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The three neutrino mixing scenario under the next atmospheric measurements

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We analyze the expected sensitivity of current and near-future water(ice)-Cherenkov atmospheric neutrino experiments in the context of standard three-flavor neutrinos oscillations. In this first in-depth combined atmospheric neutrino analysis, we analyze the current shared systematic uncertainties arising from the shared flux and neutrino-water interactions. We then implement the systematic uncertainties of each experiment in detail and develop the atmospheric neutrino simulations for Super-Kamiokande (SK), with and without neutron-tagging capabilities (including SuperK-Gd), IceCube-Upgrade, and ORCA detectors. We carefully review the synergies and features of these experiments to examine the potential of a joint analysis of these atmospheric neutrino data in resolving the octant of the atmospheric mixing angle at 99% C.L. and determining the neutrino mass ordering above 5σ by 2030. Additionally, we assess the capability to constraint
the reactor mixing angle and the CP-violating phase in the leptonic sector independently from reactor and accelerator neutrino data, providing vital information for next-generation neutrino oscillation experiments such as DUNE and Hyper-Kamiokande.

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