

MEMBER REPORT

SOCIALIST REPUBLIC OF VIET NAM

ESCAP/WMO Typhoon Committee

16th Integrated Workshop

(Video conferencing)

2-3 December 2021

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I. Overview of tropical cyclones which have affected/impacted Member's area since the last Typhoon Committee Session

Till November 2020, there have been 08 tropical storms and 03 tropical depressions in BienDong Sea of which, 01 tropical depression and 04 storms directly affected the mainland of Vietnam; 26 heavy rains concentrated in the central provinces and the Central Highlands; many places experienced heavy rain with total rainfall from 300 - 700mm, 279 hailstorms, thunderstorm, lightning; 62 local heavy rains and floods, in which, 08 tube floods, flash floods, 153 river bank landslides... killed 42 people and injured 64 people.

1.1. Meteorological assessment

In 2021, there have been 11 tropical storms and tropical depressions appeared in Bien Dong Sea (08 tropical storms and 03 tropical depressions, tracks shown in Fig. 1.1). In which, tropical depression in July (05-08/7), storm No.02 (KOGUMA), tropical storm No.06 (DIANMU), tropical storm No.07 (LIONROCK) and tropical storm No.08 (KOMPASU) directly affected Viet Nam mainland. The landfall of tropical depressions and storms caused strong winds force 6-7, gust force 8, especially tropical storm No. 2 caused strong winds force 9, gust force 10 for in the coastal regions. Details of maximum intensity, maximum observed windspeed and total rainfall for those tropical cyclones are shown in Table 1.

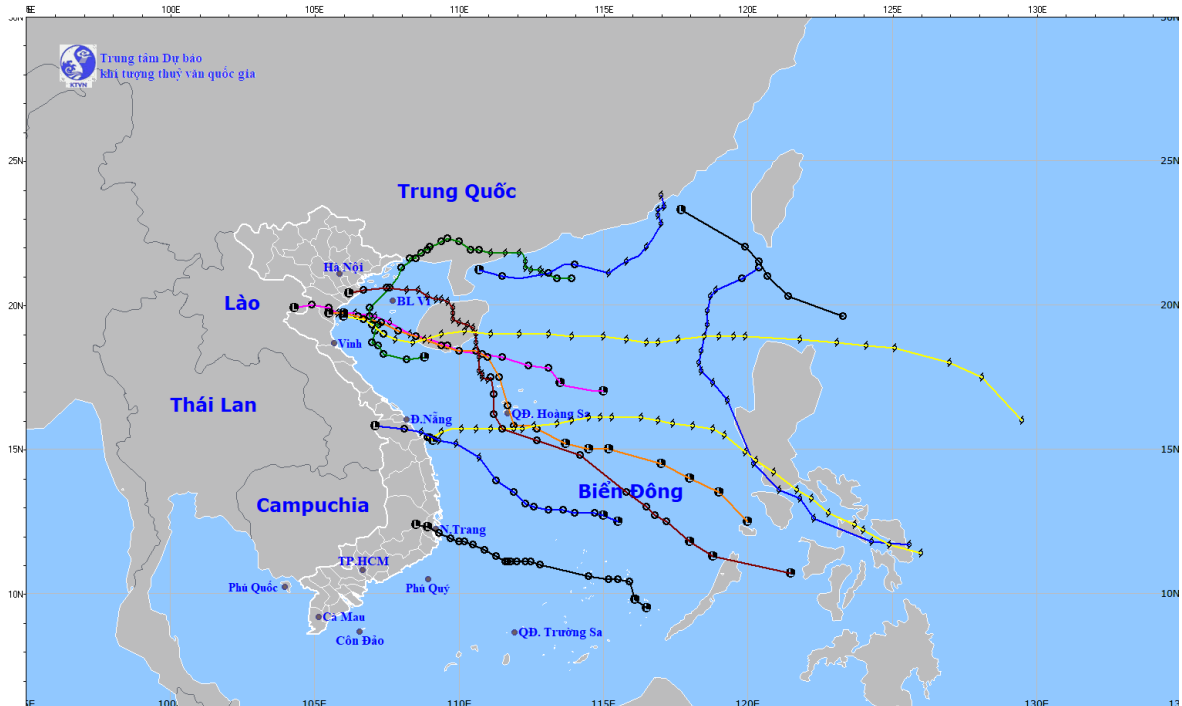


Figure 1.1. 2021 tropical cyclone tracks in Bien Dong sea

Table 1. Statistics on tropical cyclones in 2021 in Viet Nam

TS Name (International Name)	Maximum intensity (Beaufort scale)	Maximum observed windspeed	Total rainfall
TS. Number 2 (KOGUMA)	Wind force level 9, wind gusts level 10	Hon Dau 22m/s (level 9) strong wind gusts 27 m/s, (level 10), Văn Lý 21m/s (level 9), strong wind gusts 25 m/s (level 10)	From late of June 11 th to June 13 th , Total rainfall in the NorthEast and Thanh Hoa to Quang Tri provinces are about 50-100mm, some places up to higher 120mm; especially Nghe An and Ha Tinh provinces about 150-280mm, some places up to higher 300mm.
TS. Number 5 (CONSON)	Wind force level 8, wind gusts level 10	Ly Son: 20 m/s (level 8), strong wind gusts 27m/s (level 10).	From late of September 10 th to the night of September 13 th , total rainfall in the provinces from Quang Binh to North Binh Dinh, Kon Tum, North Gia Lai Quang Ngai about 100-300mm; especially from Thua Thien – Hue to Quang Ngai about 300-500mm, some places up to higher 600mm.
TS. Number 6 (DIANMU)	Wind force level 8, wind gusts level 10	Ly Son : 19m/s (level 8) strong wind gusts 25m/s (level 10), Con Co: Tam Thanh 17m/s (level 7), strong wind gusts 21m/s (level 9).	On Sep 23 th – 24 th , total rainfall in the provinces from Quang Tri to Binh Dinh about 100-250mm, some places up to higher 250mm; Kon Tum and Gia Lai about 80-150mm, some places up to higher 200mm.
TS. Number 7 (LIONROCK)	Wind force level 7, wind gusts level 9	Bach Long Vy 14 m/s (level 7) strong wind gusts 21 m/s (level 9), Cua Ong 14 m/s (level 7) strong wind gusts 17 m/s (level 7).	From the night of Oct 05 th to Oct 08 th , total rainfall in the provinces from Quang Tri to Quang Ngai 250-500mm; Quang Binh, Binh Dinh, Phu Yen and the North of Highlands 100-150mm.
TS. Number 8 (KOMPASU)	Wind force level 9, wind gusts level 11	Bach Long Vy 24 m/s (level 9), strong wind gusts 31 m/s	On Oct 13 th – 14 th , total rainfall in the provinces from the North and Thanh Hoa to Quang Tri about: 100-180mm.

TS Name (International Name)	Maximum intensity (Beaufort scale)	Maximum observed windspeed	Total rainfall
		(level 11). Co To: 16 m/s (level 7), strong wind gusts 24 m/s (level 9).	
Tropical Depression – July		TD wind speeds force level 6 (11m/s), strong wind gusts level 7 (16m/s) at Bach Long Vi and Co To; wind speeds force level 7 (15m/s), strong wind gusts level 7 (17m/s) at Hon Dau.	On Oct 07 th – 08 th , total rainfall in the North provinces, The North of the Central about: 50-100mm.
Tropical Depression – October		TD wind speeds force level 6 (11m/s), strong wind gusts level 7 (15m/s) at An Nhon; force 6 (11m/s), gust force 7 (17m/s) at Quy Nhon.	On Oct 26 th to 27 th , total rainfall in the provinces from Binh Dinh to Ninh Thuan and Highlands about: 100-200mm, some places up to higher 250mm.

1.2. Hydrological Assessment

In 2021, the prominent disaster situation related hydrology in Vietnam can be mentioned as:

- In the Northern part, the river flood situation during flood reason 2021 is not severe in which flood peaks were recorded around the Alarm level 2¹. Flash floods and landslides are dangerous hydrological phenomena that have taken place in the northern mountainous areas.

¹ Alarm level 3: severe flood; Alarm level 2: moderate flood situation

- In the Central of Viet Nam, severe flooding occurred in several Central Viet Nam's provinces as results of TS CONSON and DIANMU, especially Nghe An province, where suffered the terrible damage by TS DIANMU.

- In the Southern part, saline intrusion in the Mekong delta area always occurs in every dry season. The severity of saline intrusion will depend on the situation of the upstream Mekong flow.

2.1. Flash flood and landslide in the North of Viet Nam

The flash floods and landslides in the North of Vietnam is likely to occur at any time of the year when localized heavy rain patterns appear. In 2021, the first lash flood event appeared in the April in mountainous area. During April and September, around 10 severe flash flood and landslide occurrences in which concentration time is in July and August.

Most flash floods are caused by local heavy rains which appeared during a short time, on a small area - local characteristics. This is a challenge in the operational warning and forecasting in Viet Nam.

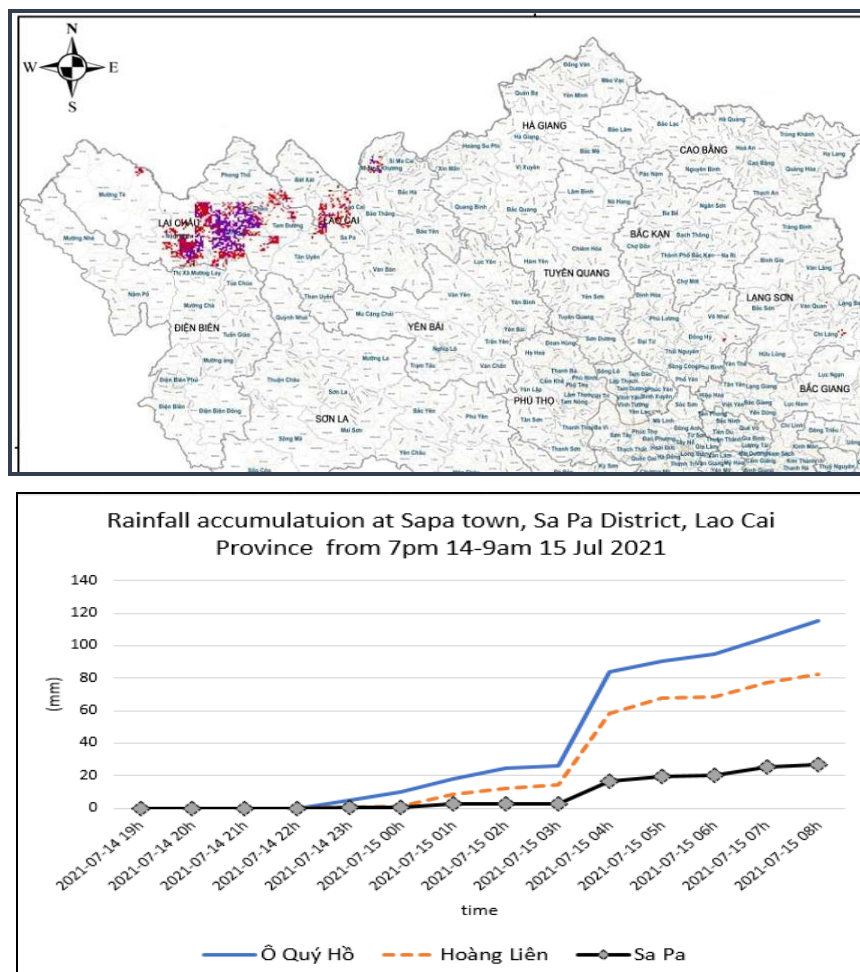


Figure 1. 2. Flash flood risk map detect high risk situation in Sa Pa town, Sa Pa District, Lao Cai province on 15th Jul, 2021



Figure 1.3 Part of Cat-cat eco-tourist village was swept away by flash flood

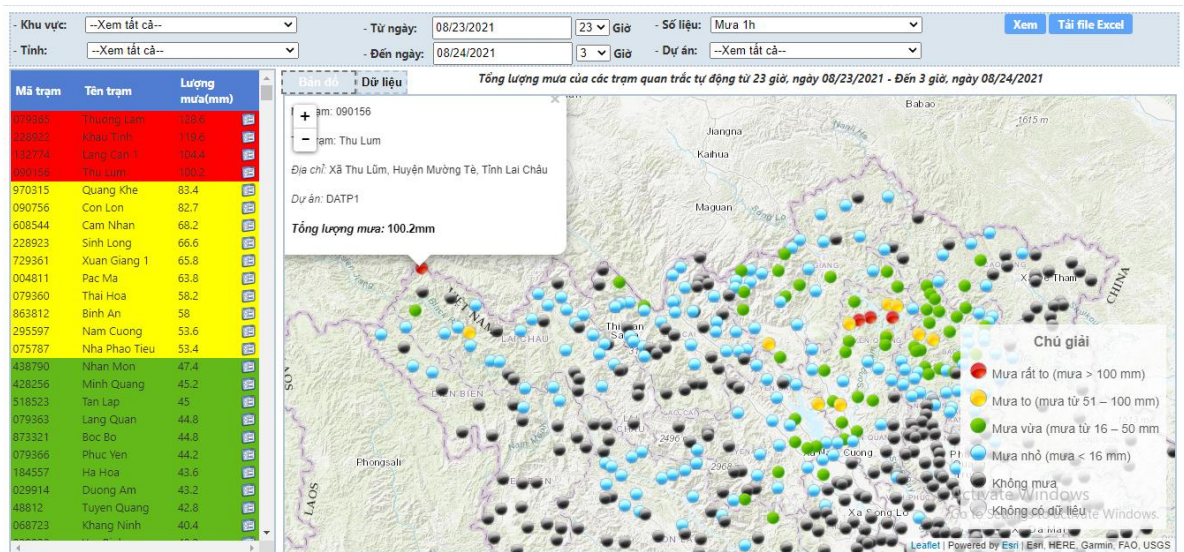


Figure 1.4. Landslide occurrence at Muong Te district, Lai Chau province as a result of 3hr-accumulated rainfall > 100mm

2.2. Severe flooding in the Central of Viet Nam

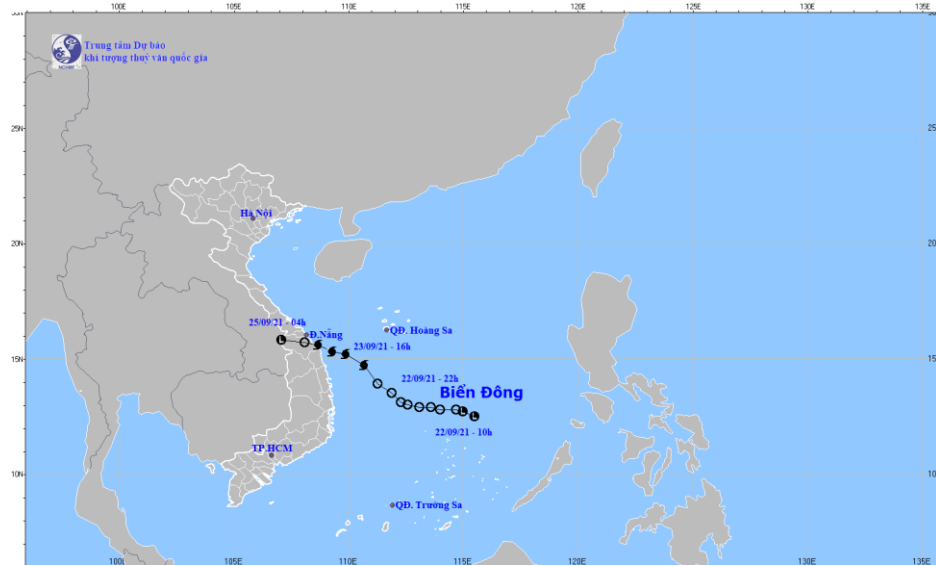


Figure 1.5. Storm track of tropical storm DIANMU

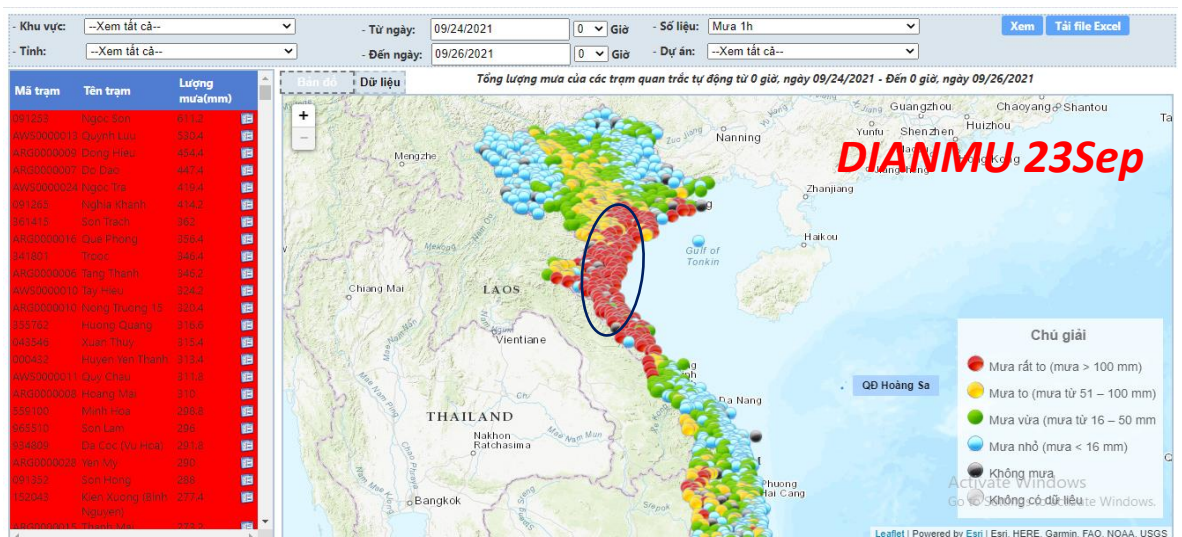


Figure 1.6. Total rainfall from 24 to 26th September 2021 during in the Central of Viet Nam after landfalling of TS DIANMU

After landfalling on 23rd Sep, the TS DIANMU was downgraded into a low pressure in the border area of Viet Nam – Laos PDR, extremely rainfall were recorded at synoptic stations from 300 – 500mm in two days (Fig. 1.6) leading to river water level rising up to Alarm level 2 and severe flooding in the central provinces of Viet Nam.

Nghe An province is the place suffering the most severe flooding and inundation due to heavy rainfall on the 25th Sep from 150 – 250mm. The Fig. 1.7 illustrates the severe flooding situation in Nghe An province.

As a result of tropical storm DIANMU circulation, a large damages of human life, losing of houses, crops, poultries, castles was listed as follow:

- People: 03 missing, 03 injured;
- Houses: 118 broken; 2725 houses under water
- Agriculture: 849 ha rice field & 2525 ha vegetable fields inundation;
5402 castles and poultries died
- Infrastructure: 5 schools destroyed; Landslide and broken roads at 5 positions

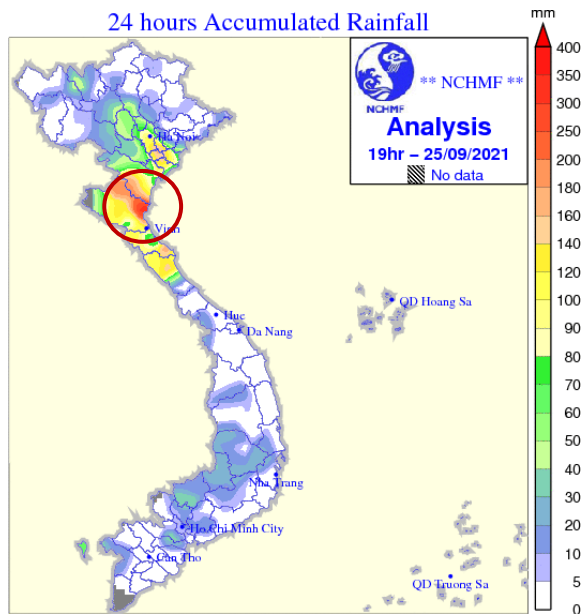


Figure 1.7 Severe flooding in Quynh Luu district – Nghe An (25th Sep)



2.3. Saline intrusion in the Mekong delta area

BẢN ĐỒ DỰ BÁO XÂM NHẬP MẶN KHU VỰC ĐỒNG BANG SÔNG CỬU LONG NĂM 2020 - 2021

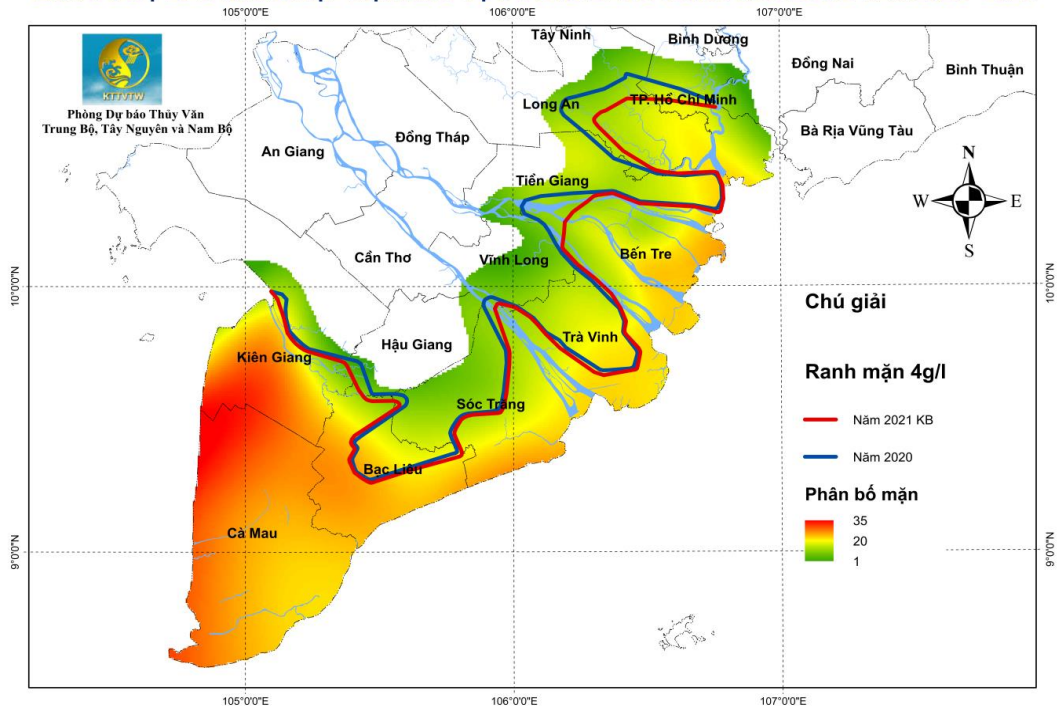


Figure 1.8. Saline intrusion map prediction for dry season 2020-2021 in the Mekong delta

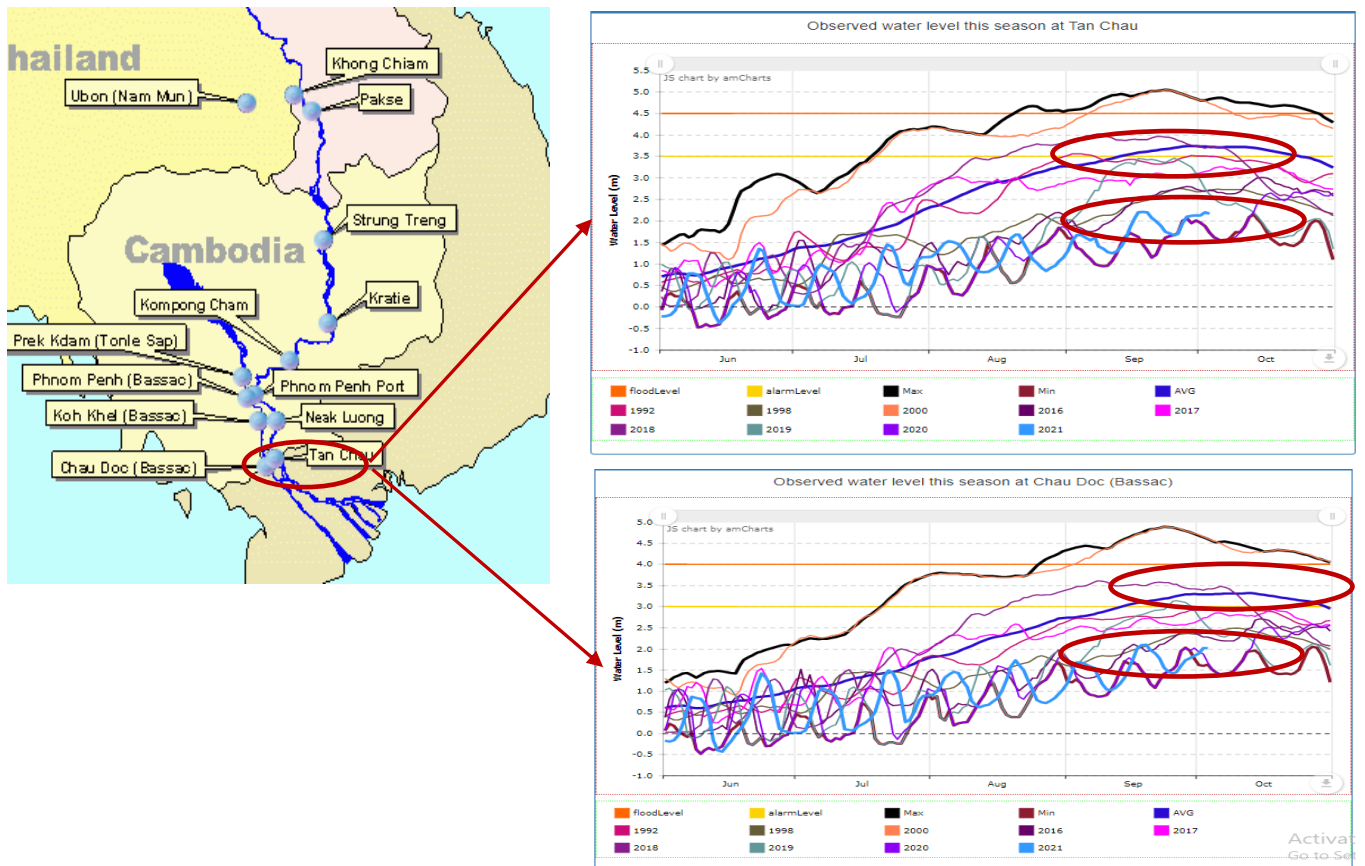


Figure 1.9. Water levels at Tan Chau & Chau Doc in 2021 (blue line) are much lower than long-term average (dark blue line)

During the dry season of 2020-2021, there was no flood situation in the downstream of the Mekong River leading to saline intrusion occurrence in the Mekong Delta area. However, salinization situation was less severe than that in the dry season 2019-2020 which was the historical record for saline intrusion depth of 50 – 60km from estuaries (the saline intrusion depth in 2019-2020: ~ 100km).

1.3. Socio-Economic Assessment

Since the beginning of 2021, besides meteorological and hydrological natural disasters, there were also 122 light earthquakes recorded in Viet Nam; 158 river bank landslides. Till November 2021, natural disasters in Viet Nam caused: 85 dead and missing, 89 people injured; 260 houses completely collapsed, 8838 houses were damaged, roof blown; 97761 cattle and poultry died and swept away; 125029 ha of rice, vegetables; 11,289 hectares of crops were damaged; 43.7 km of dikes, embankments, canals and canals are damaged or eroded; 109 km of roads were damaged

Estimated economic damage in 2021 due to natural disasters: about 1,632 billion VND, equivalent to 70 million US\$.

1.4. Regional Cooperation Assessment (highlighting regional cooperation success and challenges.

1.4.1 Hanoi Regional Forecasting Support Centre (RFSC) of the Severe Weather Forecasting Project (SWFP)

As recommended by the Regional Subproject Management Team (RSMT) of SWFP-Southeast Asia in the meeting in 2015 (Ha Noi, Viet Nam, August 2015) and agreed during its meeting in November 2017 in Ha Noi, Viet Nam, a two-week training desk had been organized at RFSC Ha Noi from 7 to 18 May 2018 with attachment of two experts from NMHSs of Philippines and Thailand and forecasters from Viet Nam Meteorological and Hydrological Administration (VMHA). Two expert lecturers from Hong Kong Observatory (HKO), Hong Kong, China joined and gave lectures at the training desk.

Experts and forecasters from VNMHA has attended the Regional Training Workshop on Severe Weather and Impact based Forecasting and Warning Services in Vientiane, Lao PDR from 19 February - 1 March 2019. VNMHA experts have shared the current status of warning and information delivery, current challenges in impact-based forecasting and risk-based

forecasting as well as exchanging these solutions to enhance the forecasting, alerting activities of Viet Nam.

At the eighteenth World Meteorological Congress (Cg-18, June 2019) through its Resolution 15 (Cg-18) decided among others to remove the 'demonstration' designation of the SWFDP and renamed it as Severe Weather Forecasting programme (SWFP). Subsequently, the SWFDP-SeA became SWFP-SeA

With the acceptance for Project Proposal "Training workshop based on the Severe weather Forecasting Project (SWFP) for the Southeast Asian Region" from ASEAN Committee on Science and Technology (COST), the second two-week Training Desk was organized at RFSC Ha Noi in December 2019. In 2020, the third Training Desk was organized via online platform hosted by Vietnam. In 2021, The Training Workshop on Severe Weather and Impact Based Forecasting and Warning Services was held on 1-12 February via online platform.

1.4.2. Development of Southeast Asian Flash Flood Guidance System (SeAFFGS)

The SeAFFGS is a system under Global Flash Flood Guidance System of WMO which have been developed by Hydrologic Research Center - USA. The purpose of the SeAFFGS project is the development and implementation of FFGS specifically for Cambodia, Lao PDR, Thailand, Viet Nam. The SEAFFGS is now on going in development.

The system is integrated with many rainfall data sources with high quality such as:

- + Radar, WFR provided rainfall forecast from 1 – 24hrs: WRF-3km (VNMHA), WRF-ARW 2km (TMD), WRF-6km (TMD), WRF-4km (MRC);
- + Integrating automatically rain gauges;
- + Administration information.

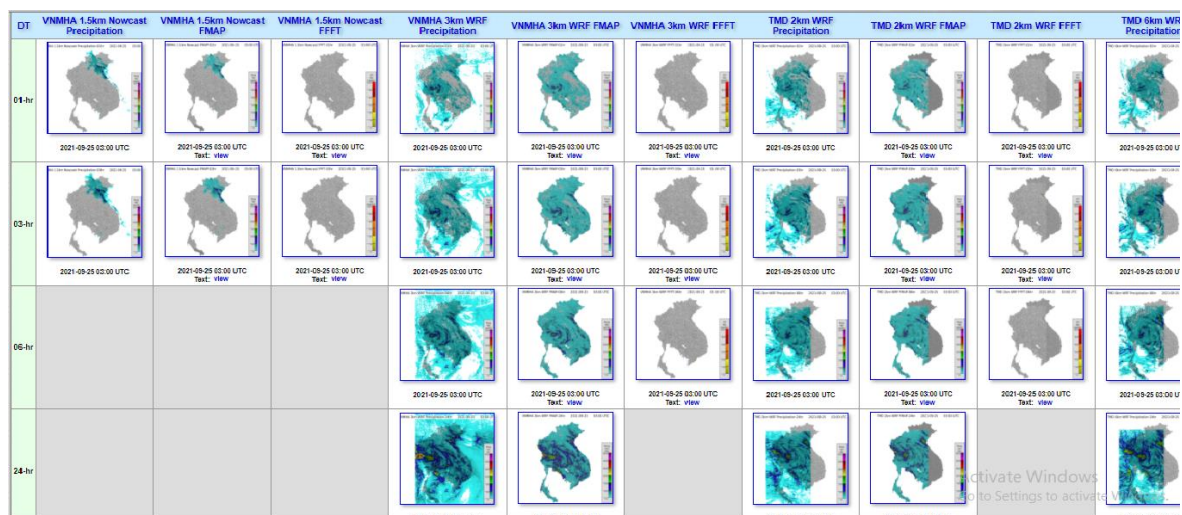


Figure 1.10. The SeAFFGS –flash flood supporting warning system

1.4.3. Other collaborations

In 2021, VNMHA keeps posting our discussion and questions on tropical cyclone analysis and forecast in RSMC Tokyo forum at https://my.redmine.jp/tc_communication/login

International and regional cooperation in natural disaster prevention and control have been promoted; responsibility of SENDAI action framework has been realized, AHA Center Agreement is signed, regional maneuvers on disaster responses took place in Indonesia; the participation of Vietnam in APEC, ARF, International Storm Committee etc. has been maintained;

Bilateral cooperation with developed countries and regional countries have been promoted both in in-depth and practical manner. In late 2019 and 2020, Vietnam has signed new Collaboration Agreement with International Research Institute for Climate and Society (IRI) on developing climate services in Vietnam, including but not limited to building up the National Framework for Climate Service in Vietnam.

Vietnam has also joined The Weather and Climate Science for Service Partnership (WCSSP) Southeast Asia which currently involving four partner countries: the Philippines, Malaysia, Indonesia and Vietnam. This project aims to jointly develop and improve underpinning capability in global and regional forecasting systems, and advance the understanding of high-impact weather events in order to provide better advice and mitigate their socio-economic impacts. This cooperation has been renewed in late 2021.

- Vietnam has been keeping close coordination with multilateral organizations such as the World Bank, Asian Development Bank, UN agencies, JICA, GIZ, etc. has been promoted to seek for technical assistances

and financial supports as well as high quality human resources of disaster prevention and control;

II. Summary of Progress in Priorities supporting Key Result Areas

2.1. Central Data Hub, HPC and forecast supporting system

Central Data Hub (CDH) is a part of the information integration system that provides the forecasting sub-systems access to all required data sources. The CDH will support and provide each separate forecasting sub-system the access to different data sources such as synoptic manual observation, automatic weather station, automatic rain-gauge, water level and sea level data, radar and satellite data will be also stored in CDH. The CDH and the forecasting sub-systems are independent systems but they are closely linked, with the CDH has a key role in collecting (near) real-time data from all required sources, so latest available data is always available from CDH, and for providing forecast data to the services, provided by VNMHA.

Regarding the issue of providing information to Members through the SWFP’s portal of RFSC Hanoi, the Figure 2.1 shows access statistics from Members including Viet Nam, Laos, the Philippines and Cambodia forecasters in 2021.



Figure 2.1. The statistics of website swfdp-sea.com.vn from Jan-Nov 2021

Identified opportunities/challenges, if any, for further development or collaboration:

VNMHA is providing severe weather warning for short-range and medium range everyday and NWP on SWFDP-SeA website for member countries to use in daily severe weather forecast and warning. Feedbacks and suggestions from members are welcome for a better information design and delivery.

Priority Areas Addressed:

KRA 1: To mitigate against the damaging impacts of typhoons and enhance the beneficial typhoon related effects for the betterment of quality of life through scientific research, technological development and operational enhancement.

KRA 4: To enhance capacity to generate and provide accurate, timely and understandable information on typhoon-related threats

2.2 Impact-based forecast and warning services in Viet Nam

Viet Nam Meteorology, Hydrology Administration (VNMHA) keeps moving toward an impact-based forecast and risk-based warning for meteorological and hydrological phenomena. Since 2017, VNMHA has been changing the way of information design and delivery to the disaster risk management section, local governments and the public through traditional media (TV, printed papers) as well as social media and online papers. The target of impact-based forecast and impact-based warning is to warn the risk of natural hazards for different regions, different users. It requires the VNMHA an extra effort in understanding the possible impacts of severe weather phenomena, especially tropical cyclones.

In late 2019 and 2020, Vietnam received support from WMO Public Weather Services Delivery (PWSD) Programme of the DRR and Public Services Branches to set up a project named Viet Nam Public Weather Service Delivery Project on Impact-based Forecast and Warning (IBFWS) and Communication under sponsor of CREWS-Canada. In this project, UNESCAP and WMO support VNMHA to complete the IBF Manual for Operationalizing Impact-based Forecasting and Warning Services (IBFWS) for Viet Nam with online training session attached. UK Met Office is supporting VNMHA to equip a TV studio and training VNMHA forecasters to use those studio equipments and software to produce weather forecast presenting videos to broadcast on TV national channels and VNMHA's social media channels.

Identified opportunities/challenges, if any, for further development or collaboration:

VNMHA understands that to have a complete impact-based forecast system, VNMHA need to cooperate with different stakeholders in disaster risk management to have a common agreement on the possible impacts of severe weather in Viet Nam as well as the international cooperation and support with developed countries. With this additional support from WMO, especially the Public Service Branch, together with previous collaboration of VNMHA and Finland Meteorology Institute (FMI), UK Met Office and other international partners, Viet Nam will soon have an impact-based forecast system in near future. The cooperation projects PROMOSERV3 with FMI and WCSSP with UK Met Office are two ongoing projects that will support Viet Nam in those area. The PROMOSERV3 will provide a toolkit to produce and distribute the impact forecast of meteorological phenomena such as heavy rain, strong wind... and part of WCSSP project will guide VNMHA forecasters and staffs on how to build an impact matrix and step by step to get an impact-based forecast system.

Priority Areas Addressed:

KRA 1: To mitigate against the damaging impacts of typhoons and enhance the beneficial typhoon related effects for the betterment of quality of life through scientific research, technological development and operational enhancement.

KRA 2: To strengthen typhoon related disaster risk management in various sectors, including hydrological and aviation sectors, through strategic partnerships and collaboration.

KRA 3: To strengthen the resilience of communities to extreme weather and typhoon related disasters through the intelligent use of data, information and communication technology.

KRA 4: To enhance capacity to generate and provide accurate, timely and understandable information on typhoon-related threats

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2.3 Short-range Regional Ensemble Prediction System (SREP-32)

With the new HPC system (CrayXC40) at VNMHA, since 2019, the regional NWP products have been significantly upgraded, especially of very high resolution of deterministic forecast (3km, Southeast Asia domain) with

boundary conditions (from ECMWF) and the regional ensemble forecast was also upgraded by using the Weather Research and Forecasting Model with Advanced Research with ARW dynamical core (WRF-ARW) with various physical model configurations (generated from different typical cumulus, shortwave radiation, boundary layer and from simple to complex cloud micro-physic schemes).

VNMHA has been applying the data assimilation for WRF-ARW at 3km horizontal resolution using almost quality controlled observation data from NCEP and Vietnam’s local observation since 2020. This new data assimilation products, named as WRF3km-IFS-DA, has been sharing via SWFP for SeA portal for all members of the project. An example of high resolution products for improving short range forecast of heavy rain over the northern Vietnam is shown in Figure 2.2.

In 2021, the radar data (10 radar stations of Vietnam) was also assimilated experimently for improving the short-range heavy rainfall forecast (upto 24h). The rainfall forecast from NWP from 0-6 hours will be blending with nowcasting products of SWIRLS system of Hong Kong Observatory.

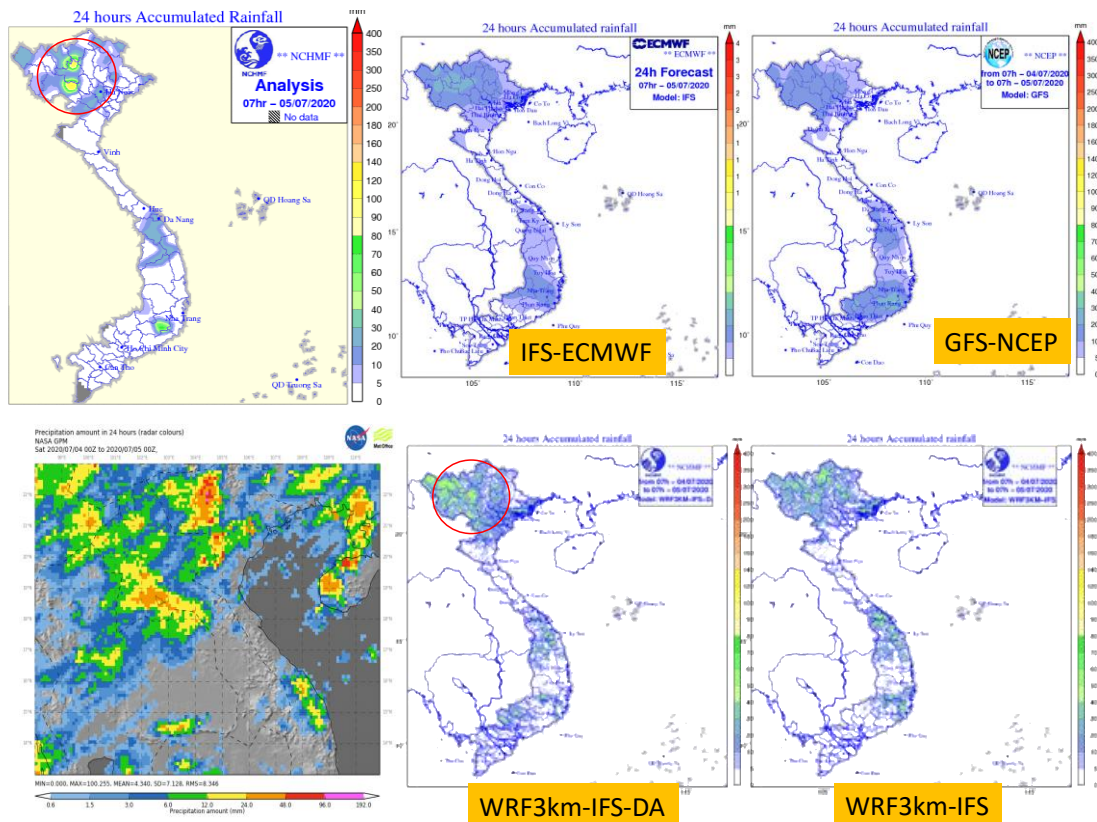


Figure 2.2. Comparison of observations (top-left from Vietnam’s observation and bottom-left from NASA’s precipitation estimation) and models: IFS-ECMWF, GFS-NCEP, WRF3km-IFS and new data assimilation

product WRF3km-IFS-DA for heavy rainfall over the northern Vietnam on 05-Jun-2020.

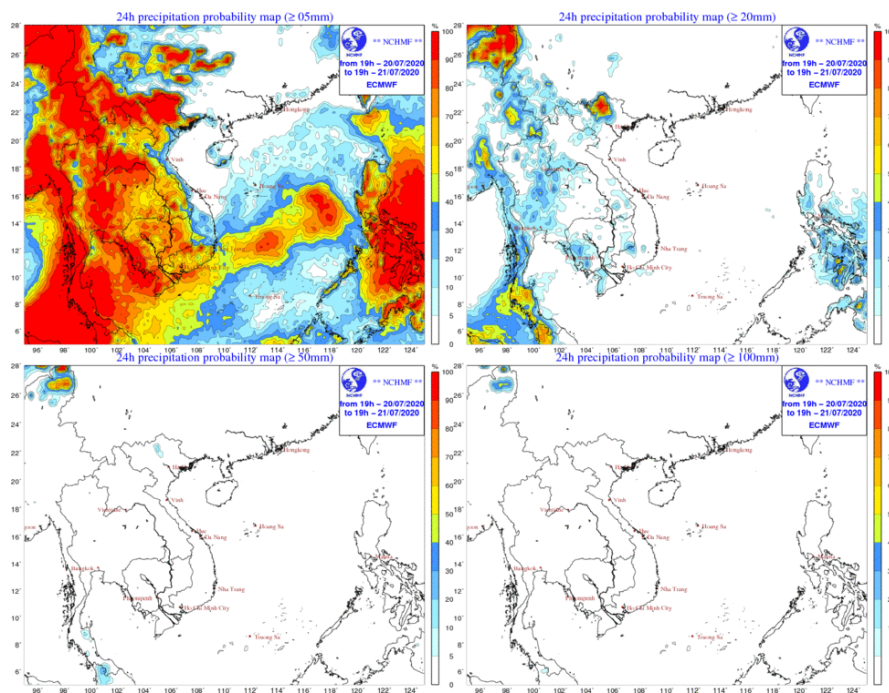


Figure 2.3. 24-hour rainfall ensemble forecast from ECMWF (51 members) at 12 UTC (19 LT) of 20 July 2020

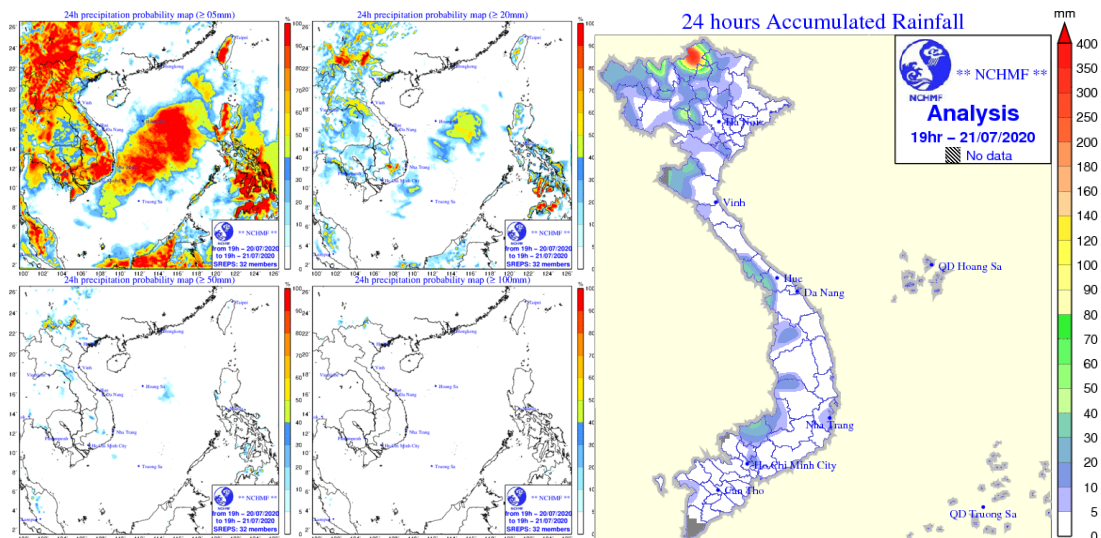


Figure 2.4. 24-hour rainfall ensemble forecast from SREPS-32 (left) and observation (right) at 12UTC (19 LT) of 20 July 2020

Regarding the regional ensemble system, the resolution of 32 ensemble members is 9km and using GFS-NCEP as boundary conditions. Figure 2.3 to 2.5 are examples of 32-member SREPS and ECMWF's ensemble forecast for a heavy rainfall case in 2020 with probability map products at different thresholds.

Identified opportunities/challenges, if any, for further development or collaboration:

VNMHA is providing high resolution NWP (WRF3kmIFS, WRF3kmIFS-DA) and the regional ensemble SREPS-32 products on SWFDP-SeA website for Member countries to use in daily severe weather forecast and warning. Feedbacks and suggestions from Members are welcome for a better information design and delivery.

Priority Areas Addressed:

KRA 1: To mitigate against the damaging impacts of typhoons and enhance the beneficial typhoon related effects for the betterment of quality of life through scientific research, technological development and operational enhancement.

KRA 4: To enhance capacity to generate and provide accurate, timely and understandable information on typhoon-related threats

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