Geophysical Research Abstracts,
Vol. 11, EGU2009-9992, 2009
EGU General Assembly 2009

Error structure in simulated and measured snow cover information

S. Kolberg and K. Engeland

SINTEF Energy Research, Energy Systems, Trondheim, Norway (Sjur.Kolberg@sintef.no, 47 73947250)

The use of satellite data in calibration and updating of snow cover models require an assessment of the error structure in order to assimilate the remotely sensed information with other types of data. In particular for grid distributed models, the spatial covariance needs to be modelled in order to avoid over-conditioning on the potentially very high nominal number of measurements.

It is shown that use of the Normalised Difference Snow Index (NDSI) directly as the interface variable, rather than re-scaling and truncating to fractional snow covered area (SCA), facilitates the use of a Normal error model, and removes the most dramatic heteroscedasticity. The dependency of simulated and measurement errors on forest cover, elevation and terrain exposure is analysed, as is the spatio-temporal correlation structure of these errors.

Table 1 summarises the most important reasons why an assumption of independent errors (like when multiplying single-observation likelihood terms) is likely to cause over-conditioning. An alternative error model attempting to provide a more realistic assessment of the information content in the data is proposed.

Table 1: Imperfections degrading the performance of a simple multiplicative error model. Spatial connectivity of terrain attributes also yields spatially correlated errors.

Redundancy source	Measured values	Simulated values
Spatial autocorrelation	Imperfect atmospheric correction (image specific)	Errors in the snow storage or melt depth GMRF surfaces Bias in elevation gadients
Temporal autocorrelation	Temporally stable (but spatially heterogeneous) bare ground reflectance	Biased melt rate Albedo-melt feedback Non-Gamma distribution Sub-grid heterogeneous melt
Correlation with terrain attributes	Heterogeneous snow reflectance (fresh / ripe snow) Heterogenous illumination Varying forest cover	Biased elevation gradient in storage or melt depth. Errors in albedo or radiation simulations
Heteroscedasticity	Varying NDSI sensitivity to snow and bare ground reflectance	Varying SCA sensitivity to melt depth Deviation from NDSI-SCA transformation model