

Tropospheric Lapse Rate and its Relation to Surface Temperature for warm and cold seasons from Reanalysis Data

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Estimates of the tropospheric lapse rate γ and analysis of its relation to the surface temperature T_s in the interannual variability have been made using the global monthly mean data of the NCEP/NCAR reanalysis (1948 - 2001), in particular for warm (August) and cold (January) seasons. The tropospheric lapse rate γ for January is about 5.9 K/km in the Northern Hemisphere (NH). Over the ocean is about 6.0 and about 5.7 K/km over the continents. For August this value is about 6.3 K/km and 6.2 for ocean and 6.4 for continents. The value of γ has a maximum for the NH as a whole in August (7.0 K/km) and minimum (3.5 K/km) in January (Fig. 1).

The values of $d\gamma/dT_s$ (Fig. 2), the parameter of sensitivity of γ to the variation of T_s for the NH in the interannual variability, are found for January to be about 0.06 km⁻¹ (0.060 km⁻¹ for the NH as a whole, 0.055 km⁻¹ over the ocean, and 0.061 km⁻¹ over the continents). These values for August are about 0.038 km⁻¹ (0.038 km⁻¹ for the NH as a whole, 0.043 km⁻¹ over the ocean, and 0.038 km⁻¹ over the continents).

Positive values of $d\gamma/dT_s$ characterize a positive climatic feedback through the lapse rate and indicate a general decrease in the static stability of the troposphere during global warming (Mokhov and Akperov, 2006)(see also Mokhov 1983). Along with a general tendency of γ to increase with rising T_s , there are regional regimes with the opposite tendency, mainly over the ocean. The negative correlation of γ with T_s is found over the oceanic tropics and midlatitudes, in particular, over the oceanic belt around Antarctica (Mokhov 1993).

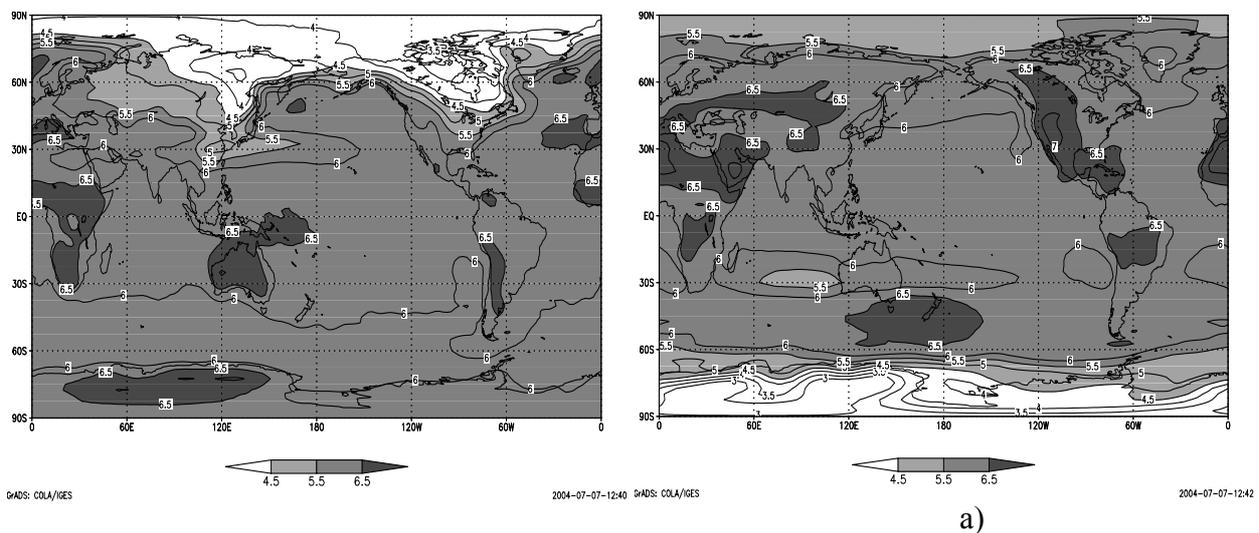


Fig. 1. Geographical distribution of annual mean γ [K/km] for January (a) and August (b).

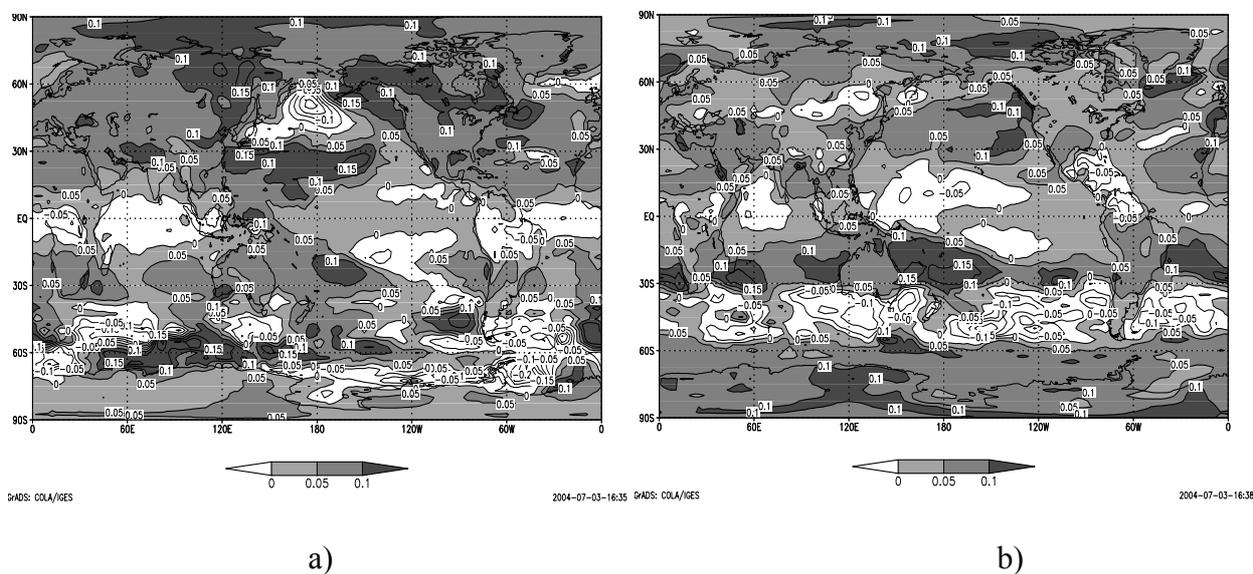


Fig. 2. Geographical distribution of coefficients of regression of γ [K/km] to T_s [K] for January (a) and August (b).

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References

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