Tropical coastal dehydrator in global atmospheric water circulation: An overview

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Summary
• A conceptual advance of the global water cycle
  • The precipitation concentrated in tropical coastlines
  • The role of an atmospheric dehydrator between the ocean and land
• New insights on
  • Climate maintenance and change
  • Direct freshwater supply over the coastal ocean

Background and objectives
• Previous view of ocean-land water circulation: evaluated at the coastline alone
• Satellite observation revealed dominance of tropical coastal precipitation
• Objectives
  1. How much is the precipitation amount over the tropical coastal region?
  2. Re-examine the ocean-land water circulation taking into account tropical coastal precipitation

Methods
• Data
  • TRMM 3A25 Precipitation, 0.5°x0.5°, 37°S–37°N, 1998-2011 (13 years)
  • JRA-55 Column water vapor flux, Precipitation, Evaporation, 1.25’x1.25’, Global, 1981-2010 (30 years)
  • GLOBE elevation, 30”x30”, Global
  • Distance from the coastline (DFC)
  • Defined as a distance between each data cell and the nearest coastline
  • Precipitation as a function of DFC
  • Calculated from TRMM precipitation at each 50-km DFC bin
  • Landward water vapor transport L:
    • calculated from JRA-55 column water vapor divergence assuming water budget relation (divQ=E-P)

Results
How much is the tropical coastal precipitation?

Ocean-land water circulation

Discussions
• Climate maintenance and change
  • Rainwater volume due to tropical coastal precipitation: 1 x 10¹⁴ m³/yr, which corresponds to 10% of global
    and must considerably contribute the maintenance of global climate (Yamanaka et al., 2018).
  • The maritime continent with the world’s longest coastline may produce the largest precipitation on Earth, which sustains the current Earth’s global climate (Yamanaka, 2016).
• Coral reef change due to the sea level change, and continental aggregation and dispersal cause climate changes through the distribution and intensity changes in the coastal precipitation and the water circulation
• Direct freshwater supply over the coastal ocean
  • Significant amount of net freshwater is supplied from the atmosphere to the coastal ocean, which is comparable to that of the land water discharge
  • A new insight on the ocean salinity distribution and its associated dynamics, and on the freshwater distribution.

Publications

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