Ocean 50 year temperature trend fields are determined through a robust multiple regression parametric fit to a carefully checked global ocean temperature archive. The archive consists of all historical data from 1960 - 2008, with poor accuracy Mechanical Bathythermographs removed, fall-rate corrected eXpendable Bathythermographs, CTD and bottle data. Pressure-corrected Argo data are also used from 1999 onwards. Temperature responses to major interannual and decadal climate modes are fit simultaneously with a 50 year trend and seasonal cycle, to help reduce any biases caused by aliased natural variability. Patterns of 50 year linear ocean temperature changes are statistically robust and reveal common mechanisms in separate ocean basins: warming of the ventilated thermocline, a poleward shift of Southern Hemisphere subtropical gyres and intensification of Northern Hemisphere western boundary currents. In the tropics, the Pacific equatorial thermocline flattens with the subsurface cooling transmitted to the South Indian Ocean via the Indonesian Throughflow. The fastest warming basin down to 2000m is the Atlantic. Many of these warming patterns are reproduced in 20th century ensembles of the Coupled Model Intercomparison Program's model runs. However in the CMIP ensembles, regional contrasts are weaker, but more importantly, the models are mixing the warming signal much deeper than is observed. In essence, the simulated climate thermal inertial is much larger than reality.