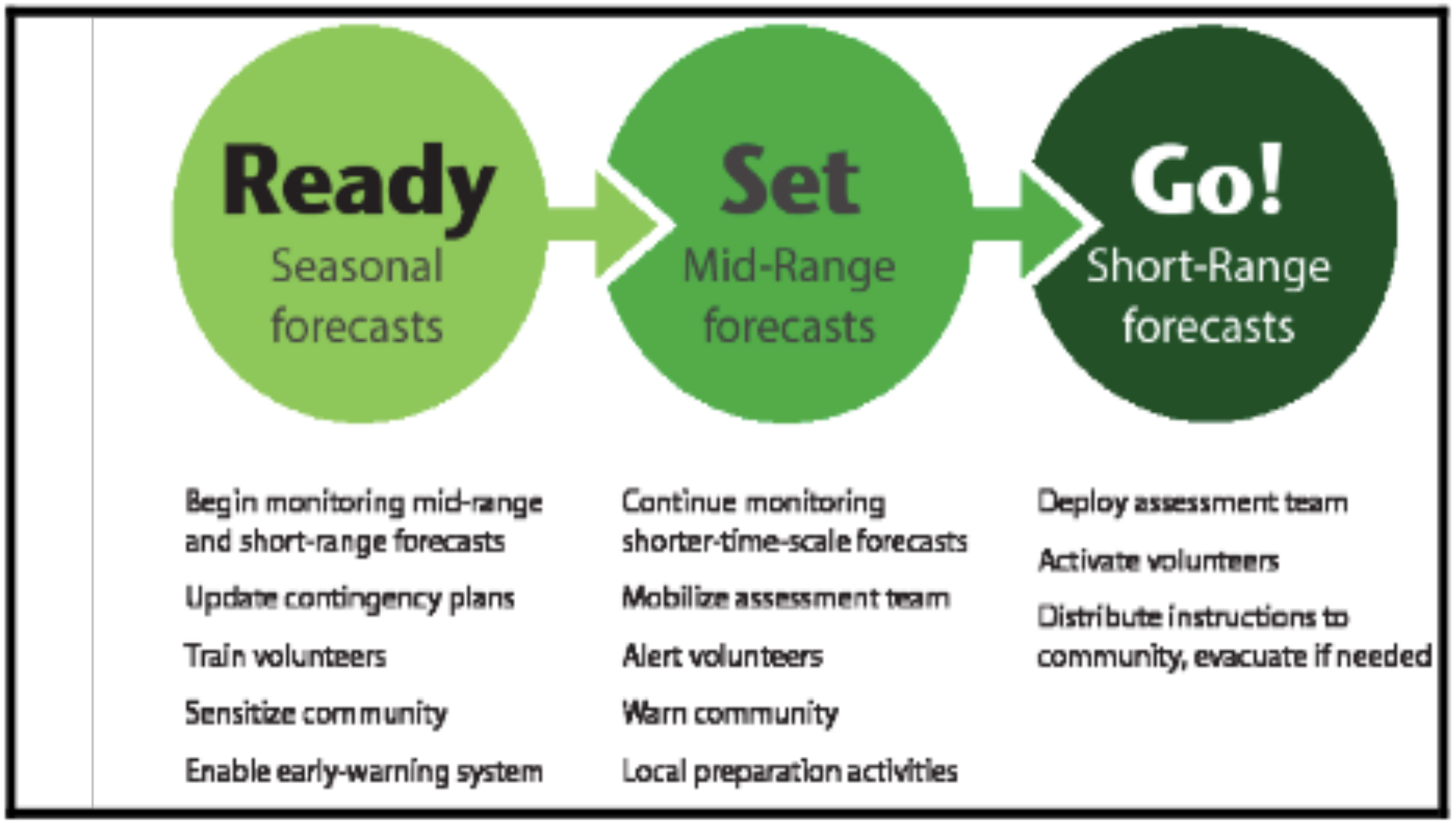
MJO, Monsoon, Stratosphere, Snow/sea-ice/soil moisture …

Teleconnections

Modelling

Resolution, Initial conditions, ensemble generation, ocean-atmosphere coupling, systematic errors

Opportunity to use information on *multiple* time scales



Red Cross – IRI example

S2S Database

- Use TIGGE protocol (GRIB2) for archiving the data. The data should also be available in NetCDF for the WCRP community.
- Archive daily means of real-time forecasts + hindcasts.
  – Real-time forecasts 3 weeks behind real-time
  – Hindcasts depending on centre (nonuniform)
  – Common 1.5x1.5 degree ERA-interim grid
  – Update frequency depending on centre
- Variables archived: most of TIGGE variables + ocean variables and stratospheric levels + soil moisture/temperature
- ~18TB in yr 1, ~9TB/yr thereafter (cf TIGGE is currently 180TB/yr)
- ECMWF will be a main archiving centre. UKMO will archive a subset of the data (Climate Cloud)
- Archiving in the ECMWF server will start in 2014.

Sub-seasonal real-time Operational Forecasts

	Time-range	Resol.	Ens. Size	Freq.	Hcsts	Hcst length	Hcst Freq	Hcst Size
ECMWF	D 0-32	T639/319L62	51	2/week	On the fly	Past 18y	weekly	5
UKMO	D 0-60	N96L85	4	daily	On the fly	1989-2003	4/month	3
NCEP	D 0-60	N126L64	16	daily	Fix	1999-2010	daily	4
EC	D 0-35	0.6x0.6L40	21	weekly	On the fly	Past 15y	weekly	4
CAWCR	D 0-120	T47L17	33	weekly	Fix	1989-2010	3/month	33
JMA	D 0-34	T159L60	50	weekly	Fix	1979-2009	3/month	5
KMA	D 0-30	T106L21	20	3/month	Fix	1979-2010	3/month	10
CMA	D 0-45	T63L16	40	6/month	Fix	1982-now	monthly	48
Met.Fr	D 0-60	T63L91	41	monthly	Fix	1981-2005	monthly	11
SAWS	D 0-60	T42L19	6	monthly	Fix	1981-2001	monthly	6
HMCR	D 0-60	1.1x1.4 L28	10	monthly	Fix	1979-2003	monthly	10

Subprojects

- Monsoons
  – e.g., predicting the timing of monsoon onsets, and active/break phases, all monsoons
- MJO
  – Passage over the Maritime Continent and its interaction with the diurnal cycle of rainfall over islands (w/MJO-TF/GEWEX GASS); air-sea interaction
- Africa
  – link to CBS & SERA; weather-within-climate; rainfed agriculture; capacity building
- Extreme Weather
  – Predictability of extreme events (heat/cold waves, drought, tropical cyclones..) – develop a metrics
  – case studies
- Verification
  – Recommended set of metrics & datasets for verifying S2S forecasts; provide guidance on verification topics to be researched, including methods for probabilistic predictions.

Conferences/Education outreach

- S2S session at WWRP Open Science Conference – 16-21 August 2014, Montreal

Education:

- A proposal to ICTP for a 2 week training course in 2015 for scientists from developing countries.

- Training course with APCC/KMA in fall 2014

Possible topics for WGSIP-S2S coordination

- Teleconnections – “stationary” (ENSO) vs transient (MJO), eg with blocking & NAO
- Drift/initial shock and verification of the first month – both use coupled models
- Data dissemination – sharing between groups, dissemination to users in similar formats
- Verification – reference datasets, minimum hindcast lengths, ensemble sizes, MME approaches, spatial methods
- GFCS – eg support of NMHSs, RCCs, RCOFs, capacity building workshops

PROPOSED LIST OF VARIABLES TO BE ARCHIVED

Additions are marked in red.

1. Multi-level fields

	Unit	Abbrev.	Descript	1000	925	850	700	500	300	200	100	50	10
Geop. height	gpm	gh	Inst. 00Z	x	x	x	x	x	x	X	x	x	x
Spec. hum.	Kg/kg	q	Inst. 00Z	x	x	x	x	x	x	X			
Temperature	K	t	Inst 00Z	x	x	x	x	x	x	X	x	x	x
U	m/s	u	Inst 00Z	x	x	x	x	x	x	X	x	x	x
V	m/s	v	Inst 00Z	x	x	x	x	x	x	X	x	x	x
W	Pa/s	w	Ins 00Z					x					

2. Single-level fields

	Unit	Abbreviation	Description
Potential vorticity at 320K	K m^2 kg^{-1} s^{-1}	pv	Inst 00Z
10 metre U	m s^{-1}	10u	Inst 00Z
10 metre V	m s^{-1}	10v	Inst 00Z
CAPE	J kg^{-1}	cape	Daily Av. 4x
Skin temperature	K	skt	Daily Av. 4x
Snow depth water equivalent	Kg m-3	sd	Daily Av. 4x
Snow density	kg m^{-3}	rsn	Daily Av. 4x
Snow fall water equivalent	kg m^{-2}	sf	Accumulated
Snow albedo	Proportion	asn	Daily Av. 4x
Soil moisture top 20 cm	kg m^{-3}	sm20	Daily Av. 4x
Soil moisture top 100 cm	kg m^{-3}	sm100	Daily Av. 4x
Soil temperature top 20cm	K	st20	Daily Av. 4x
Soil temperature top 100 cm	K	st100	Daily Av. 4x
Surf. Air Max. Temp.	K	Mx2t6	4xday
Surf. Air. Min. Temp.	K	Mn2t6	4xday.
Surf. Air. Temp.	K	2t	Daily Av. 4x
Surf. Air Dewpoint Temp.	K	2d	Daily Av. 4x
Sea surface temperature	K	sstk	Daily Av. 4x
Sea ice cover	Proportion of sea ice	ci	Daily Av. 4x
Surf. Pressure	Pa	sp	Inst 00Z
Time Integrated Outgoing long-wave radiation	W m^{-2} s	ttr	Accumulated
Time integrated surface latent heat flux	W m^{-2} s	shlf	Accumulated
Time integrated surface net solar radiation	W m^{-2} s	ssr	Accumulated
Time integrated surface net thermal radiation	W m^{-2} s	str	Accumulated
Time integrated surface sensible heat flux	W m^{-2} s	sshf	Accumulated
Time integrated surface solar rad. downwards	W m^{-2}s	ssrd	Accumulated
Time integrated surface thermal rad. downwards	W m-2 s	strd	Daily 4v. 4x
Total cloud cover	%	tcc	Daily Av. 4x
Total column water	kg m^{-2}	tcw	Daily Av. 4x
Total precipitation	kg m^{-2}	tp	Accumulated
Convective Precipitation	kg m^{-2}	cp	Accumulated
Northward turbulent surface stress	N m^{-2} s	nsss	Accumulated
Eastward turbulent surface stress	N m^{-2} s	ewss	Accumulated
Mean sea-level pressure	Pa	msl	Inst 00Z
Water runoff	kg m-2	ro	Accumulated
Surface water runoff	kg m-2	sro	Accumulated

3. Ocean fields

	Unit	Abbreviation	Description
Sea surface salinity	psu	ssts	Daily Av. 4x
Depth of the 20 deg isoth.	m	20d	Daily Av. 4x
Heat content top 300m	Degrees C	tav300	Daily Av. 4x
Salinity in top 300m	psu	sav300	Daily Av. 4x
U surface current	m s^{-1}	u	Daily Av. 4x
V surface current	m s^{-1}	v	Daily Av. 4x
Sea surface height	m	sl	Daily Av. 4x

4. Constant fields

	Unit	Abbreviation	Description
Land sea mask	Proportion of land	lsm	daily
Orography	gpm	orog	daily
Soil type	categorical	slt	daily