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Variability and trends in streamflow input to Hudson Bay, Canada

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This presentation will explore the variability and trend in streamflow input to Hudson Bay (including James Bay), Canada, over 1964-2008. Twenty-three rivers, spanning a maximum gauged area of 2.53×10^6 km^2, are chosen for this study. These rivers collectively transport 521 km^3 of freshwater to Hudson Bay each year. Adjusting this value for the missing contributing area yields a total annual freshwater flux of 762 km^3 into Hudson Bay. The standard deviation and coefficient of variation in annual streamflow input to Hudson Bay reach 48.9 km^3 and 0.09, respectively. The monotonic trend assessed with a Kendall-Theil Robust Line shows no detectable (|signal-to-noise ratio| < 1) change in total discharge into Hudson Bay over 1964-2008; however, further analyses reveal a detectable 16% decline in annual streamflow input to Hudson Bay for 1964-1989 followed by a detectable 26% increase over 1989-2008, marked by a record discharge of 633 km^3 in 2005. There is a notable shift in the seasonality of Hudson Bay discharge over time, with a detectable positive (negative) trend in winter (summer) streamflow from 1964 to 2008. Annual hydrographs for regulated and natural rivers over two periods suggest these changes arise from the storage of water in reservoirs during spring and summer that is later released for the generation of hydroelectricity in fall and winter. The naturally-flowing rivers show a marked decline in the variability of daily streamflow input to Hudson Bay in recent years while the opposite trend is found in the regulated systems. The recent diversion of 19 km^3 yr^{-1} or 71% of the annual streamflow from the Rupert River northward into La Grande Rivière for enhanced power production will further exacerbate the streamflow timing shifts observed in Hudson Bay. The talk will end with a brief discussion of the potential impacts of flow regulation on the Hudson Bay marine environment.