The Model Diagnostics Task Force of the NOAA MAPP program is developing a software framework to more easily integrate community process-oriented diagnostics into climate and weather forecasting model evaluation packages so that they can more efficiently inform the model development process. In this presentation, we will discuss the concept of this framework that includes a set of software tools and best practices for implementation of diagnostics into the standard evaluation packages of the NCAR and GFDL climate models. Examples of the types of diagnostics that we are developing will also be presented, including those related to the Madden-Julian oscillation (MJO). In particular, we will employ tropical weak temperature gradient balance to diagnose the major MJO moistening processes in reanalysis, a climate model with a good MJO (SP-CESM), and a model with poor MJO activity (OLAM). It is shown that radiative feedbacks help to destabilize the MJO in observations and Sp-CESM, whereas radiative feedbacks in OLAM are weak and insufficient to overcome strong drying processes associated with a vertical convective heating profile that is too top-heavy and efficient at drying the column. Diagnostics related to MJO teleconnections will also be applied to CMIP5 models, highlighting reasons for severe teleconnection biases even in models that produce good tropical MJO variability. Biases in the upper tropospheric mean flow and their impact on Rossby wave propagation to higher latitudes are a major determinant of model success in producing realistic MJO teleconnections.