

evaporation is a process of vertical diffusion.

The tank evaporimeter might be expected to yield acceptable indications of evaporation from larger water surfaces under certain conditions and for long periods, say a year. But for shorter times its predictions may be erratic and unreliable and, in extreme cases, quite misleading. In any case the evaporimeter cannot be accepted as a meteorological instrument.

The merits and limitations of the various methods for measuring evaporation, based on one or other of the physical requirements, were discussed and, provided accurate measurements of net radiation can be made, the energy balance chosen as best. But radiation estimates based on climatological formulae are inadequate.

The work of Penman and Ferguson was summarised, and the recommendation made that the simplest procedure in the use of these methods, if radiation equipment is available, would be to determine the temperature of the water surface directly by measurement and then substitute in the appropriate 'sink-strength' formula for water vapour transfer.

The 'aerodynamic' methods (Thorntwaite - Holzman - Pasquill) were outlined. Their restriction to short periods, and the complications introduced under non-neutral conditions, were noted. Finally, the 'eddy-correlation' technique, developed in the Division of Meteorological Physics, C.S.I.R.O., was explained, and its potentiality for measuring natural evaporation under practically any condition emphasised. Progress in the mechanisation of the method was reported.

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Evaporation Pan Coefficients in Australia

by C.E. Hounam

Mr. Hounam of the Bureau of Meteorology defined pan coefficient as the ratio E_p/E_t where E_p is the lake evaporation and E_t that from a pan or tank.

Coefficients have been measured at several overseas storages but these cannot be applied in Australia as they apply to a different type of tank.

The water loss from a large storage has been estimated using Penman's equation. As this requires a knowledge of radiation the newly established Australian network has been used to develop an empirical relationship which enables radiation to be estimated from sunshine.

The estimated pan coefficients obtained for three stations by using Penman's equation and pan evaporation suggest a decrease in the value of the coefficient towards the interior of Australia. This is substantiated to some extent by recent observations from large diameter pans at Kirkleigh and Griffith, i.e., a smaller value of the coefficient is indicated at Griffith which has a considerably drier climate than Kirkleigh. If this is true the result is important because losses from larger storages in the interior of Australia would be considerably less than the very high rates indicated by the pan evaporimeters. They would also be less than indicated by the application of the often applied approximate coefficient 0.9 to the pan evaporation.

It was concluded that too much weight has been placed on the value of the evaporation tank as a method of observing water loss.

In the discussion Mr. Swinbank stated -

"I support Mr. Hounam's remarks on the need for extension of the radiation network. This would provide material indispensable to a proper evaluation of natural evaporation through the energy balance approach. But I cannot agree with his proposal to use the radiation measurements to estimate evaporation from future water storages via Penman's formula. Application of the formula to determine the evaporation from an existing water surface in terms of meteorological elements appropriate to that surface could be expected to give satisfactory results, with some reservations concerning the assumptions made by Penman. Extension to a freely transpiring vegetative cover might be made with less enthusiasm. But to use the net radiant energy, temperatures and saturation deficits measured over dry regions of the interior to estimate the evaporation which would ensue were a water storage to be made there is totally unjustifiable, as examination of the formula readily shows.

"Pan coefficients so based would be quite unrealistic. Mr. Hounam's suggestion to abandon tank

evaporimeters in favour of this approach seems to be a case of forsaking the substance for the shadow."

Dr. Priestley supported Mr. Swinbank's remarks and stated that Brunt's formula for the net flux of long wave radiation, which is incorporated in Penman's equation, has not been tested for Australian conditions. It was desirable that this be done for stations in the Australian radiation network.