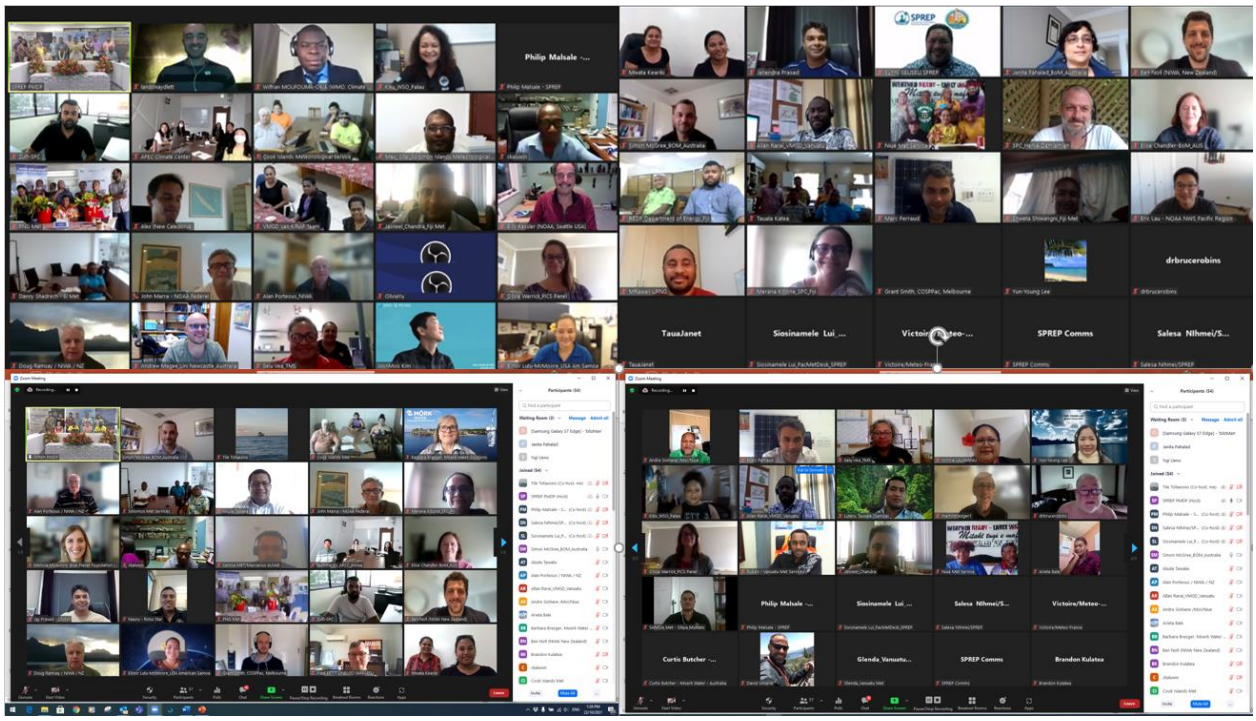
Ninth Pacific Islands Climate Outlook Forum (PICOF-9)

October 2021



Hosted virtually by the Secretariat of the Pacific Regional Environment Programme Pacific Met Desk Partnership and World Meteorological Organisation

21-22 October, 2021

Introduction

Regional Climate Outlook Forums have been held annually in the Pacific since 2015, and biannually since 2020, allowing dialogue and learning between the providers and users of climate information. Pacific Islands Climate Outlook Forums (PICOF) are organized by the Pacific Meteorological Council's (PMC) Pacific Islands Climate Services Panel (PICS Panel), its secretariat SPREP and the WMO and supported by various international and regional organisations.

The October PICOF 9, was held virtually and was organised around the following objective: *To produce objective, user-relevant climate outlook guidance in real time to reduce climate-related risks and support sustainable development for the coming season in sectors of critical socioeconomic significance with a focus on the energy sector for the Pacific Islands region.*

A PICOF 9 Regional Statement summarising climate and ocean conditions over the past months, tropical cyclone (TC) and seasonal outlook Nov-April 2021/2022 was produced as an output of PICOF 9. These products will provide guidance to National Meteorological and Hydrological Services (NMHS) to develop their specific country outlook for this season.

This report offers a short summary of material presented during the virtual meeting, the key discussion points, and any Meeting recommendations and action points.

Agenda Item 1: Opening & setting the scene

SPREP PMDP welcomed participants to the 9th Pacific Islands Climate Outlook Forum (PICOF 9) held virtually on 21-22 October 2021. A representative from the PNG met service, Kasis Inape, blessed the meeting with an opening prayer. The WMO Representative delivered welcoming remarks and was officially opened by the Director General of SPREP.

The Meeting: (opening statements/remarks summary)

- Acknowledged and appreciation of all the NMHS
- Noted that despite the challenges of COVID19, regional platforms such as PICOF must continue to support NMHS and keep everyone informed and prepared for climate extreme events
- Noted the WMO reforms and innovative efforts to translate science and bring these to services

- Acknowledged the dedication and efforts from the PICS Panel and Partners in organizing the meeting
- Noted the progress of PICOF over the last few years
- Acknowledged the impacts of La Niña at the end of 2020 and early 2021 noting the need to evaluate how we prepare and respond to these events
- Noted the IPCC AR6 and the Next Generation climate projections and the expected impacts with the need to prepare our communities
- Encouraged on-going efforts to include sectors and applaud the decision to focus on the renewable energy sector for this PICOF

The PICS panel Co-chairs provided an overview of the meeting objectives.

The Meeting: (objectives)

- Build partnerships among NMHSs, regional organizations, and the RA V Pacific RCC Network, facilitate uptake and use of their products and services in support of the member countries of the region;

- Compare forecast guidance for the Pacific Islands region and discuss how these are produced in terms of accuracy, utility, weaknesses and strengths;

- Present, discuss, and summarise the climate and ocean conditions for the last six months and model outlooks for the next six months in the Pacific Islands region;

- Discuss how NMHSs are currently accessing and assessing the available guidance, making them nationally relevant, tailoring them for specific end users, and disseminating them to users;

- Continue capacity building/human resource development activities for the NMHSs, particularly on sectoral application aspects of seasonal and sub-seasonal predictions;

- Provide simple, easy to understand seasonal prediction information to the energy sector, and obtain feedback on the usefulness of this information. Discuss how seasonal and sub-seasonal forecast products can become more relevant for the renewable energy sector and how NMS can better engage with this sector and vice versa.

The Meeting: (Outcomes)

- Better understanding of the drivers of variability and state of Pacific Island climate and ocean over May to October 2021;
- Improved understanding of climate, ocean and tropical cyclone outlooks over November 2021 to April 2022, reasons for differences between model outlooks and model confidence for the outlook period;
- Production of a regional statement summarising the ENSO state, tropical cyclone, climate and ocean patterns from May 2021 and outlooks for these variables to April 2022;
- Better understanding of the climate and ocean seasonal prediction needs of the renewable energy sector;
- Contacts established and plans formulated to improve information exchange between the energy sector and NMHSs. For the purposes of PICOF, this relates specifically to the delivery of seasonal forecasts.

Agenda Item 2: ENSO update and outlook

The Meeting:

Discussion:

- Noted the upper ocean heat content changed from positive to negative in July, indicating that this winter will have La Niña conditions. Ocean subsurface temperatures show the same conditions.
- Noted the warming signal in the western pacific and cooling signal in the eastern pacific, getting stronger as time goes on up to October 2021, where there is enhanced upwelling of cold water.
- Noted the Pacific Islands Regional Climate Centre (PI-RCC) ENSO tracker indicates that La Niña watch was activated by all agencies in September, and some agencies have shifted to La Niña Watch to La Niña event in October.

- Notes current conditions have been shifting to La Niña development, with a sea surface temperature of 0.8 deg C in mid-October. The tropical Pacific atmosphere is also consistent with La Niña conditions.

- Notes individual model and MME ENSO Outlooks from Met France, APCC SCOPIC, NCEP, BOM, APCC MME, WMO LC LRFMME, and CPC/IRI. While some vary in the specific peak season of La Niña, or the intensity of the event, it is generally agreed that La Niña conditions will start in November, December and January (NDJ) and last until the beginning of 2022, with a decreasing magnitude throughout the period. The WMO LRFMME and APCC MME agree that a weak La Niña event is expected for NDJ, lasting until January, February and March (JFM) 2022, whereas NCEP CFSv2 indicates a strong La Niña event lasting until March, April and May (MAM) 2022.

- We can expect that this La Niña event will be a Double Dip La Niña event due to the La Niña event that occurred in 2020 (2 La Niña events forming in consecutive years, similar to 2010-2011, and 2016-2017 La Niña events)

- Conclusion:
    - Since PICOF-8, ENSO neutral conditions persisted with oceanic conditions changing to shift from neutral to La Niña development conditions starting from mid-July 2021 to early-October
    - La Niña Watch to La Niña event was expected in October 2021
    - All models indicate a large chance of the presence of La Niña for NDJ 2021-2022. After the maximum peak in November, the relative magnitude will decrease throughout the period until April 2022
    - Weak La Niña event expected for NDJ, lasting until JFM 2022

Agenda Item 3: Looking Back- Review and Evaluation of May-October 2021 Climate outlook.

i. Atmosphere

The Meeting:

- Recounted the PICOF-8 outlook where climate model outlooks favour the tropical Pacific Ocean being at neutral El Niño Southern Oscillation (ENSO) levels for most of this period
- Noted the continuing influence of La Niña is evident in atmospheric and ocean seasonal forecasts especially for May to July.
- Noted drier than normal conditions are favoured for island groups close to the equator. Existing drought (including in Tarawa, western Kiribati and Penrhyn, northern Cook Islands) is likely to continue for a few more months
- Noted that most countries in the southwest Pacific are entering their dry season and this should be taken into account when considering the above rainfall outlooks. In countries where above normal rainfall is favoured, the dry season may be wetter than usual
- In countries where below normal rainfall is favoured, water stress may be experienced
- The SOI values were neutral since March to July 2021 before showings signs of La Niña. Since September SOI has sat within the La Niña boundaries
- Rainfall - models agree with La Niña impacts that were felt and experienced by countries like Niue, Cook Islands, PNG, Tonga - experiencing lots of rainfall
- August-October - most countries now experiencing lots of rainfall assuming warm SST are moving back in the area between Fiji to PNG

- Outgoing Longwave radiation – In May 2021, the Intertropical Convergence Zone (ITCZ) displayed to the north which we expect during a La Niña.
- Fromer May to July, La Niña impact on rainfall continues in Tuvalu, Kiribati, Tokelau, northern Cook Islands and French Polynesia. From July to September, rainfall in the above countries gradually returns to normal. Separately serious to severe rainfall deficiencies have developed in northern FSM, northern RMI and around New Caledonia and southern Vanuatu
- ENSO association with Pacific rainfall - Pattern consistent with past La Niña events, negative anomalies exist in the years after La Niña event south of the equator, north of the SPCZ
- Areas with significantly wetter (green) or drier (orange) conditions during La Niña for year T (top) and year T+1 (lower) (Smith et al. 2008)
- Indian Ocean Dipole status - IOD is currently negative. May have contributed to enhanced rainfall over New Guinea.

- All five international climate models surveyed by the Bureau (including ACCESS-S) indicate the monthly IOD value for November will be within the neutral range, indicating a return to neutral weekly values in the coming weeks.

- A temperature anomaly - above normal chance to the west of Fiji and regions around the southern cooks and French Polynesia July- Dec- above normal air temperature over

- SOI showed neutral ENSO phase until September SOI is in positive phase (La Niña)
- SPCZ displaced southwest, while in May the ITCZ was displaced to the north. Consistent with the transition to La Niña-like behaviour
- Significant rainfall suppression (<10th percentile) over parts of the Pacific in the past three months (June-August), e.g. RMI, Vanuatu, and part of Fiji while in the first 3 months (April-June), northern RMI, parts of

Solomon Islands, Kiribati, Tuvalu and Vanuatu also experienced below normal rainfall. Conversely significantly more rainfall than over, e.g., Palau, RMI, parts of PNG, Rotuma, Samoa, Tonga and Southern Cooks (Apr-Jun 2021) and southern PNG, central Solomon Is., southern Tuvalu and southern Cook Is. Experience above normal rainfall (June -August)

- Near normal temperatures in the equatorial Pacific over May - June, warmer than normal west of Fiji, southern Cook Is., and southern French Polynesia between May – July 2021. Above normal air temperature over southern PNG, western Solomon Is., Vanuatu, Fiji, Niue, southern Cook Islands and southern French Polynesia over July-September

Discussion:

- No Questions

ii. Ocean

The Meeting:

- Reviewed past statements from PICOF 8 and noted that climate model outlooks favour the tropical Pacific Ocean being in neutral El Nino - ENSO levels for most period

- Noted the continuing influence of La Niña
  - Few coral bleaching events
  - Notably higher than normal sea levels
  - Higher tides leading to flooding in low lying costa areas
  - Noted end of first quarter - pacific SST warmer than normal continuing on to August
  - NW Pacific and some countries in the Pacific have normal and near cooler conditions - evidence of LaNina like citations
  - SST Nov- 202 up to Feb, have cooler conditions, neutralized conditions in central equatorial,
  - SST have strengthened in the east and moving to central Pacific Ocen

- Subsurface temp - noted from Nov 2020 to February 2021, negative subsurface temperature anomalies persisted in the eastern half of the Pacific Ocean
- During March through May 2021, positive anomalies shifted eastward in association with two downwelling Kelvin waves
- In July, negative subsurface temperature anomalies emerged. In mid-September, negative anomalies in the east-central Pacific strengthened indicating cooler conditions
- Most countries experienced higher than normal sea level conditions 1-2.5mm increase/higher than normal sea level
- Validated sea level recordings from the University of Hawaii where water levels were above normal
- Noted that Coral bleaching - NW was on watch and warning whereas the remainder of the region was on no stress levels
- Chlorophyll concentration – a good indicator of upwelling - noted as we progressed through the year, concentration was more to the west and to the central - reports from Cooks there were fewer fishing activities corresponding to the low productivity reflected on the chlorophyll plot
- Current anomaly, climatology shows anomalous - march-ay along the equator and recently east to west movement
- Case Study - KI - Austral winter months- Notable events last 6 months, king tide flooding - exp in March – a combination of spring tides in March and a positive sea level anomaly - exp overtopping - nuisance flooding
- Combination of high tide and -flooding in Samoa - sea level anomaly following LaNina peak is consistent of LaNina decay-to Neutral conditions

Discussion:

- Cook Islands asking about La Niña impacts on Ocean conditions, which may impact local fisheries and how likely it is to change - local fishing groups experiencing lower catch

- SPC - upwelling usually pushes chlorophyll allowing for higher productivity influencing the quantity of catch - rest of the questions to be covered in outlook
- Dr Chalapan - UPNG - since PLSM installation, what are the long-term impacts and trends of sea level rise?

- SPC-BOM - NOAA - COSPPac - Tide Gauges - PLSM - in addition to the Tide gauges installed to monitor relative and absolute sea level - information discussed and shared during COSPPac meetings - sea level outlook as an element of Sea-level outlook that will be presented as part of ACCESS-S - North Pacific - NOAA issue ocean outlooks
- BOM - Simon - requested clarification of the verification of the official PICOF8 WMO LC LRF MME outlooks
- SPREP - countries below (lats) identified countries that will receive below normal rainfall, the lag time between June and July after La Niña - consistent with WMO long range forecasting
- SPC - observations set by Bureau consistent with outlook presented in the previous sessions

iii. Northern Hemisphere tropical cyclones

The Meeting:

- Noted that during La Niña, TCs tend to develop farther west, within Chuuk or Yap States, or the Republic of Palau, continuing W-WNW toward the Philippines or the Philippine Sea.
- Noted that the 2020 season was a slow TC season
- Noted that near normal TC outlook was predicted for the 2nd half of 2021 in June for Guam, CNMI, ROP, FSM, and RMI.
- Noted that there were several super typhoons in 2021- Super Typhoon Surigae (Palau, Yap-FSM), Tropical Storm Choi-Wan (Palau), Typhoon Champi (Guam), Tropical Storm Omais (Guam, CNMI), Typhoon Mindulle (Guam, Rota-CNMI), Tropical Storm Namtheun (Northeast of Guam and CNMI), Tropical Storm Kompasu (Palau, Yap-FSM, Guam, CNMI)
- Noted that in 2021, there have been 24 tropical cyclones in the western North Pacific, 2 tropical depressions, 13 tropical storms, 4 typhoons, and 3 super typhoons. Typhoons are underperforming, but there are still 2 months left in the season.

Discussion

- Comment from Kiku - Palau: From October 5-10, had a monsoon surge where they had strong winds over Palau, and had powerful thunder, lightning, and torrential rainfall followed by landslides and flooding, with a new moon on Oct 6, meaning astronomical tides, measuring over 7 feet in sea level rise. It was a severe prolonged event, the worst seen in Palau.
- NOAA: Have to keep in mind astronomical tides as any events will compound and lead to high tide swelling

Agenda Item 4: Looking Forward - Seasonal and Intra-seasonal Pacific guidance for 2021/22.

i. Atmosphere

The Meeting:

- Noted that WMO LRF MME is the official outlook for PICOF and then compare it with Nodes - NIWA, BoM, NOAA, SPREP etc.

- Continue using outlooks and tailored products from RCC Network partners
- WMO LC MME based on 14 GPC LRF models (one was added in Sep 2021)
- Many other national and research models in existence
- Model skill varies significantly from model to model depending on a range of factors, such as model physics, initial conditions, length of hindcast, number of ensemble members etc.
- Below normal rainfall favoured for the southern
- Forecasted Nov-Dec Below normal rainfall for the southern PNG, Solomon Islands, Southern Cook Islands, near normal for Guam, SNM, central Solomon Is, Samoa, central French Polynesia
- WMO LCE skills are lowest around Guam and CNMI, Northern PNG along
- Good skills around Equatorial Pacific except for Fiji
- Access-S – Nov - Jan 2021 wetter
- Below normal outlook in the southern region - French Polynesia
- Access-S skill in Nov-Jan - areas of low skill are common for both models
- Access-S probability skill scores

- NIWA outlook - The ICU monthly and seasonal climate forecast products are based on the Copernicus Climate Change Service (C3S) Multi-Model Ensemble (MME)
    - 8 models: ECMWF, UKMO, Météo-France, DWD, CMCC, NCEP, JMA, and ECCC: More than 470 ensemble members
    - Climatology is derived from the corresponding GCMs hindcasts (1993 – 2016)
    - Hindcasts and forecast data processed at NIWA once per month
- ICU outlook are similar- main difference - is central pacific near Central Kiribati
- NIWA updated skill scores - C3S MME vs ERA5 for monthly and seasonal precipitation
    - MMEs outperform the best individual models
    - Outlooks issued in September – December tend to have the best skill, as influenced by the peak of ENSO events
- NIWa water stress outlook - area of suppressed outlook from Phil's presentation and the NIWA outlook and you get the water stress areas and likely to persist
- APCC-MME - similar to WMO MME outlook - main difference- no below normal probability over PNG mainland and the area of near normal probability is near central equatorial pacific region.
- PICASO - Regional and Local outlook - The Equatorial Pacific is expected to have drier than normal conditions (with high reliability) in the next season. In particular, the probability of drier than normal conditions are likely to be greater than 50% in Penrhyn, Kiritimati, Tarawa, Kanton, Nauru, Momote, Nanumea, Nui, Funafuti while the most subtropical islands will experience wetter than normal conditions.
- SPREP SCOPIC – La Nina type outlook – the difference between WMO MME - favours Palau western and central Kiribati and climatology for Tuvalu
- Above average rainfall for PNG
- Remarkable consistency

Areas of greatest concern:

- Greatest in Nov as we enter the wet season – Tuvalu, Tokelau and Southern Kiribati, PNG to Fiji region - wetter than normal conditions around PNG, less than above normal and enhanced tropical cyclone region
    - Flooding expected

- Rainfall Outlook Feb-Apr 2022 • WMO LC MME has a limited number of dynamical models available (Beijing, Montreal, Seoul, Washington) • APCC MME • SCOPIC • Warning! Skill is not great for this period, but useful early indication of likely conditions. Obtain updates as they become available. -
- Skill is low for these months
- WMO Lead Center for LFR MME - below to near normal – PNG region, extensive near normal probability in the North Pacific
- APCC MEME outlook similar -
- SCOPIC- similar to WMO

- NIWA - most likely precipitation category over the coming seasons weaker

- WMO LRF center MME- Air Temp - SST outlooks - note they are similar for Nov – Jan. Below normal - eastern pacific and near - above normal

ACESS S

APCC- similar to WMO LC Outlook - impressive skill across equatorial Pacific in Temp outlook. Hotter than normal conditions are expected in many of the islands located along the ITCZ/SPCZ axis in the next two seasons, particularly during NDJ. On the hand, the eastern Pacific is expected to be within the cooler than normal conditions.

MSLP and Airflow - Nov - Jan - positive -central equatorial pacific - NIWA plot- northerly airflow through southern equatorial to the southern tropics- this will result in warm moist air flowing south – south-east expected and associated with warmer air temp - consistent with Air temp outlooks, in a La Nina event you expect the reverse - (cooler air flowing north-northwest)

Summary:

The transition from neutral to a La Niña-like ENSO state is evident in the rainfall, air temperature and wind seasonal outlooks for November 2021 to January 2022 and February to April 2022. The outlooks are largely consistent with conditions experienced over the same period in the past when a La Niña-like ENSO state has been present. • Drier than normal conditions are favoured for island groups near and west of the Dateline that are located close to the equator (excluding the area west of New Guinea). The expanse of drier than normal conditions extend northeast and southeast from the dateline towards the subtropics (Fig X). Islands in this region that have experienced low rainfall during or since the last La Niña event are likely to continue to experience these conditions. Forecast confidence for this region is high. Wetter than normal conditions are favoured for islands located between Palau

and the central Marshall Islands in the North Pacific and southeast PNG to southernmost French Polynesia in the South Pacific. Forecast confidence for this region is moderate to high. A similar pattern is favoured for February to April 2020 with minor differences. Consistent with signs of a La Niña event maturity and decline, the chances of drier than normal conditions ease near and west of the dateline. The chances of wetter than normal conditions also ease in the South Pacific but become stronger and are more extensive in the North Pacific. • Associated with ocean surface temperature patterns, warmer than normal air temperatures are expected for many island groups, particularly in the western equatorial Pacific, extending northeast and southeast towards the subtropics (Fig. 2). Cooler than normal air temperatures are more likely closer to and off the equator near and east of the Dateline. The air temperature outlook pattern for February to April 2022 period is similar but less emphatic. • Wind outlooks show a stronger than normal easterly airflow along the equator over November to January with a larger than normal flow of warm and moist air into the northern and southern hemispheres in the western Pacific. This pattern is consistent with the warmer and wetter outlook presented above

Discussion: no questions

ii. Ocean

The Meeting:

- WMO MME - 3 months SST Nov-Jan - typical La Nina pattern central - below normal - central pacific above normal surrounding the central Equatorial.

    - Consensus between the models
    - WM OMEE - 6 month - similar and less intense in the below normal regional - models forecasting and early peak, decline earlier Dec - Jan
    - Similar except Beijing Model forecasting an earlier decline
    - Skill for WMO LRF - good skill in the band along with EQ- high correlation but in the western pac- warm pool, we get patchiness to the north of eq in the Jan-Mar skill - lighter colours around Fiji - Solomon and coral see - most likely attributed to TC cooling - TC creates cooling as it passes - this affects the skill of models for SST during peak cyclone region
    - ACCESS-S SST anomalies - November - January - positive anomalies - SST skill patterns same along the equator, reduction in skill around the north of PNG
    - Sea Level Anomaly - forecast for persistence and doesn't change- similar to outlook provided by NOAA - moving slightly to neutral - above normal

- High Tide anomalies around FSM to Palau region, a band from PNG stretching through the Solomon Islands, Fiji, Samoa and French Polynesian - similar to the case study shown in Kiribati
- Highest tides expected for FSM-Pohnpei, PNG – Port Moresby. Kiribati – Betio and Funafuti
- Coral Bleaching- alerts high for northern PNG, Palau - RMI
- Bleaching can be caused by freshwater inflows, salinity change, nutrient pollution intense sunlight
- Fisheries convergence zone high in the north-west Pacific from October to December. November to January, expected to move northwest
- For Cook Islands - contracting westward - if looking for the country based- moving north Cook Island around December
- Key messages: Warmer than normal for most countries in the west, including COSPPac partner countries in the south. Cooler along the equator towards the east.
- Sea Level favoured being higher than normal for most countries. Palau, FSM >20cm
- Countries to be aware of higher tides that can lead to flooding along coastal zones
- Coral Beaching on alert levels for PNG, FSM, RMI
- Fisheries convergence zone slightly expands eastward

Discussion

- Noted - tide forecast TG (John) NOAA is working on developing for all UH Tide Gauge
- Dr. Chalapan -Science information - caution on the use and integration of data and conveying of information and impacts so as not to confuse people
- NOAA- John Mara- offered to discuss more - predicted tide and add anomaly to get a sense of how much extra water you might get in addition to the normal expected sea level
- NOAA has other tools and offers to discuss offline
- Zulfi - SPC - predictions based on Tide Gauges - all TG provide data to GSL and is used for all Global Models - Tide prediction and forecast already used datasets for north pacific countries, central and southern

pacific - NOAA is using COSPPac data to provide- tide predictions and forecast

ii. Tropical Cyclones

The Meeting:

- reminded countries of the different outlooks and areas of responsibilities as it slightly varies

- Noted normal to slightly below normal season predicted and validated for 2021 season
- La Niña conditions were present
    - Predicted 9 TC- observed 8 (3 severe)
    - NIWA 8 -10 with 3+ severe - observed 8 (severe 3 TC)
- 2021/2022 TC outlook
    - BoM - Total TC perceived with a 51% chance of above average (9)
    - NIWA - Total TC- 9-12 (3Severe TCs)
- A near normal slightly above normal season is the consensus outlook
- Increased likelihood of La Niña conditions
- Both outlooks consider relations between ENSO indicators and tropical cyclone numbers
- 2021-22 BoM outlook - above average numbers favoured in the west near west of New Caledonia, Queensland
    - Western region 4 TC's 59 %
    - Eastern region 6 TCs 46%
- NIWA cyclone risk outlook
    - Normal to slightly above normal season predicted
    - Island groups - Vanuatu - coral sea region, normal to elevated risk this season- consistent with the warm ocean to the west
    - Central near normal and reduced potential to the east
    - Elevated risk around NZ
- 2021-2022 NIWA cyclone number outlook - 9-12 named storms predicted
- Elevated activities in central to western part of the Pacific

- West of New Caledonia - ocean temp - in the Coral sea -near normal - 2020 Oct - 2021 - warmer than average ocean temp
- Key climate driver: La Nina
- Model in agreement on La Nina conditions developing as a factor in TC season, warmer than normal away from central pac leading to TC genesis
- Model precipitation skill based on ENSO status - La Niña - models works
    - Models best during El Nino
    - Atmospheric response to LaNina - strong agreement on lower than normal pressure in the west
    - Higher pressures further to the east and closer to the Eq
    - Lower presser areas indicate TC development
    - MJO- can be used to help build confidence for favourable conditions for TC development
- Reminded that no matter the ENSO state, severe cyclones can occur and that it doesn't take a severe cyclone to have severe impacts

Discussion

SPREP - asked for clarification for the area of responsibility - is it possible to use something that is similar to what the rest of the Pacific countries use - consistency

Ben NIWA - note the desire to have a consistent statement across the Pacific and something the long range nodes can look at and can be addressed by the RCC nodes

Day 1 – Co-chair acknowledged the presentations and the participants and closed forum.

Agenda Item 6: PICOF state of climate for May to October 2021 and Seasonal Outlooks for November 2021 to April 2022.

SPREP welcomed participants and in particular, the partners from the Energy sector and a representative of Samoa Meteorological Services opened Day 2 meeting with a Prayer. The PICS Panel co-chair gave opening remarks to acknowledge the participant, donor and development partners, and members of the Energy sector

The Meeting:

- Noted the importance of Meteorological and hydrological information data to inform the energy sector with their planning

    - Noted the importance of the provision of Met information for renewable energy investment and research
    - Highlighted the importance of hearing from the 5 case studies
    - Importance of using the information for guidance

The PICS panel co-chairs provided an overview of the meeting objectives. The chair encouraged the partners to utilise the opportunity for dialogue and exchange of expertise,

- Noted the importance of energy sector colleagues understanding Pacific climate, including variability
- Highlighted year to year and decade to decade variability in climate variables, and noted the influence of long-term climate change
- Noted the various climate drivers that influence climate variability in the Pacific, emphasising the importance of ENSO and overviewing the implications of the three ENSO phases on rainfall
- Noted the reasonable accuracy of seasonal climate predictions
- Summarized the outputs of Day 1 of PICOF-9, namely, La Niña thresholds are being approached, near normal or slightly above normal number of tropical cyclones are expected for the coming season, sub-tropics are likely to be wetter than normal, equatorial countries have a higher chance of below normal rainfall, sub-tropics most

likely wetter, sea surface heights running 10 to 20 cm above average, coral bleaching expected to intensify across some island groups, especially in the west.

- Noted cooler than average SSTs in the equatorial central Pacific over past months, emphasising that all regional forecasting centers are showing progression towards La Niña.
- Noted unusually warm ocean temperatures in the western Pacific, which is likely to influence tropical cyclone activity
- Emphasised potential increased risk of TC activity in the western Pacific associated with the marine heatwave although noting that all countries should remain vigilant and prepare for the season ahead
- Noted likelihood of warmer than normal air temperatures for many countries in the coming months
- Noted the signal for above normal rainfall in the subtropics and below normal in the central equatorial Pacific going north
- Highlighted countries likely to experience water stress in the coming months
- Noted areas of coral bleaching concern in the Western Pacific.

Discussion

SPREP highlighted that information provided during the presentation is also available from NMHSs and noted that one purpose of PICOFs is to build relationships between NMHSs and sectors. For example, strengthening relationships utilising current MOUs.

Agenda 7: Pacific case studies – linking information on climate and ocean monitoring/prediction/projections to renewable energy

i. Energy Roadmap

The Meeting:

- **Noted** the timeline for the development of the Framework for Energy Security and Resilience in the Pacific 2021-2030
- **Noted** the long term goal of the Framework to secure robust, sustainable and affordable electricity, transport fuel and household energy service and are resilient to climate change and natural disasters

- **Noted** the priority initiatives of the framework links to the weather and climate in particular priority 10, 14, 16 with reliance on weather and climate data provided by NMHS for renewable energy (wind, solar, ocean energy)
- **Highlighted** other critical areas of the Initiative in relation to Low Carbon and energy efficiency
- **Noted** the International Energy Agency (IAEA) web-based data platform/energy analytical tool to support strategic energy planning and transition to renewable energy supply
- **Made note** of the Solar and Wind Resource assessment done throughout the Pacific
- **Highlighted** the importance of climate and weather information for decision making in the energy sector e.g., building climate resilience technologies, determine the suitable type of technologies, disaster preparedness and data collection prior to and after natural disasters
- Suggested way forward and the need to collect more data on solar and wind, rain for hydropower, ocean, consistent and prolonged data collection
- Collaboration on data collection and sharing

Discussion: No questions

ii. Afulilo Case Study

The Meeting:

- **Noted** the summary of events leading up to the development of the Afulilo Water Storage Outlook Module including donor partners in the last decade

- **Noted** the background and the aim of the Afulilo hydropower scheme and Samoa's efforts to reduce reliance on fossil fuels and increase energy self-sufficient by 2030
- **Highlighted** the development of products and outcomes of model over the last decade
- **Noted** the importance of maintenance of the hydro-dam, the management of the dam, and the components of the dam

- **Highlighted** the interaction between Samoa Met and the EPC hydro data flows, examples of applications of the model based on user request
- **Demonstrated** how the daily forecast allows EPC to understand dam water levels to make decisions on how much power can be generated and how much water resources be maximised over a period
- **Demonstrated** the decision support tool based on CliDESc and customised for EPC and their decision making.
- **Noted** future development for validation and further customisation with EPC, room for improvement of catchment capture features, integrate EPC data management systems, add the option for rainfall forecast intervention from Samoa Met Division, incorporate spillway losses, improve integration of seasonal scale storage planning and incorporate real time dam level monitoring

Discussion: No questions

iii. Moerk Water Solutions Asia

The Meeting:

- Sustainable water solutions and appropriate technology to build climate resilience.
- Assist remote communities to access sustainable energy and clean drinking water
- Build and install high quality solar-powered water treatment systems
- Important to have a multi-layer approach including the vocational training and train people from each community to operate their own system
- Invest in robust and sustainable solutions using modern technology.
- People in the community take ownership of the technology.
- Building technology from high quality material and easy to operate, low maintenance.
- Products to last from 7 - 10 years
- Identify the needs of the community and tailor the technology to their needs.
- Have worked across the Pacific, Australia and Africa.

- Invest in community empowerment. For example, on Uripiv Island Vanuatu-residents had to cross the sea to fetch water during the drought. Reliant on rainwater and brackish wells.
- Provide remote monitoring and be able to address problems in a timely manner.
- Understand the community needs.
- Operators are trained - training the locals to ensure sustainability.

E.g., solar system design and operator training - capacity building and self-reliance

Impact

- Uripiv now has access to electricity and safe drinking water every day of the year.
- Health care centre has clean water for patients and cleaning instruments.
- People no longer have to travel by boat to get drinking water.
- Community resilience - people now come to Uripiv for water
- Resilience & Adaptation – Uripiv Island still had clean water and solar power after cyclone Harold.
- Technologies with solutions, with low maintenance cost and resilient to CC, therefore, communities adaptable to climate e.g. Uripiv Island.
- Website - can book a strategy meeting and start a consultation approach as well as video.
- Link for Moerk water solutions: https://www.moerkwater.com.au/uripiv-case-study

Discussion:

PICS panel co-chair asked how information like PICOF focusing on seasonal climate and weather forecasting could be used by communities in conjunction with technologies private sector support to prepare for climate events such as drought, prolonged rainfall

Curtis responded that climate and weather forecasting helps identify the urgency for implementing a solution. It also provides a model that communities and governments can use for their forward planning. Identifying challenges ahead means we can be prepared for the potential crisis before it happens.

PNG - short term climate- if Moerk has technology for desalinisation? Requested if this has been done.

Curtis clarified that it's an effective technology but has a lot of issues in high maintenance issues. The best thing is to look at best practices and testimony stories available on their website. Using other filters using rainwater as freshwater -

iv. Blue Planet Foundation

The Meeting:

- **Noted** development in Hawaii of energy technologies and monitoring equipment

- **Highlighted** some of the record breaking extreme climate and weather events recorded in Hanalei, Kauai, April 2018
- **Noted** the background and goal of Blue planet foundation to progress clean renewable energy, lower dependency on fossil fuel, and increase ambition to developing a campaign to achieve 100% renewable energy by 2045
- **Noted** some of the efforts Hawaii has undertaken for its 100% transformation:
    - Kauai Tesla Project with offsite battery storage,

- shifted energy - retrofitting 3000 electric water heaters with grid interactive controllers to control >2MWh on on-demand energy storage, prices to devices
- technologies responding to price signal on the grid
- Electrification of transportation
- Green aviation decarbonizing travel- aviation with a low fuel engine, airbus hydrogen

Discussion:

NIWA asked how sub-seasonal information is used in Hawaii's renewable sector

- Utilities are working and utilise the sub seasonal information to develop for instance - roof cover- based on the sunshine hours

PNG- has ocean currents been considered as part of the renewable energy plan?

Blue Planet foundation - responded that there are existing projects still in the testing phase and have yet to reach commercial scale. Have also considered off-shore wind is possible for harvesting - this needs to be balanced with tradeoff/land use for wind production

v. Low Carbon

The Meeting:

- **Acknowledged** the developments and the work of the Maritime Technology Cooperation Center (MTCC). Pacific capacity building for climate mitigation in the maritime shipping industry

- **Noted** the MTCC pacific activities such as the Pacific low carbon maritime transport supporting sustainable development goals of PICTs
    - Supported national approaches to uptake loa carbon technologies and operations within the maritime sector to reduce GHG emissions

    - Provide capacity building activities - 200 participants, 64+ females and the rest are males
    - Contribute to an international regional network for information sharing
- **Noted** the successful pilot projects and applications of maritime solar energy in PICTs vessels in Vanuatu (private inter-island vessel) 32% savings in the first months and Samoa - 10 % savings - and a huge reduction of monthly emissions (101 tons Vanuatu and 135 tons Samoa)
- **Acknowledged** the Green Pacific Ports efforts in Solomon Island, Fiji and Tonga to improve port operations efficiency, reduce port carbon footprint and green port marine pollution -
    - Solomon Islands - saved 8 months - 27% electricity emission and 13% electricity and fuels
    - Fiji Ports 21% of office electricity usage = $19,000 FJD reduced - using LED lights, reducing air condition etc.
    - Tonga - 17% electricity emissions and 11% electricity and fuels
- **Noted** the successes of the Hybrid-outboard electric motor demonstration project to demonstrate a solar-powered outboard motor on a fiberglass boat and encourage change to fossil fuel-powered crafts
- **Noted** the successes and challenges from the demonstration and how the case studies have highlighted activities that can be scaled up, the need for long term projects, an integrated approach and building on the current status and port development
- **Noted** the need for ongoing capacity building activities as well as challenges in particular high staff turnover
- **Noted** challenges and barriers affecting technology transfer in the transport sector such as data sharing, management and operations, policies, education and finances. Have identified and trued to build vessel profile- engine type and option for replacement and/or appropriate energy efficient technology
- **Noted** the summary of lessons from the MTCC Pacific pilot projects and initiatives
    - Pilot project challenges have been heightened by the COVID-19 pandemic. With a limited budget and timeframe, MTCC-Pacific engaged primarily with countries that have shown commitment by the operators to implement some ship energy efficiency activities which meant scaling its scope and reach in the region.
    - Solar systems are applicable to all ages of vessels trading in the Pacific islands areas and are one of the potential immediate technical

measures that could be adopted by the ageing fleet in the region and significantly contribute to exploring targets of 40% GHG emissions reduction by 2030 as discussed in the last events in the region.

- The MTCC-Pacific pilot project is also a way of promoting renewable energy onboard ships but the crucial need to collect reliable data and information on fuel consumption to ensure informed decision-making by ship operator

Discussion:

UPNG- (Dr. Chalapan) –

1. What type of solar panel is used on a stand-alone system on ships

2. What is the projected lifespan of panels with exposure to corrosion

3. What are the plans for sustainability used in Maritime.

MTCC: 1. Green solar panels - 6.34KW, installed on ships, alternative options of charging batteries through the generator

2. All equipment are marine graded- and met standards and covered under the supplier's Warranty

SPC - Zulfi - how do you see the use of climate and ocean information to create more efficiency for energy usage in the pilot countries. How do you strengthen relationships between the Marine sector and NMHS in sharing weather and climate information?

PNG - enquired about Carbon emission trading and reduction of emission overall in the Region and whether this is covered by MTCC?

MTCC: assisting with the session and development of domestic regulations at the national level, Carbon trading in the maritime at the regional level is on the radar, at the moment, priorities are on National maritime development and energy-efficient.

Agenda 8: Sector Feedback

The Meeting:

- **Noted** the seasonal outlook for the coming season and asked the energy sector to comment on how information could be applied in their work
- **Noted** that different weather and climate parameters and variables information can be provided by NMHSs including early warnings for drought and tropical cyclones, and rainfall, temperature situation over the last few months.

Discussion:

SPREP asked for more information from Akuila on the database.

SPC responded that many Pacific countries were interested and that the project consulted with NMHSs and the energy sector in Palau, Vanuatu and others who were picked for the first phase. They are using satellite data to map out the resource potential of wind and ocean for energy production.

SPREP asked all the presenters, what is the potential for climate information to fill in the gaps.

SPC responded that this information is critical for power utilities and energy companies in countries to decide on the installation of energy technology. For example, solar tech was installed in Yap - FSM but was ripped apart by a hurricane. NMHSs have a role to assist the development of technologies that can withstand disasters.

SPREP asked how seasonal forecasts and information from Met services can be used?

SPC emphasised the importance of information sharing between NMHSs and the regional agencies.

SPREP asked Solomon Meteorological Service (SIMS) and Samoa Meteorological Service (SMS) to comment on their data sharing policy.

SIMS responded that data sharing is very important and is an extension of their work with stakeholders which comes under an MOU.

SMS responded that the work with NIWA has resulted in a common understanding of sharing the data. The energy company can request climate summaries for monthly meetings on power generation. The EAR Watch bulletin provides information on drought impact which helps the energy sector with their planning. Also, the TC outlook is useful, with La Niña coming in next season, they are expecting more rainfall, and this is useful for the energy sector because more rainfall could mean more water for energy generation.

Annex 1: Agenda

Timeline

Proposed Timeline for PICOF Statement development (dates refer to Samoa local time)

Monday 15 September 2021: Pacific NMSs notified of upcoming virtual PICOF-9.

Monday 18 October 2021: Listed agencies to send content to lead agencies to summarise.

Tuesday 19 October 2021: Deadline for PowerPoint presentations to be sent to the PICS panel secretariat.

Thursday 21 October and Friday 22 October 2021: Virtual October 2021 PICOF teleconference held (see agenda below).

Friday 23 October 2020: Draft version of the October PICOF statement circulated to PICS panel for input/comments. Deadline Monday 26 October.

Tuesday 26 October 2021: Final draft of the October PICOF statement sent to the PMC members for approval, deadline for responses Wednesday 27 October 2021.

Friday 29 October 2021: October 2021 PICOF statement released.

Agenda

13:00-13:30 (Samoa local time)	Registration and communications testing.
13:30-14:00	**Agenda 1: Opening and Setting the scene. (Salesa to chair opening)** · Opening prayer - Kasis Inape · Welcome remarks- **WMO representative** · Opening remarks - **SPREP DG Kosi Latu** · Group photo -**Leanne Moananu** · Day 1 meeting objectives- **Olivia Warick**
14:00-14:20	**Agenda 2: ENSO Update and Outlook.** ENSO status and outlook, and introduction to ENSO tracker: NIWA, BoM, Meteo-France, NOAA, University of Hawaii, **APCC,** SPREP and SPC (15 minutes). - **Dr. Soo-Jin Sohn** Highlights from the LC LRFMME (KMA/NOAA) Global Seasonal Climate Update (GSCU) Questions & Answers (5 minutes).

14:20-15:15	**Agenda 3: Looking Back- Review and Evaluation of May-October 2021 Climate outlook.** **i. Atmosphere** Overview of May to October 2021 state of the climate, plus evaluation of the last PICOF outlook: NOAA, University of Hawaii, BoM, SPC, **SPREP**, and NIWA (15 minutes). **Philip Malsale** **ii. Ocean** Overview of May to October 2021 state of the ocean, plus evaluation of the last PICOF outlook: NOAA, University of Hawaii, BoM, **SPC**, SPREP, NIWA (15 minutes). **Zulfikar Begg** **iii. Northern hemisphere tropical cyclones** Overview of the TCs over last six months: **NOAA**, University of Hawaii, BoM, SPC, SPREP, and NIWA (15 minutes). **Marcus Landon** Questions & Answers (10 minutes)

15:15:16:10	**Agenda 4: Looking Forward - Seasonal and Intra-seasonal Pacific guidance for 2021/22.** **i. Atmosphere** PICOF outlook and RCC Node for LRF individual model/MME guidance and skill comparison: NIWA, **BoM**, Meteo-France, NOAA**,** University of Hawaii, APCC, SPREP, and SPC (15 minutes including 5 minutes for questions and answers). **Simon McGree** **ii. Ocean** PICOF outlook and RCC Node for LRF individual model/MME guidance and skill comparison: **NIWA,** BoM, Meteo-France, NOAA**,** University of Hawaii, APCC, SPREP, and SPC (15 minutes including 5 minutes for questions and answers). **Zulfikar Begg** **iii. Tropical cyclones** PICOF outlook and RCC Node for LRF individual model/MME guidance and skill comparison: **NIWA**, BoM, Meteo-France, NOAA, University of Hawaii, APCC, SPREP, and SPC (15 minutes including 5 minutes for questions and answers). **Ben Noll** Questions & Answers (10 minutes)
16:10-16:15	Online poll-Mapping of capacity gaps – **Tile Tofaeono**
16:15-16:20	**Agenda 5: Closing** Next steps, wrap up – **Olivia Warrick**

13:00-13:15 (Samoa local time)	Registration and communications testing.
13:15-13:45	**Agenda 1: Opening and Setting the Scene.** · Opening prayer -**Faapisa Aiono** · Opening remarks-**RCC lead**-**Simon McGree** · Day 2 meeting objectives-**Simon McGree** · Group photo -**Leanne Moananu**
13:45-14:15	**Agenda 2: PICOF state of climate for May to October 2021 and Seasonal Outlooks for November 2021 to April 2022.** · Background on Seasonal Forecast for the Pacific-**Simon McGree** · Summary of state of climate and seasonal outlook from Day 1 of PICOF (30 minutes includes 10 minutes for questions)- **Ben Noll**

14:15-15:40	**Agenda 3: Pacific case studies – linking information on climate and ocean monitoring/prediction/projections to renewable energy** **i. SPC (Akuila Tawake)-** Energy roadmap in the Pacific and how we can utilise the climate/weather information to serve this sector better -15 minutes. ii. **NIWA (Alan Porteous) -** Afulilo Water Storage Outlook Module**-** 15 minutes. Question and Answer (5 Minutes)
	iii. **Moerk Water Solutions Asia-Pasific Pty Ltd (Barbara Brezger)**- Building climate resilience in the Pacific: designing solar power and water systems for shifting weather patterns, Uripiv Island Vanuatu**–** 15 minutes **iv. Blue Planet Foundation** (**Melissa Miyashiro-Incoming Executive Director) -** Charting Hawaii's Course for a Resilient and Just Clean Energy Future-**1**5 minutes. Question and Answer (5 Minutes)
	v. SPC (Amelia Bola)-Low carbon, safe, accessible, and affordable maritime transport-15 minutes. Question and Answer (5 Minutes)

15:40-16:00	**Agenda 4: Sector Feedback panel discussion -Chair to lead discussions** Country dialogue with speakers – Questions base on presentations

16:00 – 16:10	**Agenda 5: Survey - two surveys** <u>Energy –</u> 1Is the climate statement useful? Yes/no & which section was most relevant 2. What are some of the energy likely impacts based on the statement? 3. Do you use long-range forecast, TC information and ENSO events such as the upcoming La Niña for your plans? And how? 4. How do you see yourself using other information in the PICOF statement (seasonal forecast) for planning? NMS- 1. Which or what information from the energy presentations that you found useful and relevant to improve your services? 2. Do you have an energy sector product? 3. Any agreement or sharing of information or request from energy? 4. Any plans for future development for the energy related products?
16:10-16:20	**Agenda 6: Closing.** Next steps, wrap up – **Salesa Nihmei**

Annex 2: Participants