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Modeling of Ionospheric Responses to the Solar Flux Change Based on Millstone Hill Incoherent Scatter Radar

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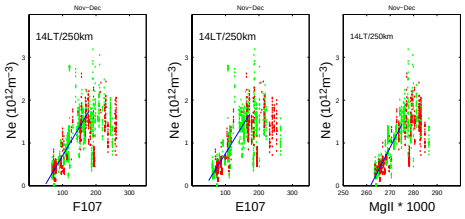
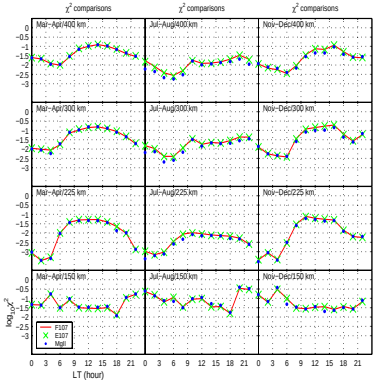
Data

MH IS radar data during 1970-2001
Within 5^{o} latitudes of the radar
http://www.openmadrigal.org

Ne and Solar Flux Indices

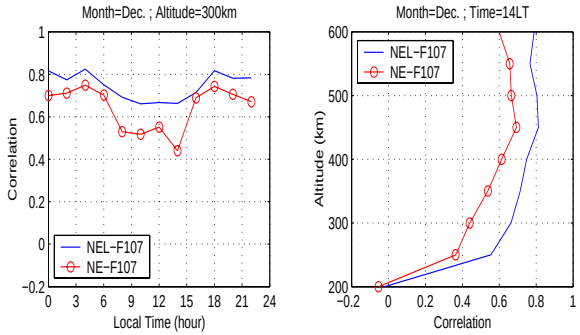


Saturation of electron density responses to solar flux represented by (a) *F107* index, (b) *E107* index, and (c) *MgII* core-to-wing index. The green dots are for quieter geomagnetic conditions with Ap index smaller than its average for the entire data of this bin. The rest part of data is represented by red dots.

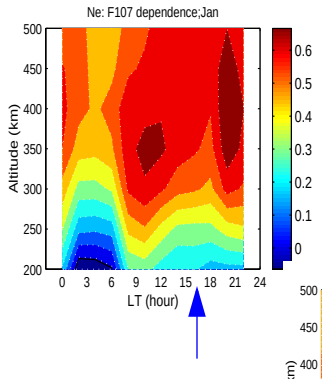


For a given altitude, time and season, Ne model can be obtained using certain solar flux index to represent the solar activity dependence. Three solar indices were tested to determine the best in terms of giving smallest model-data difference (goodness of fit; χ^2). Results show that deviations of model values given by these indices to data are practically the same, regardless of altitude,local time, and season, indicating that the long-term behavior of the these indices are identical in representing Ne changes..

NEL (logNe) and F107

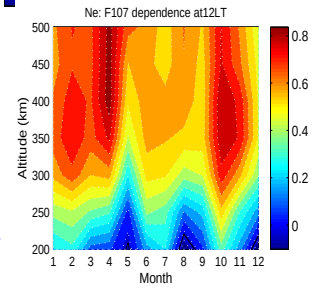


The correlation coefficient between log(Ne) and F107 are higher than that between Ne and F107.



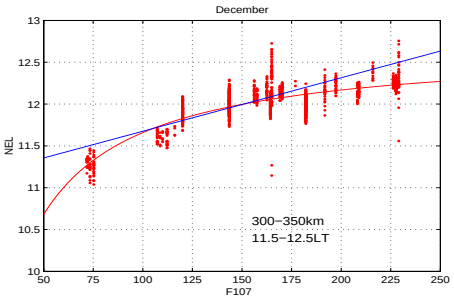
NEL dependence on F107. Contours are for the gradient dNEL/dF107, defined as the slope of the straight line for linear regression of NEL to F107.

NEL responses are stronger in equinox, and weaker in summer. NEL is less sensitive in 200-250 km to F107 changes.



F107p: Modified F107

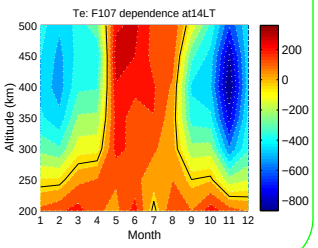
F107p = (F107-64)/(1+c(F107-64))+64;
c=0.015



Data points are as a function of F107p and NEL. Blue line: F107; Red line: F107p. .It is found that F107p better represents NEL than F107 does.

TE Responses to F107

With increasing solar activity, Te tends to decrease in winter and increase in summer. Contours are for the gradient dTe/dF107, defined as the slope of the straight line for linear regression of Te to F107



We thank W. Kent Tobiska for supplying the SOLAR2000 model. The *MgII* c/w data has been obtained through the WWW site http://sec.noaa.gov/ftpmenu/sbuv.html.