Three review papers, the first two address numerical simulation of hydrothermal simulations, the third the capabilities of our program suite "CSMP" in a hydrocarbon context.

Ingebritsen, S. E., Geiger, S., Hurwitz, S., and Driesner, T., 2010. Numerical Simulation of Magmatic Hydrothermal Systems. *Reviews of Geophysics* 48, RG1002

Driesner T. and Geiger S. (2007) Numerical simulation of multiphase fluid flow in hydrothermal systems. In *Fluid-Fluid Interactions* (A. Liebscher and C.A. Heinrich, eds.) *Reviews in Mineralogy and Geochemistry* 65, pp. 187-212.

Matthäi S.K., Geiger S., Roberts S.G., Paluszny A., Belayneh M., Burri A., Mezentsev A., Lu H., Coumou D., Driesner T. and Heinrich C.A. (2007) Numerical simulation of multi-phase fluid flow in structurally complex reservoirs. In: *Structurally Complex Reservoirs* (S.J. Jolley, D. Barr, J.J. Walsh and R.J. Knipe, eds) *Geological Society, London, Special Publications* 292, 405-429.

In my opinion, the following two papers laid the foundation of modern numerical simulation of hydrothermal systems:

Faust, C. R., and J. W. Mercer (1979a), Geothermal reservoir simulation: 1. Mathematical models for liquid- and vapor-dominated hydrothermal systems, Water Resour. Res., 15, 23–30, doi:10.1029/WR015i001p00023

Faust, C. R., and J. W. Mercer (1979b), Geothermal reservoir simulation: 2. Numerical solution techniques for liquid- and vapor-dominated hydrothermal systems, Water Resour. Res.,15, 31–46, doi:10.1029/WR015i001p00031

From Faust's and Mercer's work, the code "HYDROTHERM" originated. A few important papers done with that program:

Ingebritsen, S. E., and D. O. Hayba (1994), Fluid flow and heat transport near the critical point of H_2O, Geophys. Res. Lett., 21, 2199–2203.

Hayba, D. O., and S. E. Ingebritsen (1997), Multiphase groundwater flow near cooling plutons, J. Geophys. Res., 102, 12,235–12,252, doi:10.1029/97JB00552 *(a must read)*

Hutnak, M., S. Hurwitz, S. E. Ingebritsen, and P. A. Hsieh (2009), Numerical models of caldera deformation: Effects of multiphase and multicomponent hydrothermal fluid flow, J. Geophys. Res.,114, B04411, doi:10.1029/2008JB006151.

Hurwitz, S., K. L. Kipp, S. E. Ingebritsen, and M. E. Reid (2003), Groundwater flow, heat transport, and water table position within volcanic edifices: Implications for volcanic processes in the Cascade Range, J. Geophys. Res., 108(B12), 2557, doi:10.1029/2003JB002565.

Hurwitz, S., L. B. Christiansen, and P. A. Hsieh (2007), Hydrothermal fluid flow and deformation in large calderas: Inferences from numerical simulations, J. Geophys. Res., 112, B02206, doi:10.1029/2006JB004689.

Our papers on seafloor hydrothermal systems so far (based on CSMP simulations). The first one employs the full properties and phase relations of saltwater to magmatic temperatures and finds interesting explanations for transient salinity variations etc. The second uses the *same scheme to explore the efficiency with which saefloor systems transfer heat as a function of permeability. The others deal with unexpected self-organization of hydrothermal plumes.*

Coumou D., Driesner T., Weis P., and Heinrich C. A. (2009) Phase separation, brine formation, and salinity variation at Black Smoker hydrothermal systems. *Journal of Geophysical Research – Solid Earth* 114, B03212.

Driesner T. (2010): The interplay of permeability and fluid properties as a first order control of heat transport, venting temperatures and venting salinities at mid-ocean ridge hydrothermal systems. *Geofluids 10th Anniversary Volume* 10, 132-141.

Coumou D., Driesner T., Geiger S., Paluszny A., and Heinrich C. A. (2009) High-resolution three-dimensional simulations of mid-ocean ridge hydrothermal systems. *Journal of Geophysical Research – Solid Earth* 114, B07104.

Coumou D., Driesner T. and Heinrich C. A. (2008) The structure and dynamics of mid-ocean ridge hydrothermal systems. *Science* 321, 1825-1828.

Coumou D., Driesner T. and Heinrich C.A. (2008) Heat transport at boiling, near-critical, conditions. *Geofluids* 8, 208-215.

Coumou D., Driesner T., Geiger S., Heinrich C. A., and Matthai S. (2006) The dynamics of mid-ocean ridge hydrothermal systems: Splitting plumes and fluctuating vent temperatures. *Earth and Planetary Science Letters* 245(1-2), 218-231.

Two papers that document our model for the system H2O-NaCl as we developed it to be able to do advanced simulations of magmatic-fluid-dominated, supra-subduction magmatic-hydrothermal systems

Driesner, T., and Heinrich, C.A. (2007): The System H_2O-NaCl. I. Correlation Formulae for Phase Relations in Temperature-Pressure-Composition Space from 0 to 1000°C, 0 to 5000 bar, and 0 to 1 X_{NaCl}. *Geochimica et Cosmochimica Acta* 71, 4880-4901.

Driesner, T (2007): The System H_2O-NaCl. II. Correlations for molar volume, enthalpy, and isobaric heat capacity from 0 to 1000 degrees C, 1 to 5000 bar, and 0 to 1 X-NaCl. *Geochimica et Cosmochimica Acta* 71(20), 4902-4919.

These are the initial papers on the CSMP numerical method – the finite element / finite volume part is well documented, however, we hadn't gotten the thermodynamics fully right at that stage, so ignore everything that has to do with phase relations, heat capacity and enthalpy in there (that old approximation is probably not too bad but, nevertheless, not strict):

Geiger, S., Driesner, T., Matthäi, S.K., and Heinrich, C. A. (2006) Multiphase Thermohaline Convection in the Earth's Crust: II. Benchmarking and Application of a Finite element - Finite Volume Solution Technique with a NaCl-H2O Equation of State. *Transport in Porous Media* 63(3), 435-461.

Geiger, S., Driesner, T., Matthäi, S.K., and Heinrich, C. A. (2006): Multiphase Thermohaline Convection in the Earth's Crust: I. A Novel Finite element - Finite Volume Solution Technique Combined with a New Equation of State for NaCl-H_2O. *Transport in Porous Media* 63(3), 399-434.

Geiger , S., Driesner, T., Matthäi, S.K., and Heinrich, C. A.(2005): On the Dynamics of Thermohaline Convection in the Earth's Crust. *Journal of Geophysical Research – Solid Earth* 110 (B7), Art. No. B07101.

This is a fluid inclusion study that demonstrated that the simulated thermal evolution can indeed be seen in actual (fossil) systems if one does very careful petrography:

Kostova B., Pettke T., Driesner T., Petrov P. and Heinrich C.A. (2004): LA ICP-MS study of fluid inclusions in quartz from the Yuzhna Petrovitsa deposit, Madan ore field, Bulgaria. *In: von Quadt A., Driesner T. and Heinrich C.A. (eds.): Schweizerische Mineralogische und Petrographische Mitteilungen 84, 25-36*