Title: Land-surface modeling in numerical weather prediction models.

Michael Ek
Environmental Modeling Center
NOAA/NCEP
W/NP5 National Science. Center
5200 Auth Road, MD 20746 Camp Springs, USA

Abstract: A land-surface model (e.g. the NCEP/NCAR "Noah" land model) provides bottom boundary conditions for numerical weather prediction and climate models. These boundary conditions ("surface fluxes") are in the form of reflected solar radiation, emission of longwave radiation, and the turbulent exchange of heat, moisture, and momentum with the lower atmosphere, along with heat movement into and out of the soil. The magnitude of each of these processes is a function of near-surface meteorology, i.e. incident radiation, precipitation, temperature, humidity, wind speed, and pressure, and depends the surface conditions, i.e. vegetation type, soil texture, surface roughness, and whether the surface/soil is vegetated or bare, wet or dry, snow-covered or snow-free, frozen or not (and degrees in between). Model formulations provide valid representations of the surface physics involved (turbulent exchange, plant, soil, snow, ice processes) to yield surface fluxes to be passed to a "parent" atmospheric model. For example, stronger or weaker surface heating depends on the moisture fluxes and momentum mixing (winds), and can yield different boundary-layer structure (shallow/deep, warm/cold, moist/dry) which can then e.g. affect convection, precipitation, pollution concentrations, downstream airmasses, etc. In order to calculate these surface fluxes, we explore what is required to run land-surface models.