

## **Lake-Mountain synergy in convective clouds and precipitation over the Tibetan Plateau: a large-eddy simulation study**

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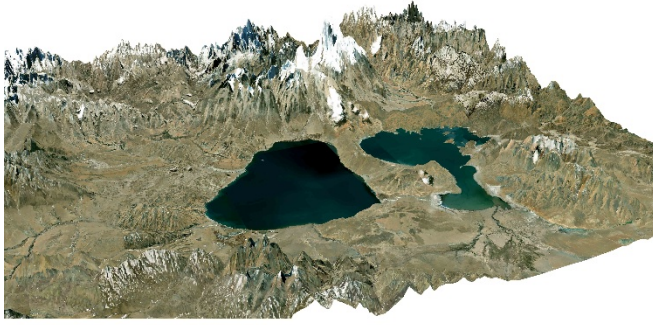
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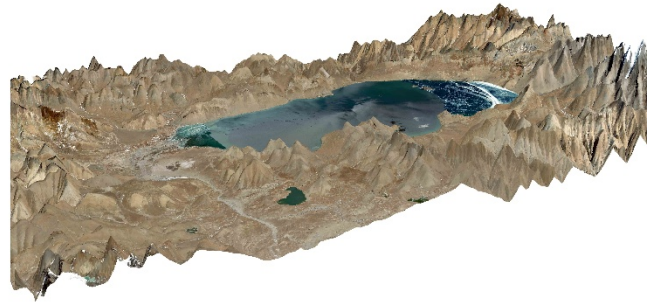
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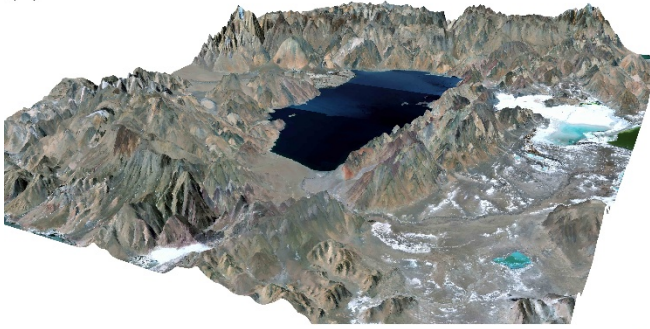
(a) Mapam Yumco



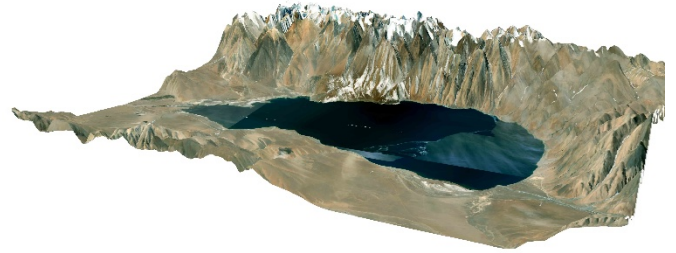
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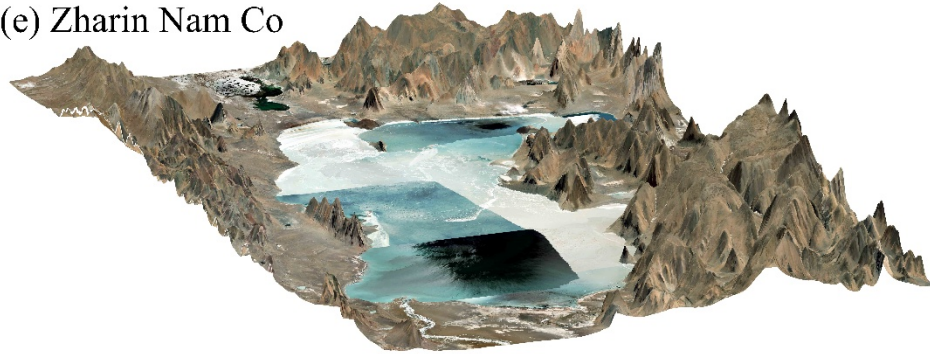
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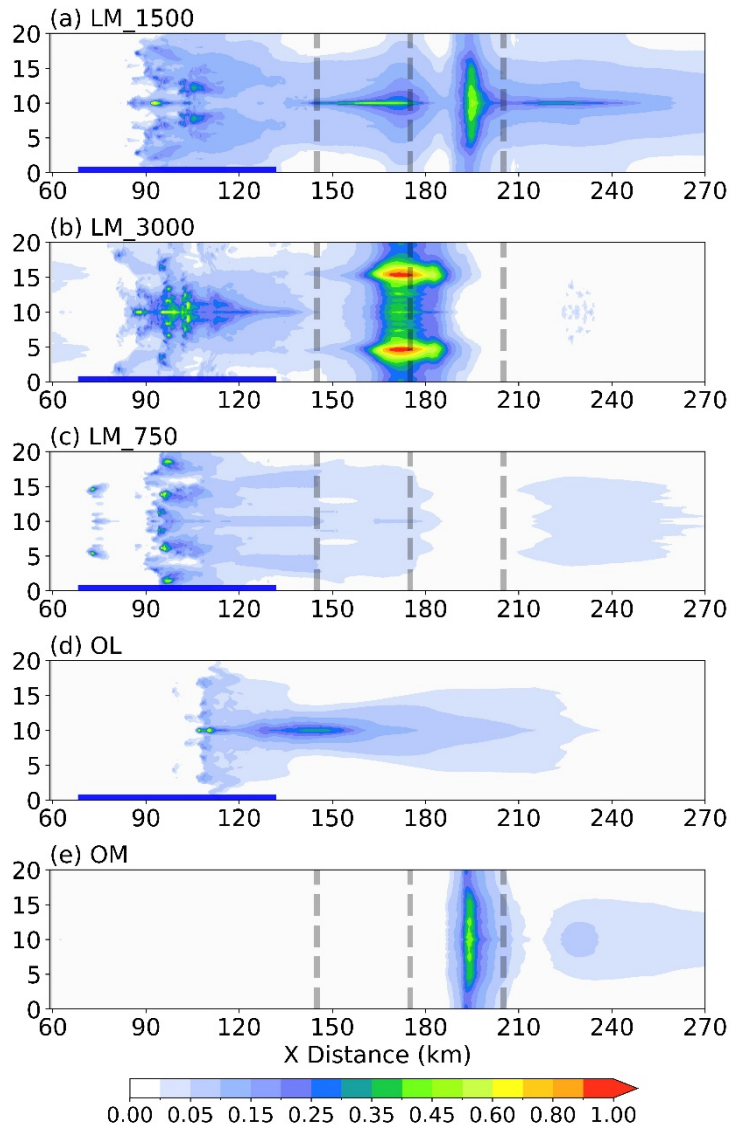
(d) Xuru Co



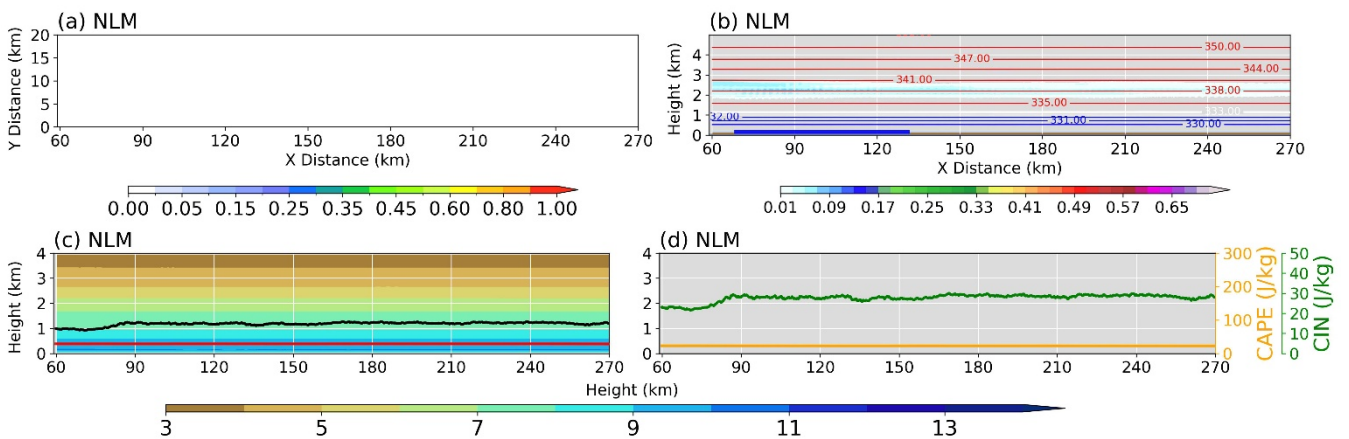
(e) Zharin Nam Co



**Figure S1.** Map of a typical lake-mountain configuration over the TP, derived from Landsat imagery and SRTM topographic dataset.

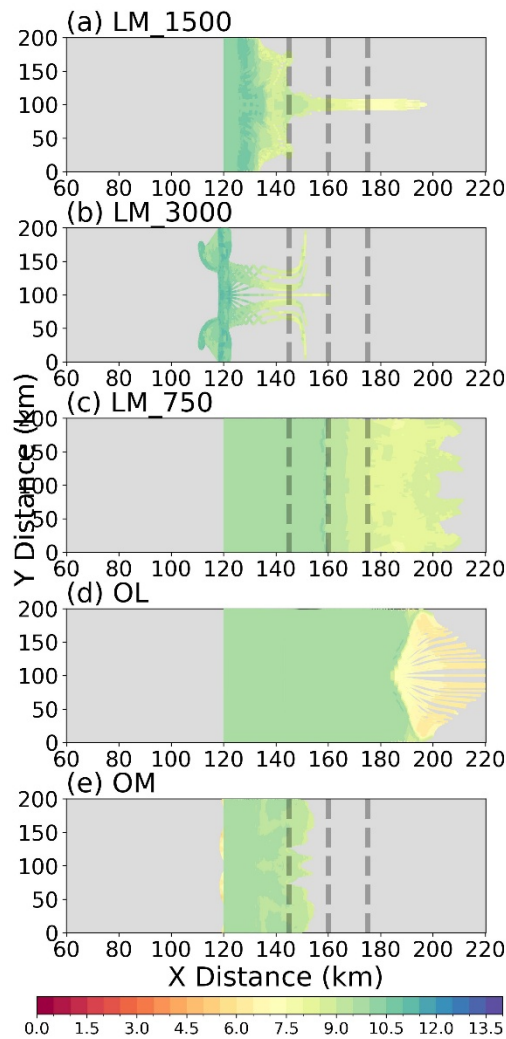


**Figure S2.** (a) Time-mean precipitation rate ( $\text{mm h}^{-1}$ ) of 20 h in LM\_1500. The thick blue line indicates the lake area ( $x=70\text{-}130$  km), and the gray dashed lines mark the windward foothill ( $x=145$  km), mountain summit ( $x=175$  km), and leeward foothill ( $x=205$  km). (b), (d), (f), (h) As in (a), but for the LM\_3000, LM\_750, OL, and OM, respectively. (c) Difference in time-mean precipitation rate ( $\text{mm h}^{-1}$ ) between LM\_3000 and LM\_1500. (e), (g), (i) As in (c), but showing the differences for LML, OL, and OM relative to ML.



**Figure S3.** (a) Time-mean precipitation rate ( $\text{mm h}^{-1}$ ) of 7-20 h in NLM; (b) Vertical cross sections of the 7-20 h

time-mean, 15-km  $y$ -averaged (over the central domain) total hydrometeor mixing ratio (shading,  $\text{g kg}^{-1}$ ) in the NLM. The potential temperature (blue-to-red contour lines, K) and vertical velocity (black dashed contour lines, only plotted positive values,  $\text{m s}^{-1}$ ). The vertical velocity field is smoothed with a  $20 \times 20$ -point uniform filter; (c-d) Vertical cross sections of the 7-20 h time-mean, 15-km  $y$ -averaged (over the central domain) water vapor mixing ratio (shading,  $\text{g kg}^{-1}$ ) in the NLM. The left panels (a) show the lifted condensation level (LCL; red lines) and the level of free convection (LFC; black lines). The right panels (b) show the surface-based convective available potential energy (CAPE; orange lines, right axis) and convective inhibition (CIN; green lines, left axis) along the cross section. The thick blue line represents the lake surface, and the gray shading represents the terrain height (m).



**Figure S4.** Forward trajectories of water vapor ( $\text{g kg}^{-1}$ ) tracer particles released at  $x = 120$  km and  $z = 50$  m in experiments with lake presence, including (a) LM\_1500, (b) LM\_3000, (c) LM\_750, (d) OL and (e) OM. The left column shows particle trajectories projected onto the  $x$ - $y$  plane.