Extremal dependence of the losses in a portfolio is one of the most important features that should be accounted for when estimating Value-at-Risk (VaR) at high levels. Max-stable processes provide a principled framework for the modeling and estimation of extremal dependence. In practice, however, this involves dealing with a challenging infinite dimensional parameter. Here, following recent developments in Strokorb and Schlather (2013), we propose to represent extremal dependence via the Tawn–Molchanov (TM) model, which is finite dimensional. Every max-stable random vector $X$ can be associated with a TM max-stable vector $Y = \text{TM}(X)$ so that the extremal coefficients of $X$ and $Y$ match and at the same time $Y$ stochastically dominates $X$ in the lower orthant order. This result readily yields an optimal upper bound on the Value-at-Risk $\text{VaR}_\alpha(X^\vee)$ of the maximum portfolio loss $X^\vee := \max_{j=1,\ldots,d} X_j$. We discuss some challenges in extending our framework to bound Value-at-Risk for the sum of dependent losses. (Received September 08, 2014)