



Sixth Meeting of the Pacific Meteorological Council (PMC-6)

Sustaining Weather, Climate, Water and Ocean Services for a Resilient Blue Pacific

14-16 August 2023, Sofitel Fiji Resort and Spa, Denarau, Nadi, Fiji

Agenda item 12.3: Hydrological data and database issues – regional review

Purpose of the paper:

1. To update and inform the PMC of hydrological data and database issues faced by Pacific countries and to identify opportunities and challenges to address these issues.
2. Seek endorsement from the PMC on recommendations on a regional approach to support national hydrological data and database needs.

Background:

1. Surface and groundwater hydrological data supports evidence-based decision making for water resources management, flood and drought early warnings and impact-based management, climate change analysis, infrastructure design, and energy and food, security. Despite a long history of hydrological data collection in the Pacific region, it is noted that accessible data has declined in the recent years. According to the “*Climate Change in the Pacific 2022*” (2022), a decline in the quality and quantity of Pacific Island climate data and metadata was identified, beginning in the 1990s.
2. Hydrological data requires a fit-for-purpose database with specialised tools that provides for data processing, quality assurance, hydrological analysis, accessibility and data sharing at national and regional level.
3. For surface water, Pacific Island Countries have used the hydrological database TIDEDA, (Time DEpendent Data), a software developed in New Zealand by the National Institute of Water and Atmospheric Research (NIWA), as the primary database for processing and analysing surface water hydrological data in the Pacific region.
4. TIDEDA is nearing its useful operational life and there are currently no plans for further software development and is expected to become obsolete without future upgrades to computer operating systems. This presents a significant risk to advancing regional hydrological data, Early Warning Systems (EWS), water resource management, and climate analysis agendas.
5. Groundwater data in the Pacific typically is stored locally in unmanaged and unsecure file formats, such as excel and standalone databases, making access difficult for quality assured and accessible data to support evidence-based decision making. National groundwater data is at high risk of being lost without efforts to provide for its proper data security and management.
6. Limitations of the current hydrological databases have been raised extensively by Pacific NHMSs and technical specialists as a priority for some time. However, significant barriers by way of financial and technical constraints have meant that these concerns have not been addressed.

7. Hydrological databases are niche software platforms with integrated specialised tools and there is high-level of complexity associated with the management of time-series water level and flow data, and groundwater data. This complexity coupled with the age of the processing tools makes the tasks of hydrological data processing somewhat specialised and requiring significant concentration. It has been evident for some time that many hydrological agencies in the region (and elsewhere) have difficulty in keeping their data processing and verification workflows up to date, and more modern tools will assist productivity.
8. Numerous proprietary software are available, but are expensive and would present a significant increase to the regional NHMS's annual operating budgets through the costs associated with the initial software purchase, ICT upgrades, and ongoing annual licensing fees. Identified up front and ongoing costs are considered a financial barrier for most countries and likely to be unsustainable, in the present approach.
9. Preliminary scoping of license-free hydrological databases indicates that current alternatives face significant limitations regarding outdated architecture, poorly supported codebases, security issues, and inadequate software support. These issues present a considerable risk to Hydrological Services or Water Resources Divisions wishing to move their existing hydrological databases to a software that addresses their current hydrological needs and that also has the capacity to support future requirements.
10. The regional requirement for a hydrological database inclusive of applications for accessing, processing, analysing, and presenting hydrological data cannot be overstated. A functional, secure, and accessible database will increase the value of hydrological data, improve the efficiency and effectiveness of national hydrological services, and promote the management of water resources and environmental services, the development of flood and drought EWS, and the analysis of climate change impacts in the Pacific.
11. The need to improve the collection, management, and availability of long-term hydrometric datasets, as well as the requirement for a fit-for-purpose hydrological database has been identified at country and regional forums over the past decade and as regional priorities in the Pacific Islands Meteorology Strategy (2017-2026) (PIMS). However, progress is uncoordinated and slow due to the absence of a clear strategy that brings together central agencies dealing with hydrological data at both the country and regional level. Furthermore, no resourcing has been allocated to document the requirements for a hydrological database at a country or regional level to ensure standardisation of software and support at these scales.

Proposed approach

The PHSP therefore recommends addressing the hydrological data and database issues experienced at a national level using a regional approach. The benefit of a regional approach to this issue includes standardisation, regional support, peer-to-peer learning, and leveraging regional funding. Note that this is not recommending a regional database, rather a database solution suitable for the region available to countries to be implemented at a national scale. Countries would be responsible for importing, managing, and maintaining their hydrological datasets, retaining sovereignty over their data and its accessibility, while benefitting from the technical support and cost benefits that a regional approach can leverage. The proposed strategy will require programmatic and dedicated funding over a number of years to provide support to countries and ensure success, as indicated by other initiatives such as the meteorological database CliDE (Climate Data for the Environment).

An outline of the proposed approach is as follows.

Stage 1 - Data stocktake

Member countries undertake a stocktake of current and historical hydrological datasets, including associated site metadata to understand the current status of hydrological data record, quality assurance and quality control processes, current data analysis requirements, and end users of data.

Stage 2 - Identification of minimum of requirements of Pacific database needs

- Identification of minimum requirements for a hydrological database suitable for the Pacific; including data processing, storage, analysis, and management applications.
- Undertake an assessment of current and future ICT requirements associated with updated databases.

Stage 3 - Database evaluation and recommendation

- Explore suitable hydrological database options, as informed by the countries database requirements, through pilot investigations.
- Consider the sustainability for long-term upkeep of selected hydrological databases.
- Use existing regional hydrological forums, such as the PHSP, to share knowledge regarding the advantages and disadvantages of various software.
- Provide a recommendation of a hydrological database standards that is accepted and supported across the region, offering a sustainable solution to the management of national hydrological data.

Recommendations

The Meeting is invited to:

- **Note** that hydrological data forms the basis of impact-based flood and drought early warning.
- **Note** existing hydrological databases and associated tools used in the region are limiting the NHS's ability to quality assure, analyse, apply, and share hydrological data at a national and regional level.
- **Note** the need to address hydrological data and database issues has been reiterated as a high priority for countries and the region.
- **Acknowledge** the important role that the TIDEDA software has played in the region and recognise that a database transition is a generational shift that requires careful planning and management.
- **Recommend** for regional technical agencies, led by SPC and including SPREP, NIWA, Bureau of Meteorology and WMO, to identify national hydrological data and database needs and subsequently undertake a feasibility study to develop a strategy addressing the documented needs.