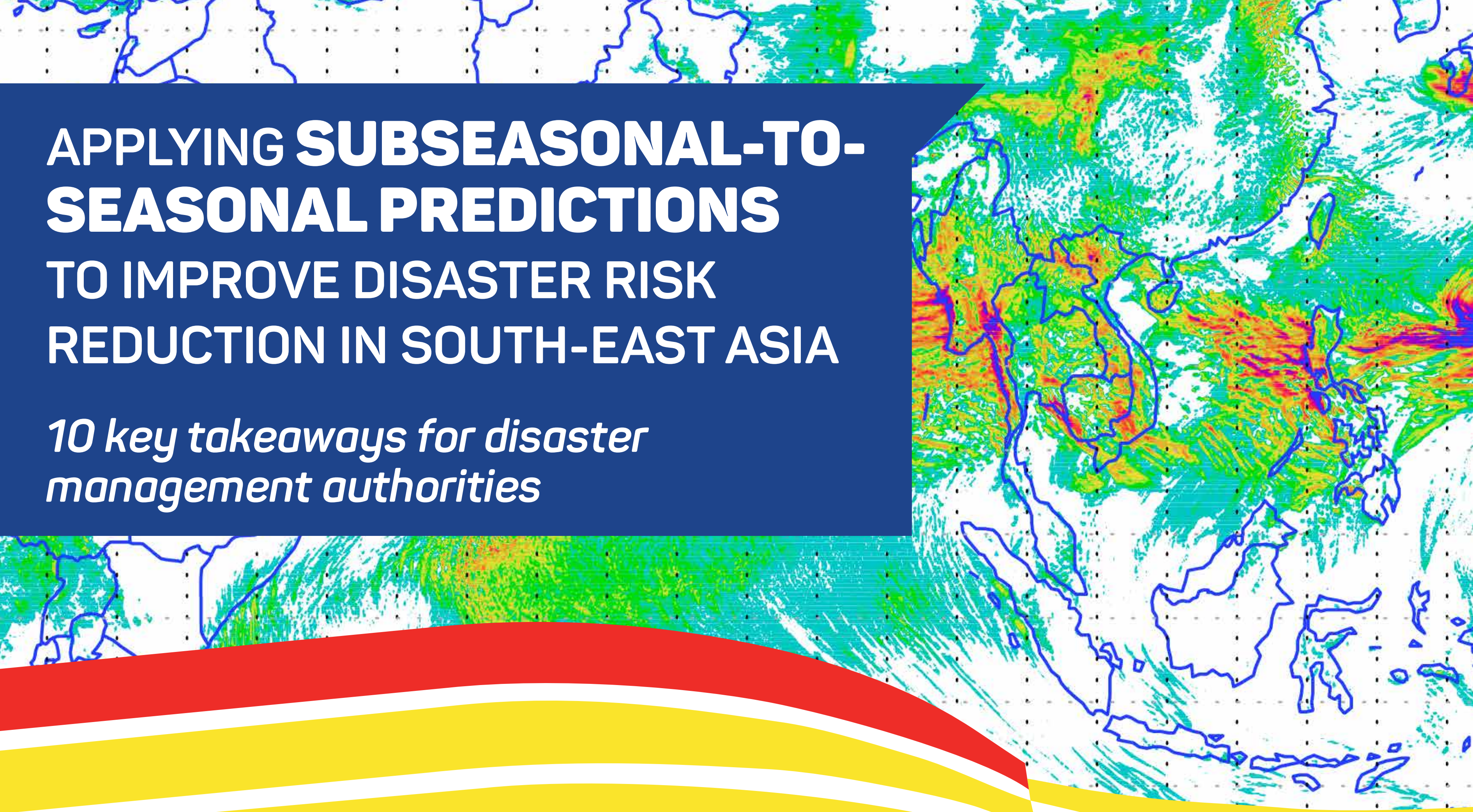

APPLYING **SUBSEASONAL-TO-SEASONAL PREDICTIONS** TO IMPROVE DISASTER RISK REDUCTION IN SOUTH-EAST ASIA

10 key takeaways for disaster management authorities

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

Regional Integrated Multi-Hazard Early Warning System
RIMES

ASMC
ASEAN SPECIALISED METEOROLOGICAL CENTRE

ST/ESCAP/2867

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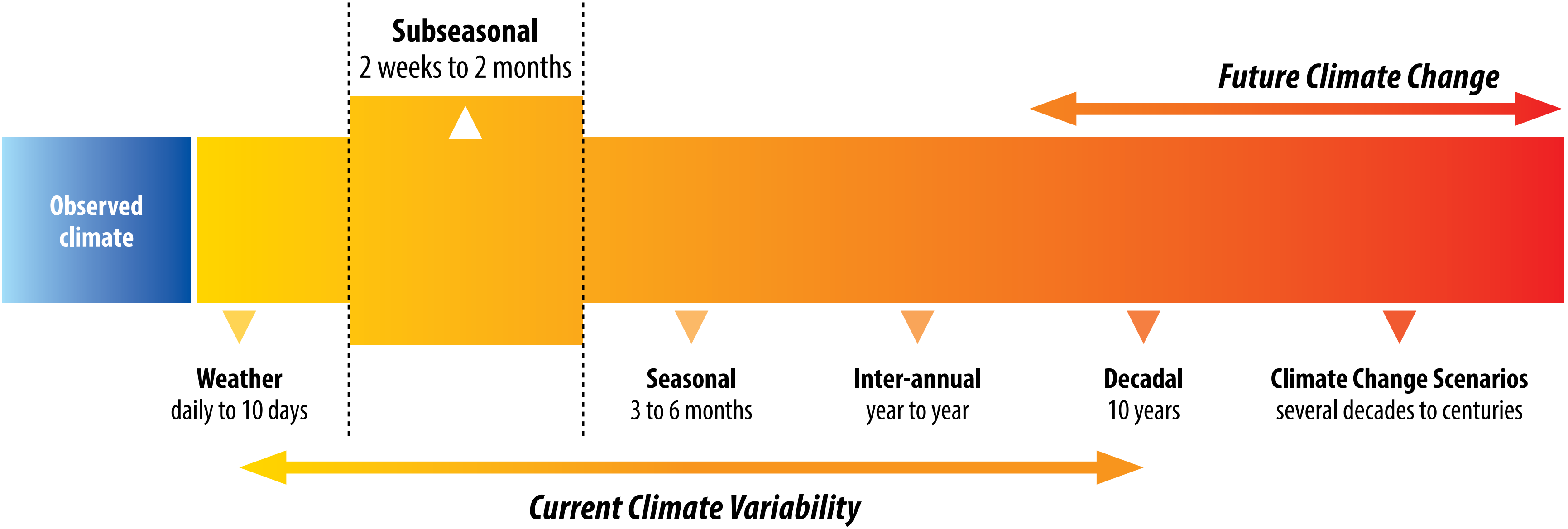
What is S2S for disaster risk reduction?

Strategies for managing disaster risk currently rely on weather forecasts (daily to 10 days) and seasonal predictions (three to six months). Until recently, predictions at the subseasonal-to-seasonal scale (defined as timescale from two weeks to two months) were thought to have low skill. Recent scientific research shows that it might be possible to provide predictions for subseasonal-to-seasonal (S2S) scales for hazards such as heatwaves, heavy rainfall and drought.

South-East Asia is one of the regions that is most likely to benefit from advances in S2S predictions because it has some of the highest skill at this timescale.



While S2S products are still largely experimental at this stage, ongoing efforts are underway to shorten the cycle from research to operations through demonstrating the benefits to societies. The United Nations, Economic and Social Commission for Asia and the Pacific (ESCAP), the Association of Southeast Asian Nations (ASEAN) Specialised Meteorological Centre (ASMC), and the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) are joining forces to ensure that South-East Asian countries can capitalize on the potential applications of S2S products, in conjunction with information for the more established weather and seasonal timescales. This primer is part of this joint institutional effort and highlights the opportunities presented by the application of S2S to bring innovations to disaster risk reduction (DRR).

1.

The South-East Asian climate presents a daunting spectrum of hazards...

The region's climate regime brings a range of hydrometeorological hazards, with heavy rainfall, tropical cyclones, typhoons and storm surges during the wet seasons, and heatwaves, forest fires, haze and drought during the dry seasons. Countries of mainland and maritime South-East Asia also remain exposed to the impacts of El Niño-Southern Oscillation (ENSO) and other modes of atmospheric variability, such as the Madden-Julian Oscillation (MJO).

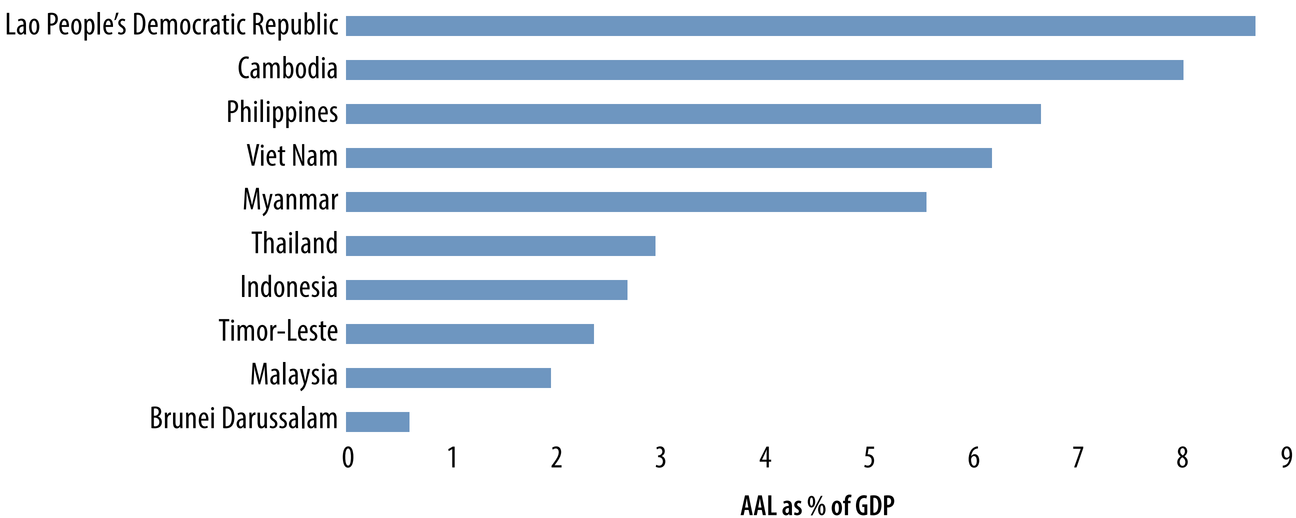
Countries within the region are also subject to large year-to-year variations in the onset and cessation of the monsoon, with severe impacts on the agricultural sector, which contributes approximately 15 per cent of the ASEAN region's Gross Domestic Product (GDP). This impacts a significant proportion of people in the region, as 104 million, or 34 per cent of the employed population, rely on agricultural livelihoods. Within specific countries this is even higher, at 72 per cent, 55 per cent and 52 per cent in Lao People's Democratic Republic, Cambodia and Myanmar respectively.[1] Interactions between a variable monsoon regime and human activity can magnify these hazards.

[1] ASEAN (2018). These figures include agriculture, forestry and fisheries.

The intensities of these hazards are changing due to anthropogenic climate change. According to the latest Intergovernmental Panel on Climate Change (IPCC) assessment report, it is virtually certain that there will be more frequent hot and fewer cold temperature extremes. It is also very likely that extreme precipitation events will become more intense and frequent, as global mean surface temperature increases.[2] Within South-East Asia, this is already resulting in heatwaves of increasing intensities during the pre-monsoon months.[3] These are emerging to be a critical climate extreme with dire public health consequences. Episodes such as the one that occurred in April 2016[4] with record high temperatures in mainland South-East Asia are likely to become more frequent.

Exposed to this spectrum of hazards are growing populations of poor and vulnerable people, costly infrastructure and other economic assets. As a result, the hazards often result in disasters. Through impacts across a broad range of social and productive sectors, these disasters threaten to increase fatalities and induce losses to socio-economic well-being. The economic losses are significant. This is highlighted in Figure 1, which compares the Average Annual Losses (AAL) sustained by South-East Asian countries, to their Gross Domestic Product (GDP). Unchecked, these losses will push people back into poverty, exacerbate inequality and reverse any hard-earned development gains.[5]

Figure 1: Average Annual Loss (AAL) as a percentage of Gross Domestic Product (GDP) for 10 countries in South-East Asia



Note: Singapore is not displayed as value is below 0.5%

2 IPCC (2014).
3 Moron, V., Robertson, A., and Vitart, F. (2018).
4 Thirumalai, K. and others. (2017).
5 ESCAP (2019).

APPLYING **SUBSEASONAL-TO-SEASONAL PREDICTIONS** TO IMPROVE DISASTER RISK REDUCTION IN SOUTH-EAST ASIA

2.

.... but it also displays relatively higher levels of predictability at S2S timescales, which can be leveraged for risk management.

The South-East Asian monsoon climate varies on multiple time and space scales; from inter-annual changes in monsoon onset and strength, to intra-seasonal fluctuation between active and break phases, together with daily variations in rainfall.[6] This variability means that surface conditions, such as rainfall and temperature, have multiple sources of predictability across different time scales. Understanding the sources of predictability provides numerous opportunities for pro-active management of disaster risks.

Year-to-year and seasonal climate variability are modulated by various phenomena such as the ENSO. The associated interactions between the atmosphere, oceans and land are relatively well-understood, and have a strong impact on whether a particular season is wetter or warmer than average.[7] On this basis, seasonal predictions are developed, which contain probabilistic predictions of seasonal mean rainfall, surface air temperature and other weather parameters. This predictability enables decision makers to proactively manage risks due to climate related hazards.

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[6] Moron, V., Robertson, A., and Vitart, F. (2018).

[7] Ibid.

Many countries have therefore established systems to use seasonal climate information for disaster risk management. For example, almost all countries in the region have established Monsoon Forums to discuss the seasonal climate outlook, the likelihood of various hazards materializing, and the corresponding response plans. This is complemented by short- and medium-range weather forecasts which indicate that a hazard is imminent, and trigger the activation of response plans, including the provision of early warnings, information about evacuations and the distribution of humanitarian aid.

In recent years, there has been growth in research at the S2S scale. An important source of predictability at the S2S scale is the MJO. This phenomenon comprises a region of enhanced rainfall and a region of suppressed rainfall that travels eastward along the equator, completing one cycle around the globe in an average of 30 to 60 days. While an MJO is not always present, when one does occur, it can bring periods (one to two weeks) of wetter and drier conditions to South-East Asia as the regions of enhanced and suppressed rainfall move over the area.

3.

South-East Asia is one of the regions that is most likely to benefit from advances in S2S predictions.

Recent advances in climate modelling mean that, for the first time, predictions are now also available in the subseasonal-to-seasonal (S2S) scale; between two weeks to two months. South-East Asia has some of the highest skill at the subseasonal timescale. Sources of predictability at the S2S range have been linked to modes of atmospheric variability such as the ENSO and the MJO, the interactions between them, as well as the slowly varying surface variables such as sea surface temperatures, soil moisture, snow cover and sea ice.[8] Studies in the prediction of the MJO, as well as new model developments, have increased the potential of S2S predictions for DRR applications.

These predictions bridge the gap between seasonal predictions and weather forecasts, by combining a higher precision than seasonal predictions with a longer lead time than the short- and medium-range weather forecasts. While the understanding of this timescale is evolving, S2S predictions can potentially predict heavy rainfall events that could result in flooding, the development of tropical cyclones, heatwaves and coldwaves, as well as the sudden intensification or reprieve of slow-onset drought, and the waxing and waning of monsoon precipitation.

[8] Vitart, F., and Robertson, A. (2018).

Table 1 provides examples of regional scale seasonal outlooks and of experimental S2S prediction products that can potentially be provided by regional and global centres. This is only a starting point, and the list of products is expected to grow over time. National Meteorological and Hydrological Services (NMHSs) should be consulted for any specific national level products.

Table 1: Regional scale seasonal and experimental S2S prediction information, provided by either ASMC or the South-East Asia Regional Climate Centre Network (SEA-RCC Network)

Hazard	Prediction product	Lead times	Regional/Global sources	Skill** (high, medium, low)
Typhoons	Tropical cyclone formation areas	2 weeks	SEA-RCC Network (planned)	Medium at 2 weeks and low at 3 - 4 weeks
Flood/wet spell	Weekly rainfall updates (wetter than average)	2 weeks	ASMC Subseasonal Weather Outlook	Medium
	Probability of high weekly rainfall totals	2 - 3 weeks	SEA-RCC Network (planned)	Medium
Drought/ dry spell	Duration of dry spells and consecutive dry events	2 - 4 weeks	SEA-RCC Network (planned)	Medium at 2 weeks, low at 3 - 4 weeks
	Weekly rainfall updates (drier than average)	2 weeks	ASMC Subseasonal Weather Outlook	High
	Probability of below normal (bottom third) and way below (bottom fifth) rainfall	1 month to 1 season	SEA-RCC Network	Low to high depending on location and season

Continued...

Heatwave	Consecutive high temperature days, with temperatures above location specific thresholds	2 - 4 weeks	SEA-RCC Network (planned)	Medium at 2 weeks, low at 3 - 4 weeks
	Weekly temperature updates (warmer than average)	2 weeks	ASMC Subseasonal Weather Outlook	High
	Probability of above normal (upper third) and way above (upper fifth) temperature	1 month to 1 season	SEA-RCC Network	Medium to high depending on location and season
Haze	Potential hotspot activity based on assessment of weekly rainfall and temperature outlook	2 weeks	ASMC Haze outlook	Medium
	Potential hotspot activity based on seasonal outlook	Season	ASMC Seasonal Outlook	Medium
Coldwave	Consecutive low temperature days, with temperatures below location specific thresholds	2 - 4 weeks	SEA-RCC Network (planned)	Medium at 2 weeks, low at 3 - 4 weeks
	Weekly temperature updates (colder than average)	2 weeks	ASMC Subseasonal Weather Outlook	High
	Probability of below normal (upper third) and way below (upper fifth) temperature	1 month to 1 season	SEA-RCC Network	Medium to high depending on location and season

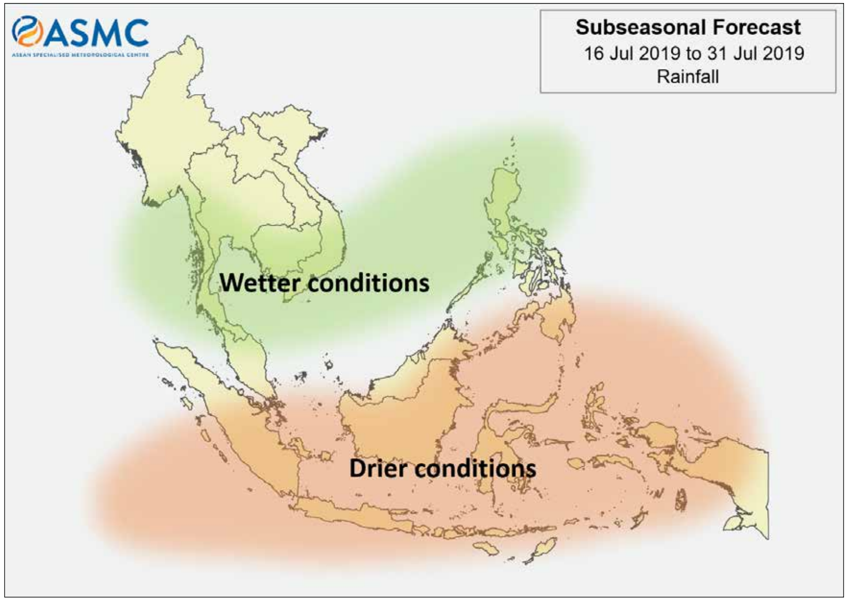
**Based on initial assessment of model skill with some variations based on season and location. Usefulness of products requires end-user assessment and further assessment of model skill.

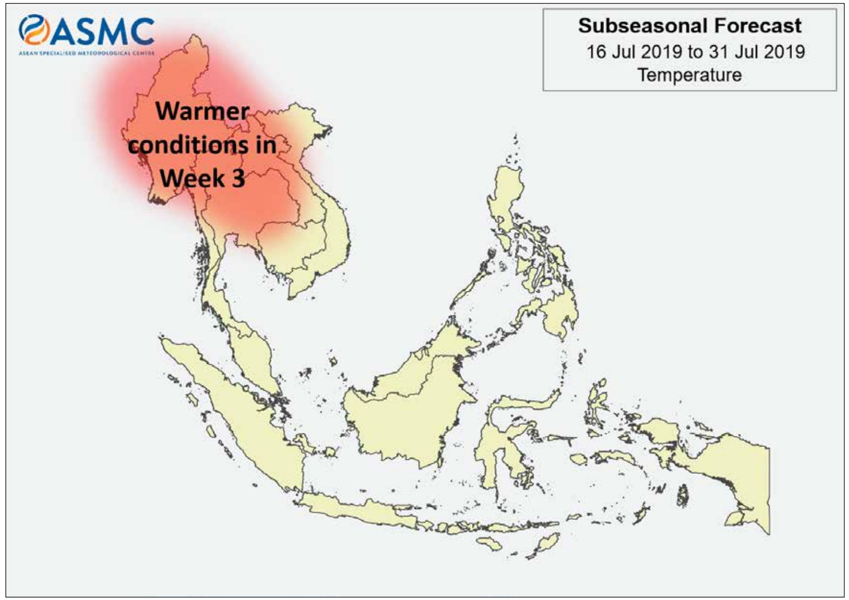
Currently available seasonal and subseasonal products

Southeast Asia Regional Climate Centre:
http://ccrs.weather.gov.sg/sea-rcc-lrf-node/

ASMC:
http://asmc.asean.org/

Examples of products from ASMC:



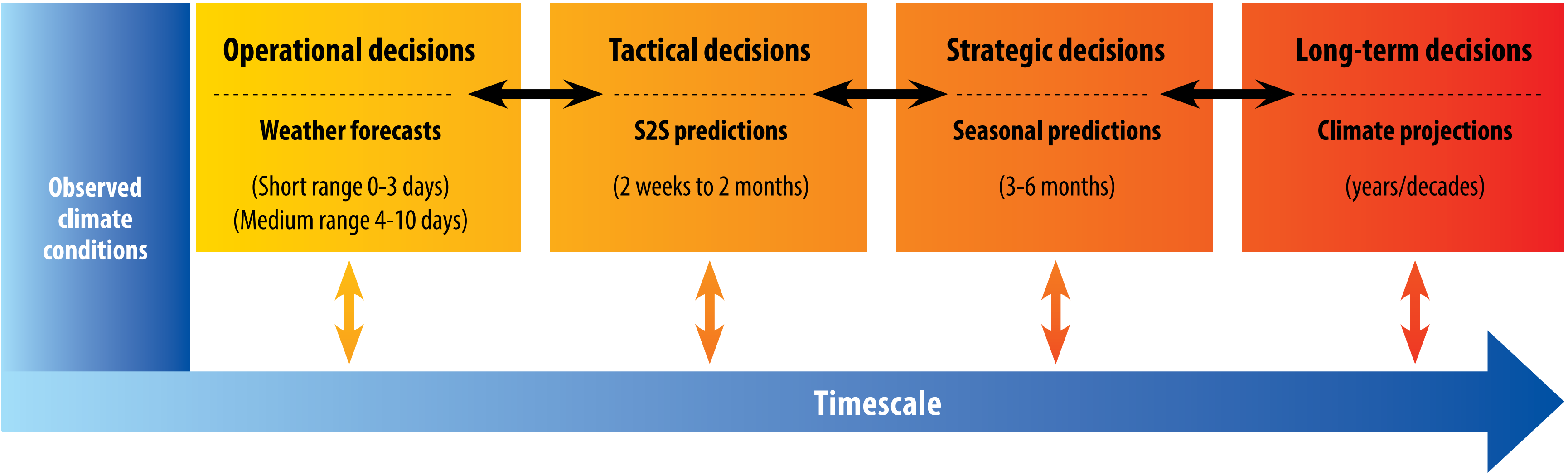


4.

S2S scale predictions can fill a critical information gap in disaster preparedness.

Until recently, the S2S scale had been considered a "predictability desert" because it was thought not to be possible to provide accurate predictions for this timescale. As a result, many preparedness activities are held off until short-range weather forecasts indicate that a hazard is imminent and the exact location is known, so that resources are not wasted in the case of a false alarm. By then, it is often too late to prepare once a rapid-onset disaster materializes, or a slow-onset disaster intensifies. This is typically reinforced by available funding, which continues to be higher for post-disaster response as opposed to prevention and preparedness over longer time scales. Ultimately, the need for higher temporal resolution and the reluctance to waste resources means that many opportunities for forecast-based action are currently being missed.

Figure 2: Disaster risk management interventions across the continuum of timescales of climate information



Source: Modified from ESCAP (2017).

5.

S2S predictions can help shift from reactive to pro-active disaster risk management.

For decision makers, the development of S2S products means earlier warning that a hazard is highly likely to occur, and the potential for a more specific demarcation of location. A range of actors can apply this newly available information across key sectors in which disaster risk can be better assessed and its impacts mitigated. This provides more time for preparedness activities, such as activating institutional processes, raising public awareness, preparing evacuation routes, or moving people out of harm's way. Table 2 summarizes a range of interventions within these various humanitarian and productive sectors that contribute to the achievement of several Sustainable Development Goals.

Table 2: Potential applications of S2S predictions information by sector

Sector	Potential interventions at S2S timescale
Disaster preparedness (SDGs 1,11,13)	• Undertake rapid assessments and continuous surveillance • Hazard mitigation, e.g., release water from dams to prevent collapse, protect infrastructure with sandbags • Activate institutional processes e.g., to support procurement, resource allocation, financial risk management, shock responsive social protection systems • Activate existing contingency plans and coordination structures • Alert volunteers and ensure availability of sufficient volunteers in affected areas • Provide media distributors with instructions, so early warning announcements can be made rapidly • Distribute instructions amongst public for accessing and understanding early warnings • Ensure emergency supplies – confirm procurement chains, activate agreements the pre-identified service/commodity/cash providers, or pre-deploy resources to areas most likely to be impacted • Prepare evacuation routes e.g., according to exact path of tropical cyclone and shelters (resources, staffing, security) • Address specific vulnerabilities – organize checks on elderly people during a heatwave deploy special assistance to people with limited mobility to secure their safety / early warning access / ability to evacuate
Agriculture, livelihoods and food security (SDG 2)	• Adjust crop-planting choices, use of pesticides and fertilizers, irrigation scheduling to limit crop failure • Support pastoralists to undertake commercial destocking, provide veterinary services (vaccination, diagnosis and treatment of diseases), provide nutrition for core breeding animals • Provide materials and support for protection of livelihoods assets (e.g., through elevated platforms/safe spaces to keep food, livestock, seeds and tools) • Activate market-based systems to ensure adequate cereal supplies (support traders, lift export bans, utilize strategic grain reserves, adjust commodity pricing and product marketing) • Pre-position grain and seed protection bags

Health (SDG 3)	• Activate heat health warning systems – including alerting decision makers and the general public to impending dangerous hot weather, advise individuals on how to avoid excessive heat exposure, spread awareness of symptoms of heat-related illnesses • Preposition medical supplies • Organize staffing of health centres • Prepare cooling centres
Water, Sanitation and Hygiene (WASH) (SDG 6)	• Stock materials such as pesticides for mosquito fumigation, chlorine tablets for water purification • Provide or activate market access to non-food items such as soap, jerry cans, etc., to improve hygiene and water storage • Public information campaigns and community mobilization to minimize risk of disease outbreaks • Train community volunteers and hygiene motivators • Provide safe water and sanitation to shelters • Provide raised latrines and drainage in flood-prone areas • Revise water allocations and activate water conservation practices
Energy (SDG 7)	• Prepare for increased utility demand using updated demand scenarios • Manage distribution, transmission and maintenance scheduling to minimize disruption to power availability • Adjust energy pricing and production to ensure power remains affordable

Sources: Adapted from: Brunet, G., and others (2010); FAO (2019); Oxfam (2016); Vitart, F., and Robertson, A. (2014); Weingärtner, L., and others (2019) and White, Christopher, J., and others (2017).

Table 2 demonstrates that there are many entry points for applying S2S information to prepare for both rapid-onset and slow-onset disasters. These can be utilized by a range of actors including government institutions, non-governmental organizations (NGOs), private sector organizations such as energy and media companies, as well as by communities and individual households. S2S predictions can therefore facilitate effective interventions to save lives, protect infrastructure and reduce disruption to a range of livelihoods. National disaster management agencies and organizations should also look into how S2S can be used to reduce the impacts of disasters across a broader range of productive sectors such as energy, tourism and commerce, in order to mitigate the growing economic impacts of disaster and thereby safeguard economic growth.

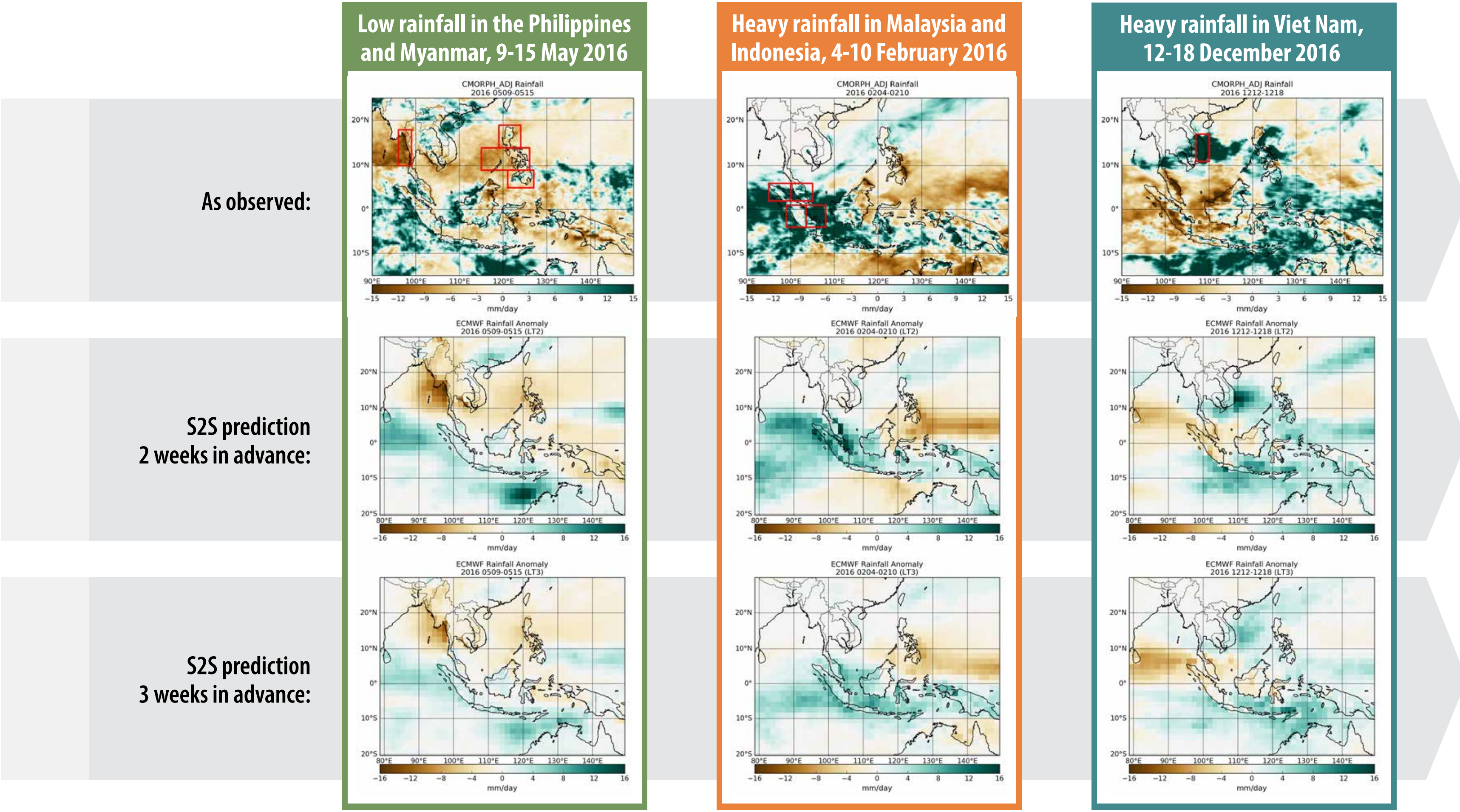
6.

Case studies demonstrate the usefulness of S2S products.

As part of the Third Workshop on Subseasonal-to-Seasonal Prediction for South-East Asia held in July 2019, real-life disasters were examined to determine the potential of S2S predictions to capture anomalous climatic events that led to drought, flooding and haze. Model outputs from the European Centre for Medium-Range Weather Forecasts (ECMWF) were used to assess potential S2S products for these events.

Table 3 summarizes information from selected case studies on how S2S products could have been used to limit the societal impacts of these disasters. Figure 3 shows that for the three case studies, S2S products given two to three weeks in advance demonstrate ability to predict extreme rainfall events and dry spells.

Figure 3: S2S predictions from ECMWF model 2 and 3 weeks in advance compared to realized extreme events



The designations employed and the presentation of materials on the maps do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 3: Summary of key findings from S2S case studies

	Drought in the Philippines and Myanmar, 9-15 May 2016	Flood in Malaysia and Indonesia, 4-10 February 2016	Flood in Viet Nam, 12-18 December 2016
Why was the event a surprise?	S2S predictions were able to predict more precisely than expected the end of the dry spell.	Event occurred during a strong El Niño, which usually leads to drier weather over this area.	One of five successive flooding events, occurring late in the year for rainfall.
People exposed:	183 million	112 million	52 million
Impacts:	These impacts were reported within the focus week 9-15 May, but resulted from persistent dry conditions over the preceding months of the El Niño. Extreme temperatures, unusual rainfall patterns, crop failures, fires and acute water shortages. In North Cotabato, Northern Philippines, 12,000 families lost over 70 per cent of their crops. In Myanmar, shallow water isolated villages from waterways, damaging tourism, agriculture, livelihoods.	Overflowing rivers and deadly landslides, thousands of houses damaged, thousands of people lost lives or displaced, e.g., in Melaka: overflowing Malacca River and flash floods affected 8,000 people, 189 people evacuated.	15 people were killed. Irrigation and hydropower reservoirs reached maximum capacities and needed controlled water releases. Nearly 12,000 houses, plus many roads, bridges and other infrastructure were flooded, damage to crops and livestock.

Information provided by S2S products:	Model indicates rainfall deficit for first two weeks of May, reduction of 10-20mm across the area, most severe in Southern Myanmar. Very high skill for weeks 1 and 2. For week 3 and 4, lower skill. Higher predictability for this event likely associated with the El Niño.	Model captures rainfall event up to three weeks before. At longer lead times (3 weeks before), rainfall anomalies are predicted but for wider area and lower probability of occurrence.	Model captures heavy rainfall event during 12-18 December. Predictability provided by La Niña and MJO. Signal is strongest with one-week lead time, and present, but weaker, at two- and three-week lead time.
Possible S2S applications highlighted by end users:	Convene Emergency Operation Centre meeting. Anticipate water shortages, develop plan to ensure water access in worst affected areas. Provide farmers with drought resistant seeds.	Earlier warnings and resource mobilization. More informed risk assessments. Early coordination with line ministries during response e.g., health, defence, social welfare.	This information could support dynamic assessment of risk and impacts during successive flooding events, which captures how the risk evolves over several weeks.

7.

End users should collaborate with NMHSs to ensure that their information needs are met based on the best available science.

S2S products are currently experimental, but the case studies confirm the potential usefulness of S2S predictions to provide advance information for extreme events that can trigger disasters. In order to effectively apply S2S predictions for disaster risk reduction, end users across a range of sectors will require tailored information products that are relevant to their disaster risk profile and institutional approach to disaster management. Close collaboration with NMHSs will ensure that the development of S2S products is driven by their requirements.

End users should collaborate with NMHSs to establish historical contexts for S2S predictions. End users from disaster management authorities have highlighted that the provision of historical information will allow them to understand the implications of S2S predictions. For example, disaster managers preparing for a flood require not only advance warning about the particular amount of rainfall that is expected, but also an outline of what has happened previously when similar amounts of rainfall affected the same area, such as which local areas were inundated and how society was impacted. NMHSs should collaborate with producers of S2S predictions to develop analogue events (that is, similar events in the past) to establish thresholds at which specific rainfall amounts result in flooding according to the local hydrology and drainage system capacities.

End users should develop strategies to use S2S information provided across a range of spatial scales. Potential end users of S2S information from the agricultural sector have highlighted that farmers would benefit most from ranges for rainfall amounts and temperature, that are provided at a lead time of two to three weeks and at the highest possible spatial resolutions. Further scientific research should therefore focus on these scales. However, information is currently available at larger spatial scales, at provincial or national levels. The case studies demonstrate that this is still useful for informing decision-making. For example, government ministries can utilise advance warning of potential crop failures over a large area, even if the specific provinces or farms to be affected are not known, in order to trigger preparedness interventions. Examples of such interventions would be enhancing the monitoring of weather and agricultural output over a large area, sensitizing the public to early warning systems through awareness campaigns, boosting institutional preparations to provide emergency cash transfers or livestock nutrition support to affected farmers and implementing market-based solutions for ensuring food security.

Predictions need to be interpreted for location-specific use bearing in mind the scientific limitations of providing predictions over small areas. End users from national disaster management authorities have highlighted that decision-making for disaster risk reduction often takes place within local administrative boundaries, and that it is challenging to incorporate S2S information developed in a low resolution pixel format. End users can bridge this gap by working with NMHSs to create lists of administrative jurisdictions (for example, provinces) that fall within pixels of high, medium, and low risk of specific climatic conditions or hazards, to ensure that the information can be quickly recognised and utilized by decision makers.

8.

To unlock the potential benefits, S2S predictions should be integrated into institutional decision-making.

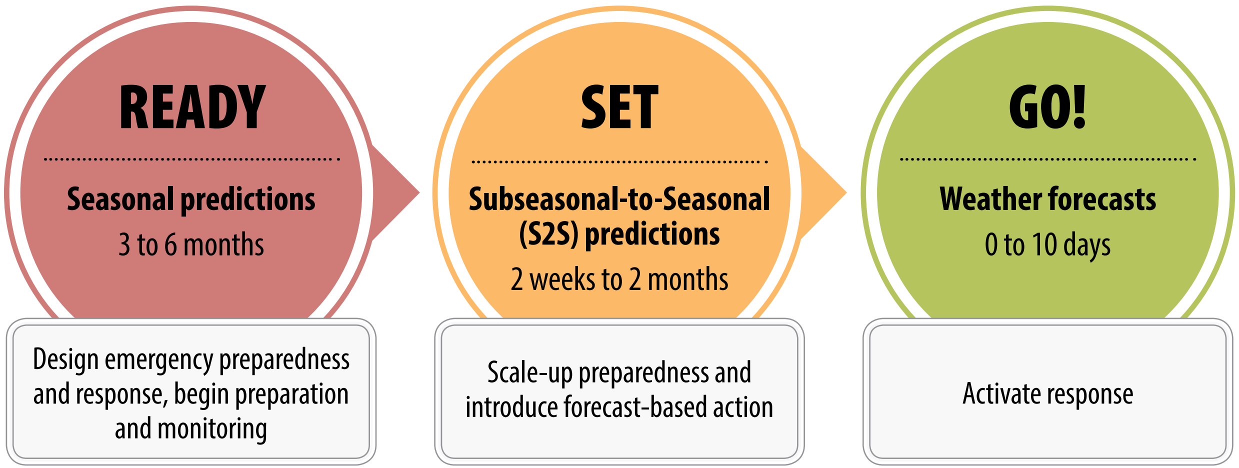
The new information provided by S2S predictions will not automatically translate into more effective risk reduction. It must be combined with seasonal and short-range forecasts and other types of information, and integrated into a comprehensive decision-making framework. The ASEAN Dynamic Risk Assessment Guidelines and Experiences (ADAGE) will be a useful framework for integrating dynamic forecast information with static and quasi-static variables (such as topography, land use, soil population, socio-economics) to inform decision-making.[9] Using S2S predictions within a dynamic framework will enable decision makers to continuously adjust their strategies and interventions with respect to the best information which is available at the time that decisions need to be made.

The International Federation of the Red Cross (IFRC) and Red Crescent Societies and national Red Cross societies have developed such a decision-making structure in which seasonal predictions provide the information needed to become 'Ready', where S2S predictions provide the trigger to get 'Set', and short to medium range weather forecasts provide the trigger to 'Go'. This allows decision makers to invest progressively more resources into preparedness as the occurrence of a hazard becomes increasingly certain. The actions at each

[9] ADAGE.

step are easier due to preparations taken at the previous step. Overall, seasonal predictions should be used to design emergency preparedness and response, to establish mechanisms for monitoring the development of the hazard, to assess the vulnerability of the exposed population, and to implement low cost, no-regret preparedness measures. S2S predictions provide the trigger to scale up preparedness interventions, target the use of resources and begin to implement forecast-based action. Doing so earlier may not be cost effective, whilst waiting any later would leave insufficient time to implement the intervention effectively. Thus, it is at this critical S2S scale that preparedness interventions can be highly effective without wasting resources. Finally, the short-range forecasts trigger the activation stage, in which people and movable livelihood assets, such as livestock, can be evacuated, and aid can be distributed.

Figure 4: 'Ready', 'Set', 'Go!' decision-making structure developed by the IFRC Climate Centre



Source: Goddard, Lisa and others (2014).

S2S predictions will be most useful when the range of actors involved in disaster preparedness, such as national and local governments, meteorological and hydrological services, NGOs, emergency services, schools and health centres, integrate them into a broader decision-making structure that combines information of varying certainties, provided at different time scales. As outlined by the 'Ready, Set, Go!' approach, actors must identify which preparedness interventions will be most effective in reducing disaster risk at each forecast lead time of three months, two weeks to two months, or 0-10 days. The following considerations can be used to inform the selection of interventions:

- **The magnitude, likelihood and location of the hazard**
- **Certainty of the information**
- **Length of time required to implement the intervention, and length of time it will remain effective for**
- **Cost-benefit analysis of intervening at a given length of time before a disaster, and availability of supportive finance mechanism over different time scales/stages of a disaster**
- **Negative impacts of intervening unnecessarily e.g., wasted resources, disruptions to staffing schedules, distrust in early warning services**
- **Social acceptability of the intervention and how this is likely to change over longer time periods**
- **Whether the intervention complements existing interventions at other time scales, fills gaps in current support**[10]

The agricultural sector demonstrates how S2S information could be integrated with existing decision-making to reduce disaster impacts. It can inform key interventions to protect crops, livestock and fisheries from the impacts of rapid-onset floods and storms, as well as slow-onset drought. Figure 4 highlights that many of the possible DRR interventions should be implemented two weeks to two months before a hazard materialises, and therefore require information at lead times of two weeks to two months.

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[10] Red Cross Red Crescent Climate Centre (2019).

Figure 5: Applying integrated decision-making within the agriculture sector

Weather forecasts 0-10 days	Subseasonal-to-seasonal predictions - 2 weeks to 2 months	Seasonal predictions - over 3 months
• Issue early warnings to farmers • Evacuate livestock • Protect grains and seeds and equipment • Harvest crops earlier • Issue index-based insurance payouts to farmers	• Monitor agricultural output • Adjust planting, irrigation, pesticide, fertilizer and harvesting schedules • Support pastoralists - commercial destocking, vaccination, diagnosis and treatment of diseases, provide nutrition for core breeding animals • Provide materials and support for protection of livelihoods assets (e.g. through elevated platforms/safe spaces to keep food, livestock, seeds and tools) • Activate market systems to prevent food insecurity (support traders, lift export bans, utilize strategic grain reserves, adjust commodity pricing and product marketing) • Pre-position grain and seed protection bags • Provide cash transfers for fishing communities to safely store their nets, farmers to store farming equipment or to support evacuation of livestock e.g. ahead of an impending cyclone	• Select flood/drought resistant crop varieties / crop diversification • Plan use of pesticides and fertilizers, ploughing, tilling and irrigation scheduling to limit crop failure • Ensure access to agricultural risk insurance • Utilise nature-based solutions for protecting agricultural assets • Develop contingency plans for crop failures

9.

Applying S2S predictions can facilitate coherence between development and disaster risk reduction.

By bridging the gap between seasonal climate predictions and short-range weather forecasts, S2S predictions provide decision makers with an opportunity to take a more holistic view of the entire DRR process. This goes beyond earlier implementation of preparedness measures; S2S predictions can inform innovative forecast-based approaches, such as adaptive social protection and forecast-based financing. These are key to realizing more proactive disaster risk management. They also provide a pathway for integrating DRR, climate change adaptation (CCA) and sustainable development.

Adaptive social protection systems incorporate disaster and climate risk information in order to reduce the vulnerability of poor and marginalized groups. For example, national social protection systems can provide anticipatory cash transfers to low-income households in the weeks preceding a hazard, thereby allowing households to mitigate their own risk through actions such as evacuating livestock and protecting housing or crops. This is more cost effective than funding response and recovery, as damage is limited. Providing cash transfers beforehand can also cushion against losses incurred by the hazard, reducing erosive coping strategies such as distress asset selling or removing children from school.[11]

[11] Weingartner, L., and others (2019).

The link between disasters and poverty can therefore be broken.[12] Adaptive social protection is being trialled both for rapid-onset hazards, such as tropical cyclones and flooding, as well as slow-onset hazards, such as drought.

S2S predictions can facilitate innovative forms of disaster risk finance. For example, forecast-based financing, such as the scheme being pioneered by IFRC, can help to fund early humanitarian action prior to a hazard materializing. Funds are released for specified interventions following triggers based on meteorological data, impact assessments of past events and vulnerability data. This means that funds can be rapidly released and utilized, providing a final chance to prevent a humanitarian crisis rather than simply respond to one.[13, 14] Similarly, Catastrophe Deferred Drawdown Options are used to provide an immediate pay-out linked to pre-defined triggers such as a declaration of national emergency. This provides decision makers with access to liquidity whilst funds from bilateral aid or reconstruction loans are still being mobilized and approved.[15]

S2S predictions provide greater lead times for the wide-ranging interventions needed to support these innovative approaches to DRR, from institutional processes to the delivery of livelihood support to farmers in remote rural areas. Nonetheless, realizing this potential will require integrated decision-making. Various government ministries as well as NGOs, private sector actors and community groups must collaborate to identify and prioritize early actions, and link them to triggers. Through such a coherent approach, S2S information can inform tactical decision-making for managing disaster risk in a cost effective and proactive manner, thereby breaking the link between disasters and poverty.

[12] ESCAP (2019).
[13] Coughlan de Perez, E., and others (2015).
[14] Red Cross Red Crescent Climate Centre (2019).
[15] World Bank (2012).

10.

Efforts are underway to prepare sectors to use S2S predictions to improve risk management.

Further work is needed on both the product development and application side to harness the societal benefits of S2S predictions. While more research is needed to further verify the usability of S2S products, efforts are being made to start building the capacities to produce and apply such information.

Product development

Through the S2S Prediction Project, various institutions are working to improve forecast skill at the S2S timescale, and to promote its uptake by end users. The ASMC, RIMES, and ESCAP are joining forces to ensure that South-East Asian countries are able to capitalize on the potential applications of this S2S information by building the capacity of NMHSs to produce such information taking into account user needs.

Needs assessment of sectors

Insights from more than two decades of advocating for the integration of seasonal climate predictions into risk decision-making shows that users face a number of constraints in using climate information, including the absence of mechanisms that allow users to identify their climate information requirements. As a result, meteorologists forecast what they know rather than produce information that meets the requirements of the users. Thus, capacity-building activities being undertaken by ASMC, RIMES and ESCAP aims to support not only the NMHSs to produce S2S information, but also the potential user sectors, such as disaster risk management, agriculture, health, and water management. Emphasising user engagement from the outset, these interventions aim to ensure that product development matches the user requirements for decision-making.

Figure 6: Strategy for promoting S2S products for disaster risk reduction

Source: Based on original figure created by Jiyul Shin, 2019.

Pilot test

Demonstrating the value of S2S predictions is important for the uptake of such products in the region. The use of real-time data available from leading modelling centres would help to better assess the value of the predictions in the region, to demonstrate the feasibility of rolling them out in operational settings. ASMC, RIMES and ESCAP are co-leading a real-time pilot project under the second phase of the S2S Prediction Project. Prototype S2S predictions will be provided via NMHSs to selected national disaster management authorities who will in turn use them on experimental basis to determine their usability for decision-making. Pilot countries will monitor and evaluate results of use, provide feedback on how to make S2S predictions useable, and formulate strategies to institutionalize uptake and integration into decision-making.

Innovations are direly needed to reverse the trend of increasing disaster impacts. Early actions, as described above, are expected to shorten the cycle from climate research to innovative applications for societal benefits. National disaster management authorities are encouraged to actively learn more about S2S products, to prepare their systems to use S2S information in conjunction with weather and climate information for other timescales, and to strengthen risk assessment and preparedness.

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APPLYING
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10 key takeaways for disaster management authorities