

RECOMMENDATIONS

1. The network of observations in the mountainous areas are usually sparse. There is a need to instrument watersheds appropriately with automatic data collection system especially in the high altitude areas. There is a need of development of adequate snow monitoring system with data transmission to central data collection system to enable a proper hydrological analysis of mountainous catchments.
2. For hydrological investigations in the mountainous catchments, the modern high technology systems of nuclear applications and remote sensing satellite information have to be developed.
3. Appropriate instruments and data acquisition systems for high altitude catchments need to be developed.
4. The development of indigenous instruments needs to be taken up on priority basis so that Indian instruments may be installed in different watersheds of the country more particularly to the mountainous catchments.
5. Since hydrologic analysis of mountainous catchments requires large amount of data on land use, soil type, soil erosion characteristics and water availability, there is a need to develop a data storage and retrieval system with a standard format to cover these elements along with the hydrometeorological and geomorphological data systems.
6. Representative basins form an essential component in the development of hydrological models. The representative basin studies need to be taken up to derive the hydrological parameters for use in the models.
7. Development of suitable hydrological models with multi resource simulation approaches are needed to take care of the mountain ecosystem for development of water resources and land management. An appropriate geographical information system has to be developed as a part of the watershed models to assist in the development of hydrological models.
8. A realistic assessment of the water resources of the hilly regions is essential for their judicious management. Water balance studies have, therefore, to be taken up for the proper evaluation of the water resources.
9. The floods in the mountainous areas have their unique characteristics especially the flash floods resulting from rainfall, snowmelt and glacial melt. To have an appropriate flood management system in the mountainous areas, suitable techniques need to be developed and adopted for the above situations.
10. The application of the conventional approaches for estimation of design flood in the mountainous areas should be examined and if necessary appropriate approach for the same may be developed. The approach to compute PMP which is used for the design flood estimation needs to be reviewed and suitably modified.
11. The glaciers as a source of water from the mountainous areas have not been adequately investigated. There is a need to have a planned system of expeditions to selected glaciers to arrive at mass balance, recession and accumulations and melt characteristics.
12. Appropriate models need to be developed for estimation of snow and ice melt yield from the watersheds and for flow forecasting.

13. Due to large scale removal of the land cover of forest and grasslands, there is a considerable degradation of land and the environment. An appropriate land and water management practice may be developed for management of watersheds which are likely to be degraded. Appropriate models to estimate soil loss and management of land to control the soil loss and sediment need to be developed. A task force needs to be set up to identify the problems and suggest adequate measures to be taken for this important area.

14. The climatic change is expected to cause temperature rise and increased snow melt. The study of impact of climatic change on regional basis for the mountainous catchments with permanent and seasonal snow cover is an important area for investigation.

15. High altitude lakes provide a useful source of water for water supply, irrigation, and hydropower development in mountainous region. The estimation of water availability, reduction in capacity due to sedimentation, and water quality problems need to be studied for judicious use of these water resources.

16. Springs are an important source of water for domestic use and irrigation in the mountainous areas. Impact of land use changes on their behaviour is a matter of concern and special attention is needed towards understanding the hydrology of spring flow.