

A directional noise model for optimising HF communications

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Atmospheric noise is a critical factor in determining the performance of HF radio communications systems. System calculations are normally performed using the noise model developed by the CCIR (CCIR Report 322-3, ITU Geneva, 1988), a model that provides global maps of noise as a function of time and season. The most difficult element in the modelling is the atmospheric noise, an element that is dominant during the night. This element results from radio waves that have been generated by thunderstorms across the globe and then propagated via the ionosphere to the receive site. The thunderstorms, which vary strongly with time and season, occur predominantly over the continental masses. Kotaki and Katoh (M.Kotaki and C.Katoh, JATP, vol.45,1984) have produced a global model of lightning occurrence through satellite observations of noise and Kotaki (M.Kotaki, JATP, vol.46, 1984) has shown that this, together with some elementary propagation calculations, can provide noise predictions that are an improvement on those provided by the CCIR model. The main problem with this and the CCIR approach is that they assume noise to be isotropic. It is clear, from both the distribution of thunderstorms and observations using directive antennas, that noise is highly directional. Consequently, it is the purpose of the current work to develop noise models that includes the directional aspect. The lightning maps of Kotaki and Katoh are combined with sophisticated propagation calculations to produce such a model. This model is then used to investigate the impact of noise directionality upon communication systems. In particular, the model is used to investigate the properties of a variety of receiving antennas.